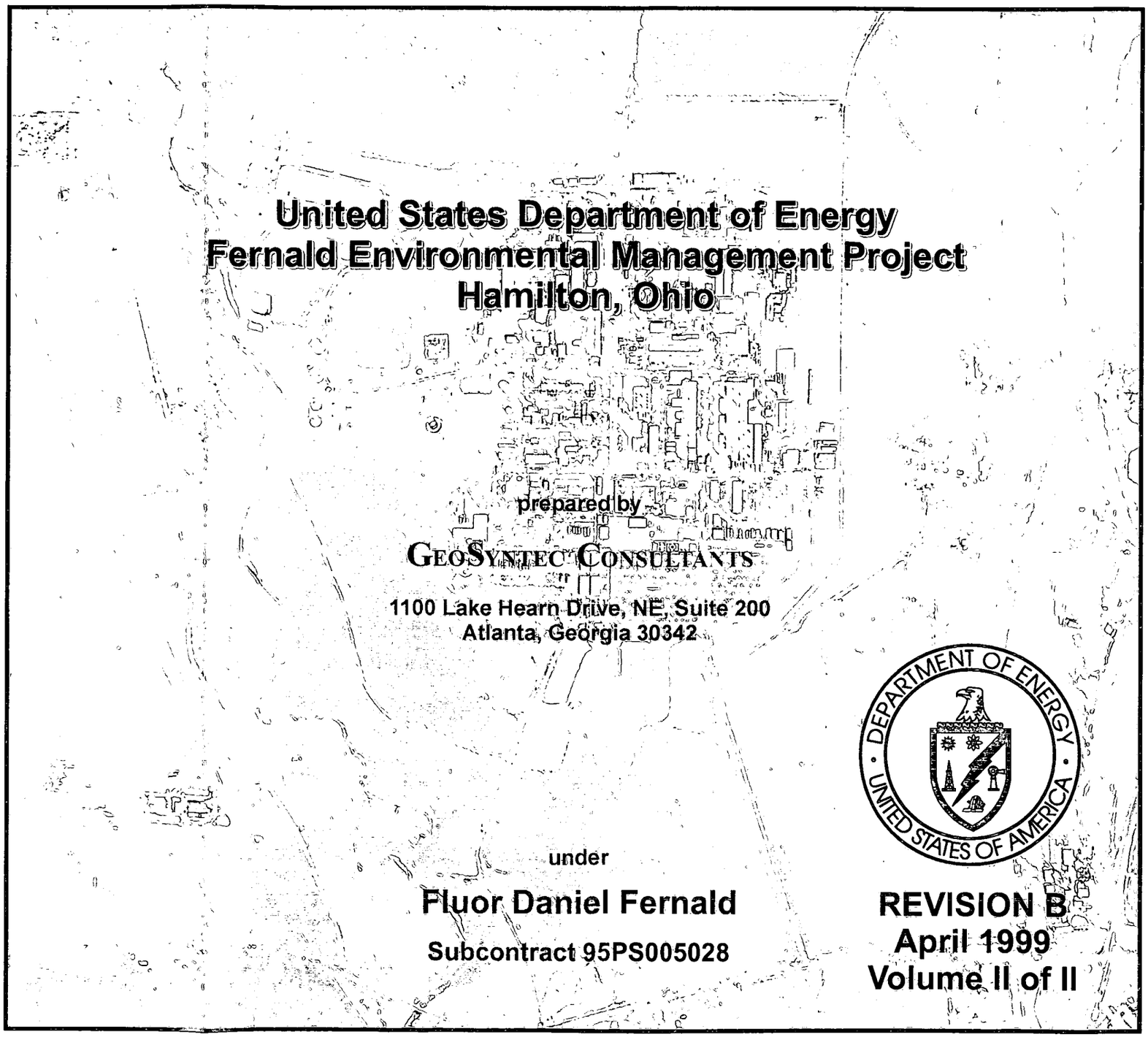
Document No. 20110-RP-0002

2195

EVALUATION OF LEACHATE TRANSMISSION SYSTEM

ON-SITE DISPOSAL FACILITY



United States Department of Energy
Fernald Environmental Management Project
Hamilton, Ohio

prepared by

GEOSYNTEC CONSULTANTS

1100 Lake Hearn Drive, NE, Suite 200
Atlanta, Georgia 30342

under

Fluor Daniel Fernald

Subcontract 95PS005028

REVISION B
April 1999
Volume II of II

2195

EVALUATION OF LEACHATE TRANSMISSION SYSTEM ON-SITE DISPOSAL FACILITY FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

Revision B
April 1999

United States Department of Energy

Fernald Environmental Management Project
Hamilton, Ohio
(FDF Project No. 20100)

Prepared by

GeoSyntec Consultants
1100 Lake Hearn Drive, NE, Suite 200
Atlanta, Georgia 30342

Under

Fluor Daniel Fernald
Subcontract 95PS005028

Document No. 20110-RP-0002

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APPENDIX B

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APPENDIX B
DCNs AND RCIs RELATED TO LTS

Drawings & Spec Noted UGB

REQUEST FOR CLARIFICATIONOF INFORMATION/ DESIGN CHANGE NOTICE

(1) WP / WO NO.: 1700	(2) S/C NO.: FSC-589	(5) Pg 1 OF 3	(6) DATE 1/21/97
(3) S/C TITLE: LEACHATE CONVEYANCE SYSTEM			(11) RCI NO.:
(4) RESPONSIBLE DISCIPLINE: EX MO CO OTHER	(4A) RCI/DCN TITLE: Piping Spec Changes		(11) DCN NO.: 1700-007

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
SPECIFICATIONS	20110-TS-0002	Ø	2195
HIGH DENSITY POLYETHYLENE (HDPE) MANHOLES, PIPE, AND FITTINGS	SECTION 02605 ART. 2.04 & 2.05	0	
DESIGN CRITERIA PACKAGE, OSDF OCT. 1996	SECTION 2.5 LEACHATE MGMT.	4	

(9) ☐ RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER (9) ☒ DCN-JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

- VALUE ENGINEERING BY OSDF TEAM (FDF, GEOSYNTEC, PARSONS) CONCLUDED THAT REDUCING SDR'S OF HDPE PIPING WOULD REDUCE MATERIAL COST WHILE STILL MEETING PIPING DESIGN REQUIREMENTS. (SEE ATTACHED LIST)
- REVISED PIPING IS STANDARD MANUFACTURER'S STOCK ITEMS AND SHOULD HAVE NO IMPACT ON DELIVERY.

(10) REQUESTOR: J. C. JENKINS COMPANY: FDF DATE: 1/21/97 (12) FCE / PE: Richard L McKinney DATE: 1/28/97

(13) RESPONSE: FOR RCI, IS A DCN REQ'D? ☐ NO ☒ YES (14) FOR DCN: ☐ APPROVED ☒ APPROVED AS NOTED ☐ DISAPPROVED

Article 2.04 of the technical specification Section 02605 shall be modified and FDF shall obtain all necessary DOE and regulatory agency approvals as required for modification of the Final Design Package and the Design Criteria Package.

① PARSONS - See Clarification Response - Page 1 of 1

② Pipe Wall thickness change may be documented as EDC as As-Built Condition

CONTROLLED COPY NO. 11

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL: Rudolph Bonapite DATE: 3 Feb 1997 (20) CHARGE NO. FOR CADD SERVICES TO INCORPORATE: N.A.

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) J. C. Jenkins DATE: 2/5/97

PERFORMANCE GRADE: (17) 4

(18) CONSTRUCTION CONCURRENCE: Richard L. McKinney DATE: 2/5/97

PURCHASE REQUISITION REQUIRED: ☐ YES ☐ NO (19)

(21) WORK COMPLETED: (SIGNOFF BY FCE OR PE) DATE:

FS-F-4259 (10/01/96)

Parsons (Carlton Schroeder) approves SDR change as shown on Page 2 of 2 for FDCE Main Carlton Schroeder 1/29/97

DCN 007

received 2-3-97

ORIGINAL 5

W.O. No.: 1700

2195 2 OF 3

DCN No.

J. C. J.

REVISED HDPE PIPING

LOCATION	SDR
1. FORCE MAIN FROM PERMANENT LIFT STATION TO BSL	
a. 4 IN. CARRIER	17
b. 8 IN. CONTAINMENT	26
2. TEMPORARY GRAVITY LINE FROM LCS MH3 TO PERMANENT L.S.	
a. 6 IN. CARRIER	26
b. 10 IN. CONTAINMENT	26
3. PERMANENT GRAVITY LINES FROM LDS/LCS MH1 TO LDS/LCS MH3	
a. 6 IN. CARRIER	26
b. 10 IN. CONTAINMENT	26

NOTE: HDPE PIPING, FITTINGS AND APPURTENANCES WITHIN ~~LCS~~ LDS/LCS MH's 1, 2, & 3 SHALL ALSO BE SDR 26

ORIGINAL

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PARSONS

DCN No.: 1700 - 007

29 Jan 97

Leachate Conveyance System
Piping Spec Changes

Recommend Status B, Approved as noted

Comments are as follows for the PARSONS drawings only:

1. Confirm that operating parameters will not exceed the operating pressure for the carrier pipe. That is, confirm that there have been no changes to the Rev 0 ~~pump~~ lift station pumping system as designed by PARSON
2. The change shall be shown on the as-built construction drawings if not incorporated into other DCN changes to plan and profile sheets.

VCN No.
J. C. J.
2195

REVISED HDPE PIPING

LOCATION	SDR
1. FORCE MAIN FROM PERMANENT LIFT STATION TO BSL	
a. 4 IN. CARRIER	17
b. 8 IN. CONTAINMENT	26
2. TEMPORARY GRAVITY LINE FROM LCS MH3 (Station 10+00) TO PERMANENT L.S. (Station 36+00)	
a. 6 IN. CARRIER	26 ✓
b. 10 IN. CONTAINMENT	26 ✓
3. PERMANENT GRAVITY LINES FROM LDS/LCS MH1 TO LDS/LCS MH3	Station 0+00 to Station 10+00
a. 6 IN. CARRIER	26 ✓
b. 10 IN. CONTAINMENT	26 ✓

NOTE: HDPE PIPING, FITTINGS AND APPURTENANCES WITHIN ~~LCS~~ LDS/LCS MH's 1, 2, & 3 SHALL ALSO BE SDR 26 ✓

ORIGINAL

DCN No.

J. C. J.

REVISED HDPE PIPING

LOCATION	SDR
1. FORCE MAIN FROM PERMANENT LIFT STATION TO BSL	
a. 4 IN. CARRIER	17
b. 8 IN. CONTAINMENT	26
2. TEMPORARY GRAVITY LINE FROM LCS MH3 TO PERMANENT LS.	
a. 6 IN. CARRIER	26
b. 10 IN. CONTAINMENT	26
3. PERMANENT GRAVITY LINES FROM LDS/LCS MH1 TO LDS/LCS MH3	
a. 6 IN. CARRIER	26
b. 10 IN. CONTAINMENT	26

NOTE: HDPE PIPING, FITTINGS AND APPURTENANCES WITHIN ~~LCS~~ LDS/LCS MH's 1, 2, & 3 SHALL ALSO BE SDR 26

ORIGINAL

2195

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

(1)WP / WO NO.: 1700	(2)S/C NO: 589	(5)Pg 1 OF 1	(6)DATE 07 May 1997
(3)S/C TITLE: LEACHATE CONVEYANCE SYSTEM		(11)RCI NO.:	
(4) RESPONSIBLE DISCIPLINE: E ☐ M ☐ C ☒ OTHER ☐	(4A)RCI/DCN TITLE: HDPE Dual Containment Pipe	(11)DCN NO.: 1700-021	

(7)DOCUMENTS AFFECTED	(7)DOCUMENT NOS.	(7)REV.	(8)OTHER
CFC Technical Specification	Section 02605 Part 2.05	0	

(9)☐RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER (9)☐DCN-JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

This DCN responds to a written request by VBS HDPE pipe supplier, ISCO INDUSTRIES, INC. in a letter dated April 28, 1997 attached to Submittal No. 77 Rev. 2, to re-evaluate the spacing allowed for support centralizers between the carrier and the containment pipe. The design change to Specification Section 2.05 is as follows:

Part 2.05.F Change "maximum allowable spacing of 4 feet" to "maximum nominal spacing of 4.5 feet".

The referenced letter above also discusses the specification requirement (Part 2.05.C) of furnishing pipe/fittings with the carrier pipe/fittings ends extending 6 inches beyond the containment pipe/fitting ends. For the pipe, this requirement is intended to allow space for proper installation (fusion welding) of the carrier pipe. Since the carrier pipe is being furnished movable within the containment pipe this requirement can be met during actual pipe installation. Quality Control inspection shall verify proper fusion welding in the field. If pipe length adjustments need to be made on a case by case basis, then it shall be made as required by Quality Control. No change to the specification is necessary.

(10)REQUESTOR: Dan Bodine Dan Bodine	COMPANY: GeoSyntec	DATE: 7 May 97	(12)FCE / PE James C. Jenkins DATE: 5/7/97

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐NO ☒YES (14)FOR DCN: ☐APPROVED ☒APPROVED AS NOTED ☐DISAPPROVED

CDC CONTROLLED COPY NO. 011

ORIGINAL

RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL: Daniel Bodine DATE: 7 May 1997	(20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE:
(16)FDF PE ACCEPE & VERIFICATITANCON THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) James C. Jenkins DATE: 5/7/97	
PERFORMANCE GRADE: (17) A	
(18)CONSTRUCTION CONCURRENCE: Richard L McGuire DATE: 5/7/97	(21)WORK COMPLETED: (SIGN OFF BY FCE OR PE) DATE:
PURCHASE REQUISITION REQUIRED: ☐YES ☒NO (19)	

FS-F-4259 (10/01/96)

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2195

REQUEST FOR CLARIFICATIONOF INFORMATION/ DESIGN CHANGE NOTICE-

(1)WP / WO NO.: 1700	(2)S/C NO.: FSC 589	(5)Pg 1 OF 1	(6)DATE 05-16-97
(3)S/C TITLE: LEACHATE CONVEYANCE SYSTEM		(11)RCI NO.: 1700-015 R	
(4) RESPONSIBLE DISCIPLINE: E☐ M☒ C☐ OTHER☐	(4A)RCI/DCN TITLE: HDPE PIPE THICKNESS	(11)DCN NO.:	

(7)DOCUMENTS AFFECTED	(7)DOCUMENT NOS.	(7)REV.	(8)OTHER
Technical Specification pg 02605-5	para 2.03D		
Submittal Nos: 25 & 58 R1			
DCN 1700-007			

(9)☐ RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER (9)☐ DCN-JUSTIFICATION,EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

Lift Stn. pipe stub-out as per Sub. No. 58 R1 & LCS/LDS MH's pipe stub-out as per Sub. No. 25 R1, pipe is SDR 11. Tech. Specs. pg 02605-5 para 2.03D specifies to have same pipe SDR as the trench pipe. DCN 1700-007 changed the trench pipe from BSL to Lift station to 4" SDR 17/8" SDR 26 & from Lift Stn. to LCS/LDS M.H No. 1 to 6"/10" SDR 26. Please clarify it's O.K to join dissimilar SDR pipe. Sub. No. 57 is not affected.

(10)REQUESTOR: Mayur P. Kadakia COMPANY: Village Bldg. Serv. DATE: 05/16/97 (12)FCE / PE: J. C. Jenkins DATE: 5/19/97

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☒ NO ☐ YES (14)FOR DCN: ☐ APPROVED ☐ APPROVED AS NOTED ☐ DISAPPROVED

Shop fabricated fittings, including stub-outs are typically produced from heavier wall pipe. In these cases design pressure ratings will remain atleast equal to the piping system. The OD of SDR 11 pipe will be compatable with both SDR 17 and SDR 26 pipe and therefore are acceptable. This was evaluated at the time of the Submittal. Plexco/Spirolite Bulletins #320 and #321 provide additional discussion on the fabrication of fittings.

RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL: Daniel Bodine DATE: 19 May 97 (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: N.A.

(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE:

PERFORMANCE GRADE: (17) N.A.

(18)CONSTRUCTION CONCURRENCE: Richard L. McKenzie DATE: 5/19/97 (21)WORK COMPLETED: (SIGNOFF BY FCE OR PE) DATE:

PURCHASE REQUISITION REQUIRED: ☐ YES ☒ NO (19)

FS-F-4259 (10/01/96)

ORIGINAL

INFORMATION ONLY

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REQUEST FOR CLARIFICATIONOF INFORMATION/ DESIGN CHANGE NOTICE -

(1)WP / WO NO.: 1700	(2)S/C NO.: FSC 589	(5)Pg 1 OF 1	(6)DATE 05-16-97

(3)S/C TITLE: LEACHATE CONVEYANCE SYSTEM

(11)RCI NO.: 1700-015 R

(4) RESPONSIBLE DISCIPLINE: E☐ M☒ C☐ OTHER☐

(4A)RCI/DCN TITLE: HDPE PIPE THICKNESS

(11)DCN NO.:

(7)DOCUMENTS AFFECTED	(7)DOCUMENT NOS.	(7)REV.	(8)OTHER
Technical Specification pg 02605-5	para 2.03 D		
Submittal Nos: 25 & 58 R1			
DCN 1700-007			

(9)☐ RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER

(9)☐ DCN-JUSTIFICATION,EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

Lift stn. pipe stub-out as per sub. No. 58 R1 & LCS/LDS MH's pipe stub-out as per sub. No. 25 R1, pipe is SDR 11. Tech. Specs. pg 02605-5 para 2.03 D specifies to have same pipe SDR as the trench pipe. DCN 1700-007 changed the trench pipe from BSL to Lift station to 4" SDR 17/8" SDR 26 & from Lift Stn. to LCS/LDS M.H No. 1 to 6"/10" SDR 26. Please clarify it's O.K to join dissimilar SDR pipe. Sub. No. 57 is not affected.

(10)REQUESTOR: Mayur P. Kadakia COMPANY: Village Bldg. Serv. DATE: 05/16/97

(12)FCE / PE: J. C. Jenkins DATE: 5/19/97

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☒ NO ☐ YES

(14)FOR DCN: ☐ APPROVED ☐ APPROVED AS NOTED ☐ DISAPPROVED

Shop fabricated fittings, including stub-outs are typically produced from heavier wall pipe. In these cases design pressure ratings will remain atleast equal to the piping system. The OD of SDR 11 pipe will be compatable with both SDR 17 and SDR 26 pipe and therefore are acceptable. This was evaluated at the time of the submittal. Plexco/Spirolite Bulletins #320 and #321 provide additional discussion on the fabrication of fittings.

RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL: Daniel Bolino DATE: 19 May 97

(20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: N.A.

(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE:

PERFORMANCE GRADE: (17) N.A.

(18)CONSTRUCTION CONCURRENCE: Richard L. McGuire DATE: 5/19/97

PURCHASE REQUISITION REQUIRED: ☐ YES ☒ NO (19)

(21)WORK COMPLETED: (SIGNOFF BY FCE OR PE) DATE:

FS-F-4259 (10/01/96)

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ORIGINAL

INFORMATION ONLY

2195

REQUEST FOR CLARIFICATIONOF INFORMATION/ DESIGN CHANGE NOTICE

RGB

(1)WP / WO NO.: 1700	(2)S/C NO.: FSC-589	(5)Pg 1 OF 2	(6)DATE 5/28/97
(3)S/C TITLE: LEACHATE CONVEYANCE SYSTEM		(11)RCI NO.:	
(4) RESPONSIBLE DISCIPLINE: ED MD CE OTHER	(4A)RCI/DCN TITLE: PIPE - HYDROSTATIC TESTING	(11)DCN NO.: 1700-033	

(7)DOCUMENTS AFFECTED	(7)DOCUMENT NOS.	(7)REV.	(8)OTHER
SPECIFICATIONS	02605	0	
20110-TS-0001			

(9)☐ RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER (9)☒ DCN-JUSTIFICATION,EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

- SEC. 02605, 3.07, C.2 REQUIRES TESTING BEFORE BACKFILLING PIPE TRENCH.
- REQUEST LATITUDE TO PERFORM TESTING AFTER BACKFILLING IN AREAS DEEMED NECESSARY TO MEET SCHEDULED INSTALLATION DATES AND COORDINATION WITH OTHER PROJECTS IN COMMON CONSTRUCTION AREAS.
- ~~ALL OTHER ARTICLES OF 02605, 3.07 REMAIN UNCHANGED~~ RGB 30 May 97

(10)REQUESTOR: J.C. Jenkins COMPANY: DATE: 5/28/97 (12)FCE / PE J.C. Jenkins DATE: 5/28/97

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐ NO ☐ YES (14)FOR DCN: ☐ APPROVED ☒ APPROVED AS NOTED ☐ DISAPPROVED

See Page 2 of 2 for Response

CDC CONTROLLED COPY NO. C011

(GEOSYNTEC) RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL: Daniel Bodine DATE: 30 May 97 (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: N.A.

(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: 5/30/97

PERFORMANCE GRADE: (17) 4 James C. Jenkins

(18)CONSTRUCTION CONCURRENCE: Richard L. [illegible] DATE: 5/30/97 (21)WORK COMPLETED: (SIGNOFF BY FCE OR PE) DATE:

PURCHASE REQUISITION REQUIRED: ☐ YES ☒ NO (19)

S-F-4259 (10/01/96)

RECEIVED JUN 04 1997 RGB

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ORIGINAL

LEACHATE CONVEYANCE SYSTEM
Pipe Hydrostatic Testing

(13) RESPONSE

Technical Specification Section 2605 Part 3.07 shall be changed as follows:

Article C.2.a. Add sentences "At pipe locations documented and approved in writing by the Construction Manager the Subcontractor may, at his own risk, pressure test pipe after placing fill over the pipes. Locations of all joints, fittings, etc., shall be documented before backfilling. The test procedure shall be as specified, except the test duration shall be minimum 3 hours. "

Article C.2.c. Replace "120 psi " with " 50 psi " and " 130 psi internal pressure for " with " 95 psi internal pressure for the LCS ".
Add sentence " Test pressures for other pipe systems shall be in accordance with ASME B31.9 937.3.4 and as otherwise specified. "

All other Articles of Section 02605 Part 3.07 remain unchanged.

The approval of pipe locations to be tested after backfilling should be evaluated on a case by case basis and where a definite need to delay testing has been established. When properly prepared, the subcontractor can complete testing rather quickly and efficiently and even during weather conditions when backfilling may not be suitable.

Ronald Butler
30 May 97

2195

BUILDING SERVICES PIPING

ASME/ANSI B31.9-1988

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937.2 Preparation for Testing

937.2.1 Exposure of Joints. All joints including welds shall be left uninsulated and exposed for examination during the test.

937.2.2 Temporary Supports. Piping designed for vapor or gas may be provided with temporary supports if necessary to support the weight of test liquid.

937.2.3 Expansion Joints. Expansion joints which cannot sustain the reactions due to test pressure shall be provided with temporary restraint, or they may be isolated from testing.

937.2.4 Equipment Not Subject to Testing. Equipment that is not to be subjected to the test pressure shall be isolated from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.

937.2.5 Precautions Against Overpressure. If the test pressure is to be maintained for a period of time during which the test fluid is subject to thermal expansion or any other source of overpressurizing during the test, precautions such as the installation of a relief device shall be taken to avoid excessive pressure.

937.3 Hydrostatic Testing

937.3.1 Test Medium. Water at ambient temperature shall be used as the test medium except where there is risk of damage due to freezing. Another liquid may be used if it is safe for workmen and compatible with the piping.

937.3.2 Vents and Drains. Vents shall be provided at high points in the system to release trapped air while filling the system. Drains shall be provided at low points for complete removal of the test liquid.

937.3.3 Preliminary Check. The system shall be examined to see that all equipment and parts that cannot withstand the test pressure are properly isolated. Test equipment shall be examined to ensure that it is tight and that low pressure filling lines are disconnected.

937.3.4 Hydrostatic Test Pressure

(a) Minimum Pressure. Except as limited in (b) below, a piping system shall be subjected to a hydrostatic test pressure which at every point in the system is not less than 1.5 times the design pressure.

(b) Maximum Pressure. The test pressure shall not exceed the maximum test pressure for any vessel, pump, valve, or other component in the system under test. A check shall be made to verify that the stress due to pressure at the bottom of vertical runs does not exceed either of the following:

(1) 90% of specified minimum yield strength;

(2) 1.7 times the *SE* value in Appendix A (for brittle materials).

937.3.5 Examination for Leakage. Following the application of hydrostatic test pressure for at least 10 min, examination shall be made for leakage of the piping, and at all joints and connections. If leaks are found, they shall be eliminated by tightening, repair, or replacement, as appropriate, and the hydrostatic test repeated until no leakage is found.

937.4 Pneumatic Testing

937.4.1 General. Compressed gas poses the risk of sudden release of stored energy. For that reason, pneumatic testing shall be used only within the following limitations.

(a) The piping system does not contain cast iron pipe.

(b) It does not contain soldered joints over 2 in..

(c) The test pressure does not exceed 150 psig.

(d) If nonmetallic, it is not larger than NPS 2.

(e) The system will be used in gas service, or for other reasons cannot be filled with water.

(f) Traces of a test liquid would be detrimental to the intended use of the piping.

937.4.2 Test Medium. The gas shall be nonflammable and nontoxic.

937.4.4 Preliminary Test. Prior to application of full pneumatic test pressure, a preliminary test of not more than 10 psig shall be applied to reveal possible major leaks. (This preliminary test is not subject to the limitations in para. 937.4.1, and may be used in conjunction with hydrostatic testing or initial service testing.)

937.4.5 Pneumatic Test Pressure

(a) Except as limited in (b) below, the test pressure shall not exceed 1.25 times the design pressure. Pressure shall be applied in several stages, allowing time for the system to reach equilibrium at each stage.

(b) The test pressure shall not exceed the maximum allowable pneumatic test pressure for any vessel, pump, valve, or other component in the system under test.

937.4.8 Examination for Leakage. After the preliminary test, pressure shall be raised in stages of not more than 25% up to full pneumatic test pressure, allowing time for equalization of strains and detection of major leaks at each stage. Following the application of test

pressure for at least 10 min, the pressure may be reduced to design pressure and examination shall be made for leakage of the piping. Leaks may be detected by soap bubble, halogen gas, scented gas, test gage monitoring, ultrasonic, or other suitable means. If leaks are found, pressure shall be vented, appropriate repair or replacement shall be made, and the pneumatic test repeated until no leakage is found.

937.5 Initial Service Leak Test

937.5.1 General. For nontoxic, nonflammable fluids at pressures not over 100 psig and temperatures not over 200°F, it is permissible to conduct the system testing with the service fluid as outlined below.

937.5.2 Service Testing. A preliminary test with air at low pressure (para. 937.4.4) may be used. In any event, the piping system shall be brought up to operating pressure gradually with visual examination at a pressure between one-half and two-thirds of design pressure. A final examination shall be made at operating pressure. If the piping system is free of leaks, it will have met the requirements of para. 937.1.

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2195

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

(1)WP / WO NO.: 1700	(2)S/C NO.: 589	(5)Pg 1 OF 1	(6)DATE 06-04-97
(3)S/C TITLE: LEACHATE CONVEYANCE SYSTEM		(11)RCI NO.: 1700-023R	
(4) RESPONSIBLE DISCIPLINE: E☐ M☒ C☐ OTHER ☐	(4A)RCI/DCN TITLE: HDPE PIPE THICKNESS-Additional Response	(11)DCN NO.:	

(7)DOCUMENTS AFFECTED	(7)DOCUMENT NOS.	(7)REV.	(8)OTHER
RCI 1700-015 R			
Submittal No. 25 R1			
Submittal No. 58 R4			

(9)☐RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER (9)☐DCN-JUSTIFICATION,EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

An additional response to RCI 1700-015R is being provided.

INFORMATION ONLY

(10)REQUESTOR: Daniel Bodine COMPANY: GeoSyntec DATE: 06/04/97 (12)FCE / PE: James C. [illegible] DATE: 6/4/97

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☒NO ☐YES (14)FOR DCN: ☐APPROVED ☐APPROVED AS NOTED ☐DISAPPROVED

Response to RCI 1700-015R is still valid. In addition, the SDR 11 stub-outs may be counterbored at the end to match the appropiate inside diameter of the connecting pipe. This fabrication must be completed and inspected at the manufacturers shop as part of the manufacturers' shop fabrication.

RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL: Daniel Bodine DATE: 06/04/97 (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: N.A.

(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE:

PERFORMANCE GRADE: (17) N.A.

(18)CONSTRUCTION CONCURRENCE: [illegible] N.A. DATE: 6/6/97 (21)WORK COMPLETED: (SIGNOFF BY FCE OR PE) DATE:

PURCHASE REQUISITION REQUIRED: ☐YES ☒NO (19)

ES-F-4259 (10/01/96)

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ORIGINAL

RECEIVED JUN 10 1997 DGB

2195

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

(1)WP / WO NO.: 1700 | (2)S/C NO.: FSC 589 | (5)Pg 1 OF 1 | (6)DATE 27 June 97

(3)S/C TITLE: Leachate Conveyance System | (11)RCI NO.:

(4) RESPONSIBLE DISCIPLINE: E ☐ M ☐ C ☒ OTHER ☐ | (4A)RCI/DCN TITLE: Cleanout Backfill Requirements | (11)DCN NO.: 1700-041

(7)DOCUMENTS AFFECTED	(7)DOCUMENT NOS.	(7)REV.	(8)OTHER
Specification 20110-TS-0002 Section 02215		0	
Submittal No 74 R1			
Submittal No 24 R2			

(9)☐RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER (9)☐DCN-JUSTIFICATION,EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

Cleanout Nos. 1A, 2, 3, 6, 7, 8, 9, 10, 12 and Temporary Cleanouts for the Gravity Line shall be backfilled with pipe bedding sand from the LCS pipe to the base of the cleanout. The pipe bedding sand shall be placed in 7 ± inch lifts and compacted with 4 coverages of approved vibratory plate compactor. Some hand tamping adjacient to the cleanout pipe and directly beneath the cleanout base will be necessary. Above the cleanout base trench backfill

(10)REQUESTOR: Daniel Bolin | COMPANY: GeoSyntec | DATE: 27 June 97 | (12)FCE / PE: L.A. Kumstrebar / Jeff Ellis 7/9/97 | DATE: 6/30/97

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐NO ☐YES (14)FOR DCN: ☒APPROVED ☐APPROVED AS NOTED ☐DISAPPROVED

→ shall be placed and compacted per specification section 02215 Part 3.03. C. 6 and Part 3.03.C.7.

Add the above paragraph to Specification Section 02215 Part 3.03.E (New sub section)

DC CONTROLLED COPY NO C011

RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL: Daniel Bolin | DATE: 27 June 97 | (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: L.A. Kumstrebar 7/8/97 | DATE: 7/8/97

(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) | DATE:

PERFORMANCE GRADE: (17) A3 James C. Jenkins | 7/9/97

(18)CONSTRUCTION CONCURRENCE: | DATE: 7/9/97 | (21)WORK COMPLETED: (SIGNOFF BY FCE OR PE) | DATE:

PURCHASE REQUISITION REQUIRED: ☐YES ☒NO (19)

FS-F-4259 (10/01/96)

JUL 11 1997

CCB

19

ORIGINAL

2195

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

(1)WP / WO NO.: 1700	(2)S/C NO.: 589	(3)PG / OF 1	(6)DATE 7-7-97
(3)S/C TITLE: LEACHATE CONVEYANCE SYSTEM			(11)RCI NO.: 1700:029R
(4) RESPONSIBLE DISCIPLINE: SO MO CO OTHER	(4A)RCI/DCN TITLE: PRESSURE TESTING CONTAINMENT PIPING		(11)DCN NO.:

(7)DOCUMENTS AFFECTED	(7)DOCUMENT NOS.	(7)REV.	(8)OTHER
TECH. SPEC. 2605-12, C.2.d.			

(9)☒RCI - INQUIRY ☐USQD SCREENING BY PROJECT ENGINEER (9)☐DCN-JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

MANUFACTURER RECOMMENDS AGAINST USING A PRESSURE TEST ON CLEANOUTS DUE TO EXTRUSION WELDS ON CONTAINMENT PER ATTACHED.

INFORMATION ONLY

(10)REQUESTOR: MJC COMPANY: VILLAGE BLDG DATE 7-7-97 (12)PCE / RE: J. C. Jenkins DATE 7/9/97

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☒NO ☐YES (14)FOR DCN: ☐APPROVED ☐APPROVED AS NOTED ☒DISAPPROVED

This is unacceptable. Project specifications and design require the containment piping to be tested at 15 psi. This has not changed. Shop design fabrication was performed by ISCO for VBS. Submittal No 74 did not specify or make any indication that the cleanout design would not be suitable under specified test conditions. The containment piping shall be tested at 15psi. If it fails it shall be repaired or removed and replaced with acceptable piping.

(GEOSYNTEC)

RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL: Daniel Bodine DATE 9 July 97 (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: N.A.

(16)PDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE

N.A.

PERFORMANCE GRADE: (17) 4

(18)CONSTRUCTION CONCURRENCE: Richard L McPhee DATE 7/16/97 (21)WORK COMPLETED: (SIGNOFF BY PCE OR PE) DATE

PURCHASE REQUISITION REQUIRED: ☐YES ☒NO (19)

FS-F-4239 (10/01/88)

ORIGINAL

RECEIVED JUL 21 1997 20

2195

July 8, 1997

Mayur P. Kadakia
Village Building Services Inc.
7311 Vine Street
Cincinnati, Ohio 45216

Dear Mayur:

This letter is to inform you that the containment lines of the 4"X8" cleanouts were made with extrusion welds. It is our understanding that the containment line will be tested at 15 psi. Although the extrusion welds can hold some pressure for short periods of time, it is our recommendation that these welds not be tested at this pressure simply because they are not designed to hold pressure and are used for gravity applications only (ie. the containment line). The cleanouts have been leak tested in the shop prior to shipment to Fernald. All extrusion welds were extruded with a wire under the weld and the weld was then spark tested. The spark test will detect any void which water may pass through. Filling the cleanouts with water sometimes fails to show small voids and potential leakage areas; therefore, ISCO has established this spark testing procedure for all extrusion welded fabrications. If these cleanouts could have been made without extrusion welds, it would have been done, but with the way they were designed, extrusion welding was necessary. Please contact me at (513)871-9512 with any additional questions, thank you.

Sincerely,

Scott Hoff
Regional Sales Manager

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PARSONS
ERA PROJECT

ROUTING CARD 2195

DOC. No.:	ISSUE:	TRANSMITTAL No.:	DATE:
CR-029	1	1700:029R	7-17-97

TITLE:	OU NO.	P.O. No.:
TESTING CONTAINMENT PRESSURE PIPING	2	~~158~~ 164 KG

REVIEW REQUEST, COMPLETE, AND RETURN TO PROJECT ENGINEER

BY 7 / 18 / 97
DUE DATE

TO REVIEWERS:

1. Check the attached document against issued specifications to ensure that this document meets the intent of our specs.
2. Date and Initial this card, in red ink, as to the status.
3. Hand carry the attached document and this card to the Project Engineer.
4. If comments are needed, mark the original document in red ink.
5. The Project Engineer will return the completed document and card to Document Control.

Note: If you are in a remote location, call the Project Engineer for pick-up.

ROUTING SEQUENCE	REVIEWING DISCIPLINE	DATE	STATUS 'A'	STATUS 'B'	STATUS 'C'
	PROCESS				
	MECHANICAL PROCESS				
	PIPING				
	STRUCTURAL				
• 1	CIVIL YUNUS AFGHAN / R.GERARD	7-21-97			YA/KG
	ELECTRICAL				
	INSTRUMENTATION				
	MATERIAL HANDLING				
	ARCHITECTURAL				
	ENVIRONMENTAL, SAFETY, & HEALTH				
	HVAC				
	GEOTECHNICAL				
	QUALITY ASSURANCE				
• 2	PROJECT ENGINEER CARLTON S.	7/22/97			CS
	TITLE III MANAGER				
	PROJECT MANAGER				

STATUS 'A' = APPROVED
STATUS 'B' = APPROVED AS NOTED
STATUS 'C' = DISAPPROVED AS NOTED

Transmitted to Client — Date: — Initials:

Document Control — Date: — Initials:

• ORIGINATING PROJECT DESIGN ENGINEER C. SCHROEDER

SPECIAL INSTRUCTIONS:

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2195

PARSONS
~~Sheet 1 of 1~~
Page 2 of 2

22 July 1997

PO-164 Leachate Conveyance System

DOC No.: CR-029 ISSUE: 1 TRANSMITTAL No.: 1700:029R
TITLE: Pressure Testing Containment Piping

Civil Comments are as follows:

1. The RCI involves the specification section prepared by GeoSyntec. No exception taken to the disapproved response from GeoSyntec (Daniel Bodine) 7/9/97.

2. If the pressure test is relaxed for the containment pipe, it should be no less than 11psi. under gravity conditions. (Based on 1.5 times an assumed maximum static head at the BSL of 17'. This is for the portion between the lift station and the BSL. and is considered to be a worse case scenario that is highly unlikely.)

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LEACHATE CONVEYANCE SYSTEM

DOCUMENT REVIEW COMMENT SHEET

PO164

SITE/OWNER:

REVIEWING DIVISION: PARSONS

DOCUMENT NO. AND TITLE: CR-029 TESTING CONTAINMENT PRESSURE PIPE

DATE: 7/21/97

REQUEST NO.: 1 / TRANSMITTAL No.: 1700-029R

DATE COMMENTS DUE:

ITEM NO.	REVIEWER NAME	PAGE NO./ STEP	COMMENT	SNO 1	COMMENT RESOLUTION
1	Y. AFSHAR		THE HDPE CONTAINMENT PIPE SHALL BE PRESSURE TESTED IN ACCORDANCE WITH THE SPECIFICATIONS AT 15 PSI.		

SIGNIFICANT REVIEW COMMENT RESOLUTION APPROVAL SIGNATURE: _____ DATE: _____

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REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE - 3068

(1)WP / WO NO.: 1700	(2)S/C NO.: FSC-589	(5)Pg 1 OF ~~1~~	(6)DATE 7/23/97
(3)S/C TITLE: Leachate Conveyance System			(11)RCI NO.: 1700-0XX
(4) RESPONSIBLE DISCIPLINE: E☐ M☐ C X OTHER☐	(4A)RCI/DCN TITLE: Gravity Flow Segment Alignment Change		(11)DCN NO.: 1700-045

(7)DOCUMENTS AFFECTED	(7)DOCUMENT NOS.	(7)REV.	(8)OTHER
90X-6000-G-00058	G-8B	0	
90X-6000-G-00059	G-8C	0	

(9)☐ RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER (9) X DCN JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

1. Provide HOPE sleeve sta. ~~18+37±~~ GGB 19+15 to ~~18+87±~~ 19+65 at grade to maintain flow line of 10/6 Leachate Transmission System (LTS) line.
2. Transition LTS line 10' left (east) of the ~~proposed~~ designed GGB centerline from sta. ~~18+87±~~ 19+65 to sta. ~~19+10±~~ 20+00 GGB.
3. Maintain 10' offset location from sta. ~~19+10±~~ 20+00 through sta. 27+75±.
4. Transition LTS line from 10' left to 22' right of the centerline from sta. 27+75± to sta. 28+65±.
5. Maintain 22' offset location from sta. 28+65± through sta. 33+00±.
6. Provide curves at transitions and to meet original alignment near sta. 33+80±.
7. Maintain ~~proposed~~ designed elevations of stations entering and exiting transitions, alter line grades to fit.
8. Record "As-Built" conditions.

(10)REQUESTOR: Jack Kellis COMPANY: FDF DATE: 7/23/97 (12)FCE / PE: James C. Jenkins 7/23/97 DATE: 7/24/97

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐ NO ☐ YES (14)FOR DCN: ☐ APPROVED ☒ APPROVED AS NOTED ☐ DISAPPROVED

See Discussion and Comments on Attached Pages 2 and 3.

CDC CONTROLLED COPY NO. C011

JUL 28 1997 GGB

(GEOSYNTEC) RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL: Daniel Bolins DATE: 25 July 97 (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: 2CUP5

(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) James C. Jenkins DATE: 7/28/97

PERFORMANCE GRADE: (17) 5

(18)CONSTRUCTION CONCURRENCE: Richard L. McKinney DATE: 7/28/97 (21)WORK COMPLETED: (SIGN OFF BY FCE OR PE) DATE: 25

PURCHASE REQUISITION REQUIRED: ☒ YES ☐ NO (19)

ORIGINAL

The purpose of this DCN is to improve and make easier the construction installation of the Temporary LTS line under existing site conditions. All stations mention in this response are based on the stationing given on the referenced drawings. The following reasons or justification are provided for the changes.

1. Avoid possible removal of existing fence along the closed north entrance road located approximately parallel to LCS Stations 28+65 to 33+00 (Drawing G-00059).

2.. Allow for additional construction safety along the east side of the constructed Sedimentation Basin by relocating the alignment 10 ft east from approximate LCS Station 20+00 to 27+75 (Drawing G-00058 and G-00059).

3. Route LTS line passed the inlet side of the Sedimentation Basin where the two 48-inch diameter CMPs have already been installed by the Phase 1 contractor. (Phase 1 Sedimentation Basin Drawing G-00075)

Comments on the requested changes by Item No. are as follows:

Item No. 8 This is standard procedure. Since different contractors may be involved for portions of the alignment changes FDF shall insure coordination of all as-builts.

Item No. 7 Proposed elevations should be designed elevations and these should be listed along with the approximate revised grades.

Item No. 6 License surveyor shall provide curve data and documentation as specified.

Item No. 5 Twenty two (22) ft offset is to the west or right as indicated and is acceptable.

Item No. 4 Ten (10) ft offset is to the east or left and is acceptable. Phase 1 contractor has already removed fence. Note, however, that the location of the revised trench alignment is approximately 15-ft from the toe of the existing stockpile. Excavation trench safety should be monitored closely.

Item No. 3 The 10-ft offset shall be maintained from approximate Station 20+00 through Station 27+75. The 19+10 station reference is a result of a field survey error.

Item No. 2 The 10 ft transition left or east of the designed centerline shall be from approximate Station 19+65 to Station 20+00.

Item No. 1 The HDPE sleeve to be provided has been selected by FDF Engineering to be a 20-inch OD pipe with approximate 2-inch wall thickness. The 50-ft long sleeve needs to be located approximately from Station 19+15 to Station 19+65. The station changes from those listed on page 1 are required because of field survey error. The HDPE sleeve must be installed such that when the 10-inch LTS is installed the invert and grade elevations are maintained. The annulus space above the 10-inch shall be filled with an insulating material and ends of the sleeve sealed. Insulating material is required because adequate depth of cover (approximately 1 ft of riprap) without insulation, is not being provided. Additional cover beyond the south end of the 20-inch pipe may be needed depending on construction completion of the Sedimentation Basin slopes.

The selection of the alignment to route the LTS line passed the inlet side (5 ft west of the basin end of the CMPs) is acceptable, because of the temporary nature of this portion of the LTS and the Sedimentation Basin.

Daniel Boltz
25 July 97

2195

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

WP / WO NO.: 1700	(2)S/C NO.: FSC-589	(5)Pg 1 OF 1	(6)DATE 07/29/97

(3)S/C TITLE: Leachate Conveyance System — (11)RCI NO.: 1700-0XXR

(4) RESPONSIBLE DISCIPLINE: E☐ M☐ C X OTHER☐ — (4A)RCI/DCN TITLE: LTS Trench Alignment Change — (11)DCN NO.: 1700-047

(7)DOCUMENTS AFFECTED	(7)DOCUMENT NOS.	(7)REV.	(8)OTHER
90X-6000-G-00057	G-8A	0	
90X-6000-G-00058	G-8B	0	
90X-6000-G-00086 (W.O. 1702 Phase 1 Const.) 90X-6000-G-00074	G-8A DGB G-5B	0 2	

(9)☐ RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER (9) X DCN JUSTIFICATION: EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

1. Relocate the LTS curve PC 11+06.56 to PC 10+56.56 and PC 13+88.88 to PC 13+38.88. Maintain proposed deltas, radii, and courses.
2. Relocate Decon Stub-out to Sta. 12+75± to maintain alignment for ~~future construction~~ piping connection to Phase 2 Decon Facility DGB
3. Maintain proposed grades for all relocated stations.
4. Record "As-Built" conditions.

(10)REQUESTOR: Jeffrey Ellis COMPANY: FDF DATE: 7/29/97 (12)FCE / PE: James C. Jenkins DATE: 7/29/97

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐ NO ☐ YES (14)FOR DCN: ☐ APPROVED ☒ APPROVED AS NOTED ☐ DISAPPROVED

The purpose of the alignment change is to avoid existing fenced enclosure containing fencing debris. Phase 2 construction drawings (W.O. 1702) are also affected. Stub-out shall have a bottom of pipe elevation of 589.00 at the "tie-in" point (12 ft North of LTS alignment). The slope of the discharge pipe outside of the Decon Facility shall increase to approximately 29% to meet the LTS stubout at the tie-in point.

(Geo Synthetic)

RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL: Daniel Bodine DATE: (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: 2CUP5

(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) James C. Jenkins DATE: 7/31/97

PERFORMANCE GRADE: (17) 5

(18)CONSTRUCTION CONCURRENCE: Richard L. Martin DATE: 7/31/97 (21)WORK COMPLETED: (SIGN OFF BY FCE DELEG) DATE:

PURCHASE REQUISITION REQUIRED: ☒ YES ☐ NO (19)

CONTROLLED COPY NO.

FS-F-4259 (10/01/96)

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ORIGINAL

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REQUEST FOR CLARIFICATIONOF INFORMATION/ DESIGN CHANGE NOTICE-

(1)WP / WO NO.: 1700	(2)S/C NO.: FSC-589	(5)Pg 1 OF 12	(6)DATE 9/2/97
(3)S/C TITLE: LEACHATE CONVEYANCE SYSTEM		(11)RCI NO.:	
(4) RESPONSIBLE DISCIPLINE: ED MD CE X OTHER	(4A)RCI/DCN TITLE: TRIAL BUTT-FUSION JOINTS	(11)DCN NO.: 1700-057	

(7)DOCUMENTS AFFECTED	(7)DOCUMENT NOS.	(7)REV.	(8)OTHER
SPEC. SECT. 02605, 3.06, E		0	

(9)☐ RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER (9)☒ DCN-JUSTIFICATION,EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

- PIPE CREWS HAVE HAD SEVERAL TRIAL BUTT-FUSION JOINTS TO DATE.
- TO INCREASE DAILY PRODUCTIVITY AND HELP MEET SCHEDULE RECOMMEND USING PRODUCTION JOINTS AS VERIFICATION OF CONDITIONS AND JOINER EACH DAY.

(10)REQUESTOR: J.C. JENKINS	COMPANY:	DATE: 9/2/97	(12)FCE / PE: James C. Jenkins DATE: 9/2/97

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐ NO ☐ YES (14)FOR DCN: ☐ APPROVED ☑ APPROVED AS NOTED ☐ DISAPPROVED

See Response on Page 2

(LIEDSYNTEC) RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL: Darrel Boling DATE: 3 Sept 97	(20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: 2CUP5
(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) PERFORMANCE GRADE: (17) 5 James C. Jenkins	DATE: 9/4/97
(18)CONSTRUCTION CONCURRENCE: Richard L McNamee DATE: 9/12/97 PURCHASE REQUISITION REQUIRED: ☑ YES ☐ NO (19)	(21)WORK COMPLETED: (SIGNOFF BY FCE OR PE) DATE:

F-4259 (10/01/96)

RECEIVED SEP 22 1997 RGB

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CONTROLLED COPY NO. 011

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(13) Response

It is true that pipe crews have had several trial butt-fusion joints to date, especially for VBS crews. Currently two trial welds for duel containment pipe are being performed for each welding location at the begining of each day. Trial welds have failed in the past for both VBS and Wise during the month of August. Trial welds at the begining of the day can not be eliminated. However, GeoSyntec will approve a minimum of one good trial weld (lager diameter pipe, unless otherwise requested by CQC) at each location at the begining of each day, subject to an additional trial weld, if requested by CQC personnel.

Daniel Bodine

ORIGINAL

2195

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

3 RGB

(1)WP / WO NO.: 1700	(2)S/C NO.: FSC-589	(5)Pg 1 OF 1	(6)DATE 09/04/97

(3)S/C TITLE: Leachate Conveyance System		(11)RCI NO.: 1700-0XXR
(4) RESPONSIBLE DISCIPLINE: E☐ M☐ C X OTHER☐	(4A)RCI/DCN TITLE: ODOT Backfill Specification	(11)DCN NO.: 1700-058

(7)DOCUMENTS AFFECTED	(7)DOCUMENT NOS.	(7)REV.	(8)OTHER
Specification Section 02215, 3.03, C		O	

(9)☐ RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER (9) X DCN JUSTIFICATION: EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

Include in the project specifications reference to ODOT Pipe Backfilling 603.08 allowing the trench to trenches to be backfilled within constraints of ODOT Specifications.

Specifically include:
"Granular material may be compacted with water if satisfactory drainage is provided for the free water. When compacting with water, the granular material may be placed in layers not to exceed 200 mm (8 inches) loose depth and each layer thoroughly saturated with water by flooding or jetting. Prior to the placement of soil over the granular material, the free water shall be drained." (Ref.- Ohio Dept. Of Transportation Construction and Material Specifications)

RGB

(10)REQUESTOR: Jeff Ellis	COMPANY: FDF	DATE: 9/4/97	(12)FCE / PE James C Jordan	DATE: 9/4/97

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐ NO ☐ YES (14)FOR DCN: ☐ APPROVED ☑ APPROVED AS NOTED ☐ DISAPPROVED

See Attached Response

DOC CONTROL COPY NO

C011

(GRO SYNTEC) RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL: Daniel Bolen	DATE: 9/9/97	(20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: 2CUP5

(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: 9/9/97

PERFORMANCE GRADE: (17) 5 James C Jordan

(18)CONSTRUCTION CONCURRENCE: Richard L. McGuire	DATE: 9-11-97	(21)WORK COMPLETED: (SIGN OFF BY FCE OR PE)	DATE:

PURCHASE REQUISITION REQUIRED: ☐ YES ☑ NO (19)

31

FS-F-4259 (10/01/96)

ORIGINAL

RECEIVED SEP 19 1997

RGB

(13) Response

Recent air monitoring indicates carbon monoxide levels may be exceeded when gasoline powered vibratory plate compactors are used for the compaction of pipe embedment material as specified in Specification Section 02215 Part 3.03.C. Carbon monoxide action levels are set forth in the newly implemented "Application of Carbon Monoxide Limits for Trenching Operations " developed by FDF IH and distributed on September 4, 1997.

In the event construction cannot proceed in accordance with the specified methods because allowable carbon monoxide levels are exceeded, or there are other documented safety concerns, the alternate method of placing the embedment sand described below may be used. The alternative method may also be used as a general substitute for vibratory plate compaction based on the approval of the Construction Manager. This method shall be added to Specification Section 02215 Part 3.03.C.8 (New Item 8).

8. a The following procedure may be used when authorized in writing by the Construction Manager in the event compaction using a gasoline powered plate compactor cannot be performed due to unacceptable levels of carbon monoxide in the trench, or as a general substitute to the vibratory plate compaction method.

b. Excavate trench in accordance with Part 3.02 of this Section.

c. Place pipe embedment fill in 7-inch ± 1-inch thick loose lift to the required pipe gradė.

d. Compact the pipe embedment fill by flooding, or a combination of flooding and vibratory plate compaction. To compact by flooding, the trench shall be filled with clean water to a minimum of 2-inches above the surface of the loose lift and then drained satisfactorily using sumps, ditches, pumps or other equipment as field conditions warrant. The water level after drainage shall be lower than the elevation of the bottom of the lift. Water levels in the trench will be visually verified by CQC personnel. The fill will be inspected and the dry density measured by CQC personnel. The minimum density requirements are defined in 8.h . The contractor's surveyor shall verify the grade of the fill surface prior to and after placing the pipe. If safety concerns at isolated locations are such that CQC personnel cannot enter the trench to measure density, the embedment fill shall be approved or disapproved based on CQC's field observations and correlation to dry density results obtained from similar work areas. Additional flooding or vibratory plate compaction shall be performed, if the specified density is not achieved after the first flooding interval. Note, water level greater than 2-inches above the surface of the loose lift may be required to achieve the specified density.

e. Place pipe on a previously compacted fill, and backfill around pipe to a maximum 8-inches above the previously placed lift. When backfilling to the pipe springline confirm that the pipe haunches have been filled and the pipe has been satisfactorily bedded.

f. Compact fill by flooding or a combination of flooding and vibratory plate compaction. The pipe shall be filled with water and capped prior to flooding, to prevent intrusion of fill and pipe flotation. Flood the fill to achieve a satisfactory density using the procedure described in 8.d.

g. Place final lift of pipe embedment fill to 6-inches above the top of the pipe. Compact as described in 8.f.

h. The fill shall be compacted to a density established as follows:

1. The Contractor shall prepare a trial area (which may be part of the production operation) compacted in accordance with Section 02215 Part 3.03.C. The trial area shall be at least 50-feet long and be comprised of a least 2 lifts of fill.

2. CQC will perform twenty (20) density tests on fill compacted using a vibratory plate compactor, in accordance with Section 02215 Part 3.03.C.

3. The above density tests will be performed on at least two different lifts of soil.

4. CQC will calculate the required density by excluding the highest and lowest measured values, and averaging the remaining 18 measured values.

5. CQC will measure the dry density of each lift of fill compacted by flooding in at least three locations. The average dry density of fill compacted by flooding shall be equal to or greater than the density calculated in 8.h.~~3~~4. In the event the required density is not met, CQC will perform two additional density tests, exclude the highest and lowest measured values, and recalculate the average dry density. In the event the recalculated dry density does not meet or exceed the required density, the lift shall be recompacted in accordance with the requirements of 8.d.

i. After CQC approval of the pipe embedment fill compaction place compacted fill above the pipe embedment fill in accordance with Section 02200.

Daniel Bodine
Daniel Bodine

GEOSYNTEC CONSULTANTS — 2195 — Page 1 of 1

Written by: Dan Bodine Date: 97 09 27 (YY MM DD) Reviewed by: _____ Date: __/__/__ (YY MM DD)

Client: FDF Project: Fernald Project/~~Proposal~~ No. 60 0166 Task No.: 3-1

Results of 20 Field Density Tests Taken in Two Lifts of Pipe Embedment Fill Compacted by Four Passes of Vibratory Plate Compactor

	Test No.	Wet Density lb/ft3	Dry Density lb/ft3	Percent Moisture %
Lift No 1 (First Lift Below Pipe) 16 Sept 97 Troxler Gauge	DB01	109.3	106.4	2.8
	DB02	111.8	107.0	4.5
	DB03	113.1	107.8	4.9
	DB04	113.6	108.0	5.2
	DB05	109.9	106.4	3.4
	DB06	110.2	107.0	3.0
	DB07	111.4	107.6	3.6
	DB08	110.6	107.4	2.9
	DB09	111.5	108.2	3.0
	DB10	111.8	108.7	2.9
Lift No 2 (Top Lift Over Pipe) 18 Sept 97 Troxler Gauge	DB11	113.4	109.6	3.4
	DB12	109.5	105.3	3.9
	DB13	112.3	108.0	3.9
	DB14	113.1	109.1	3.7
	DB15	112.3	108.4	3.6
	DB16	113.1	109.4	3.4
	DB17	114.9	110.5	3.9
	DB18	112.1	108.1	3.6
	DB19	113.7	109.8	3.6
	DB20	114.3	109.3	4.6
n = 20	Σ		2162.0	
	X̄		108.10	
	S		1.31	
n = 18 (lowest & highest removed)	Σ		1946.2	
	X̄		108.12	
	S		1.05	

Summary
Required Minimum Dry Density ≥ 108.1 lb/ft3
Reference DCN 1700-058

D. Bodine

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GEOSYNTEC CONSULTANTS

2195 Page ____ of ____

Written by: Dan Bodnie Date: 97/09/16 (YY MM DD) Reviewed by: _____ Date: __/__/__ (YY MM DD)

Client: FDF Project: ASDF Project/Proposal No. 60 0166 Task No.: 3.1

16 Sept 97

Test No	Wet Density lb/ft³	Dry Density lb/ft³	Moisture Weight lb/ft³	Percent Moisture %
DB 01	109.3	106.4	3.0	2.8
DB 02	111.8	107.0	4.8	4.5
DB 03	113.1	107.8	5.3	4.9
DB 04	113.6	108.0	5.6	5.2
DB 05	109.9	106.4	3.6	3.4
DB 06	110.2	107.0	3.3	3.0
DB 07	111.4	107.6	3.9	3.6
DB 08	110.6	107.4	3.2	2.9
DB 09	111.5	108.2	3.3	3.0
DB 10	111.8	108.7	3.2	2.9
$\bar{X}$		107.5		3.6
S		0.8		0.9

n=10
$\bar{X}$ = 107.5 γd
n=8
$\bar{X}$ = 107.4 γd
WC = 3.6% n=10
WC = 3.8% n=8

- First Lift of Pipe Embedment Sand
- Test Area Sta ~~20~~ 0+20 to 0+75 inside Trench with slopes cut back to approx. 1 to 1

Tested with Troxler Nuclear Gauge-Probe at 6 ins

GEOSYNTEC CONSULTANTS

Written by: Dan Bodine Date: 97 09 27 (YY MM DD) Reviewed by: _____ Date: __/__/__ (YY MM DD)

Client: FDF Project: Fernald Project/~~Proposal~~ No.: 660166 Task No.: 3.1

Results of 20 Field Density Tests Taken in Two Lifts of Pipe Embedment Fill Compacted by Four Passes of Vibratory Plate Compactor

	Test No.	Wet Density lb/ft³	Dry Density lb/ft³	Percent Moisture %
Lift No 1 (First Lift Below Pipe) 16 Sept 97 Troxler Gauge	DB01	109.3	106.4	2.8
	DB02	111.8	107.0	4.5
	DB03	113.1	107.8	4.9
	DB04	113.6	108.0	5.2
	DB05	109.9	106.4	3.4
	DB06	110.2	107.0	3.0
	DB07	111.4	107.6	3.6
	DB08	110.6	107.4	2.9
	DB09	111.5	108.2	3.0
	DB10	111.8	108.7	2.9
Lift No 2 (Top Lift Over Pipe) 18 Sept 97 Troxler Gauge	DB11	113.4	109.6	3.4
	DB12	109.5	105.3	3.9
	DB13	112.3	108.0	3.9
	DB14	113.1	109.1	3.7
	DB15	112.3	108.4	3.6
	DB16	113.1	109.4	3.4
	DB17	114.9	110.5	3.9
	DB18	112.1	108.1	3.6
	DB19	113.7	109.8	3.6
	DB20	114.3	109.3	4.6
n = 20	Σ		2162.0	
	$\bar{X}$		108.10	
	S		1.31	
n = 18 (lowest & highest removed)	Σ		1946.2	
	$\bar{X}$		108.12	
	S		1.05	

Summary
Required Minimum Dry Density ≥ 108.1 lb/ft³
Reference DCN 1700-058

D. Bodine

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E 2195 $\bar{X}$ = 10
$\bar{X}$ = 108.75
S = 1.44

N = 8
108.96
0.70

connection on the south side of the cleanout
sta 23+50. Monitored by Randy Livingston
tos taken.

15 - Began sliding the 10" coupling over the
to be covered. Had to tap it into place w/ flat
of ball pean hammer, Kobelco SK907L-II
e holding pipe up w/ strap during process. Pipe
laying in welding machine # 1211. R.L. still
toring as well. Both pipe ends had been shaved
the weld areas

ed placing coupling in machine clamp to move
it worked - but the pipes drifted too
apart - Finally got coupling centered to satisfy

@ 1540
57 - Weld complete & successful

N. Petro Area 60057

VBS - Hyundai t-hoe cont to place PEF
trench b/w 4CS/4DS 02 & 03. Cat
p/truck supplying t-hoe w/ PEF.
the day's 1st lift of soil b/w 01 & 02 was
plete. Took 2nd test

1610	WD 129.6	% M 13.7	
25	DD 113.9	% Cmp 98.3	P
6"/1	M 15.1		

620 PEF b/w 02 & 03 being comp. w/ vib. pl.

1650 Soil began being placed b/w 02 & 03
963B bringing to Hyundai; T-hoe put in
trench & spread.
1655 - Whacker began comp.
1500 Took tests on PEF for D. Bodine

DB 11	WD	113.4	DD 109.6	M 3.7	% M 3.4
DB 12	"	104.5	" 105.3	" 4.1	" 3.9
DB 13	"	112.3	" 108	" 4.2	" 3.9
DB 14	"	113.1	" 109.1	" 4.0	" 3.7
DB 15	"	112.3	" 108.4	" 3.9	" 3.6
DB 16	"	113.1	" 109.4	" 3.7	" 3.4
DB 17	"	114.4	" 110.5	" 4.4	" 3.9
" 18	"	112.1	" 108.1	" 3.9	" 3.6
" 19	"	113.7	" 109.8	" 3.9	" 3.6
" 20	"	114.3	" 109.3	" 5.1	" 4.1
4 passes	8" 10" 11 ft	6" tests / sta 4+10 to 5+30 6" & above pipe			

(17-20 Bonel)

1710 Wise Construction equipment parked & personel gone.
1830 Caution tape laid 28+00

0630 Arrived. Att mtg - 6 Pope & C. Brown.
0730 Toured jobsite. Observed VBS pipe still heading toward MH #11, notified Randy.
Observed Wise preparing to cont. exc. west tie
Noted H2O level in COMH #1 @ top
0800 VBS equipment heading to work areas in N. Petro

N. Petro 60057

0805 - Kobelco SK200LC T-hoe placing soil in trench b/w 02 & 03
Cat 963B carrying soil to T-hoe

2195

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

WP / WO NO.:	(2)S/C NO.:	(5)Pg 1 OF 2	(6)DATE
1700	589		10/01/97

(3)S/C TITLE: Leachate Conveyance System

(11)RCI NO.: 1700-034R

(4) RESPONSIBLE DISCIPLINE: E☐ M☐ C☐ OTHER☐

(4A)RCI/DCN TITLE: Granular Filter Material @ LCS/LDS Manholes

(11)DCN NO.:

(7)DOCUMENTS AFFECTED	(7)DOCUMENT NOS.	(7)REV.	(8)OTHER
Trenching and Backfilling	Section 02215	0	Para. 3.03.B.f, g & h

(9)☐ RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER (9)☐ DCN - JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

Specification Section 02215, Trenching and Backfilling, Para. 3.03.B.f, g and h requires the placement of 6 inches of granular filter material above the manhole embedment fill at the LCS/LDS manholes. Does the material submitted by Village Building Services, Inc. for the pipe embedment fill (Submittal #046) meet the requirements for the granular filter material? Both are specified to meet the requirements of Section 703.06 of the Ohio DOT Specifications. Please advise.

(10)REQUESTOR: Richard L. McGuire COMPANY: Fluor Daniel Fernald DATE: 10/1/97
Richard L. McGuire

(12)FCE / PE James C. Jenkins DATE: 10/1/97
J. C. Jenkins

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☒ NO ☐ YES (14)FOR DCN: ☐ APPROVED ☐ APPROVED AS NOTED ☐ DISAPPROVED

Yes, the pipe embedment fill submitted meets the granular filter requirements. CQC has been informed of this earlier this week. (and FDF Construction)

INFORMATION ONLY

RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL: Daniel Bolint DATE: 1 Oct. 97

(20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE:

(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE:

PERFORMANCE GRADE: (17) N.A.

(18)CONSTRUCTION CONCURRENCE: R McGuire N.A. DATE: 10/3/97

PURCHASE REQUISITION REQUIRED: ☐ YES ☐ NO (19)

(21)WORK COMPLETED: (SIGNOFF BY FCE OR PE) DATE:

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FS-F-4259 (10/01/96)

ORIGINAL

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

(1)WP / WO NO.: 1700	(2)S/C NO.: 589	(3)PG 1 OF 2	(8)DATE 10-29-97
(5)S/C TITLE: LEACHATE CONVEYANCE SYSTEM		(11)RCI NO.: 1700-036	
(4) RESPONSIBLE DISCIPLINE: SO MO CO OTHER O	(4A)RCI/DCN TITLE: TEST METHOD - 10" LCS	(11)DCN NO.:	

(7)DOCUMENTS AFFECTED	(7)DOCUMENT NOS.	(7)REV.	(8)OTHER
SPEC. SECTION			

(9)☐RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER (9)☑DCN-JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

SINCE NO METHOD OF SEALING PIPE (6"/10") FOR TEST HAS BEEN DEVISED BY GEO-SYNTEC, FDF, OR VBS WE WILL USE A STATIC TEST (HEAD PRESSURE) TO TEST 10" CONTAINMENT.

(10)REQUESTOR: MT CLEVELAND COMPANY: VBS DATE 10-29-97	(12)FCE / PE James C. Jenkins DATE 10/29/97

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐NO ☐YES (14)FOR DCN: ☐APPROVED ☐APPROVED AS NOTED ☑DISAPPROVED

See Page 2 for Response

INFORMATION ONLY

RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL: Dee DATE 4 Nov 97	(20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE:
(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY)	DAT:
PERFORMANCE GRADE: (17) N.A.	
(18)CONSTRUCTION CONCURRENCE: Richard L McPherson DATE 11/6/97	(21)WORK COMPLETED: (SIGNOFF BY FCE OR PE) DATI
PURCHASE REQUISITION REQUIRED: ☐YES ☑NO (19)	

FS-F-4259 (10/01/96)

ORIGINAL

The request to use a static head pressure test is disapproved. VBS was reminded to test each segment of piping prior to backfilling and making final connections to manholes and the Permanent Lift Station (PLS). However, they elected to complete the backfilling and make the connections. That procedure will make it more difficult to find leaks if they are detected during the pressure test. A method of sealing the containment piping and conducting pressure testing is described below.

If not already installed, install a fixed end seal for the LTS pipes in each LCS manhole. The fixed end seal shall be constructed by extrusion welding an approximate 2-inch length of 8-inch SDR 11 pipe cut in two halves against the 10-inch containment pipe and against the 6-inch carrier pipe. The two halves will also require welding. Pressure test at 15 psi for 3 hours the LTS containment pipe between LCS Manholes No. 1 and No. 2 and No. 2 and No. 3 and No. 3 and the PLS. The installation of the fixed end seal and pressure test are required by specifications and drawings. The space inside the manhole is tight, but greater than the space available for the extrusion welding repair of the coupling on the south side of the PLS. To assist the pressure testing, test ports shall be installed in the top of the 10-inch pipe at the south end of each manhole and in the fixed end seal at minimum one of the cleanouts within each test segment. If the test fails and there are no leaks found in the test connections or manholes, the pipe shall be isolated in segments and tested until the leak is found, repaired and again tested. After completion of successful testing, provide a plug for the test holes at the cleanouts. The test hole inside the manhole may be left open. At the manholes, the fixed end seals shall be perforated with six 5\8 inch holes after completion of all testing. This does not include the PLS which has a monitoring port.

The containment for the LCS, LCS Redundant and LDS pipes to the cell will be final tested by Petro when the final tests at the liner penetration boxes are performed. The containment between COMH 1 and the PLS should be tested in a similar manner as the LTS line except that the pipe sizes need to change.

Daniel Bodine

2195

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

(1)WP / WO NO.: 1700	(2)S/C NO.: FSC-589	(5)Pg 1 OF 1	(6)DATE: 2/25/99
(3)S/C TITLE: LEACHATE CONVEYANCE SYSTEM		(11)RCI NO.: 1700-039R	
(4) RESPONSIBLE DISCIPLINE: E ☐ M ☐ C ☒ OTHER ☐	(4A)RCI/DCN TITLE: DUAL CONTAINMENT PIPE HYDROSTATIC TESTING	(11)DCN NO.:	

(7)DOCUMENTS AFFECTED	(7)DOCUMENT NOS.	(7)REV.	(8)OTHER
SPECIFICATIONS			
20110-TS-0001	02605	0	
	Sec. 3.07,C-2		

(9) X RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER

(9) ☐ DCN - JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

- Contractor Hydrostatic Test Procedure, Submittal 90R2 does not give testing sequences for dual contained gravity piping
- Provide clarification of testing/sequencing of Dual Containment Piping on LCS Gravity Piping 6"/10" SDR 26

(10)REQUESTOR:	COMPANY	DATE:	(12)CE / PE DON GOETZ	DATE:
James C. Jenkins	FDF	2/25/99	James C. Jenkins	2/25/99

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☒ NO ☐ YES

(14) FOR DCN: ☐ APPROVED ☐ APPROVED AS NOTED ☐ DISAPPROVED

GeoSyntec RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL/DISAPPROVAL: ☐ FIT ☐ FORM ☐ FUNCTION DATE: 2/25/99	(20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE:
(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE:	
PERFORMANCE GRADE: (17)	
(18)CONSTRUCTION CONCURRENCE: DATE:	(21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE
PURCHASE REQUISITION REQUIRED: ☐ YES ☐ NO (19)	

x 3417

FS-F-4259
REV. 4: 02/16/98

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2195

Response to RCI –1700-039R
(Dated 02/25/99, Page 2 of 2)

Contractor Hydrostatic Test Procedure, Submittal 90R2, does not specifically indicate whether the pipe "system" is a single pipe or a dual containment/carrier pipe system. Testing of pipes in a dual pipe configuration does require special considerations. The carrier pipe may be tested in a dual containment configuration as long as pipe centralizers have been installed per specifications and the containment pipe remains open and not under any pressure. The test pressure shall be as specified and the pressure shall be monitored at the low end of the system. The containment pipe may be tested in the dual pipe configuration at the specified test pressure as long as the carrier pipe is under the same internal pressure. Note that all pressures must not exceed the maximum test pressures recommended by the pipe manufacturers (1.5 x rated pressure) and that test pressures if greater than 1.0 x the rated pressure, including initial expansion and time at test pressure shall not exceed 8 hours. If the test is not completed the pipe test section should be allowed to relax for at least 8 hours before bringing the pipe test section up to test pressure again.

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APPENDIX C

APPENDIX C
LTS CONSTRUCTION DOCUMENTATION

2195

VBS QC Reports and Daily Reports

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VBS QC Reports

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

2195

QC DAILY SUMMARY REPORT

Report No.: 137

Date: October 16, 1997

Weather Conditions:
Varible cloudiness. Winds were 12.3 MPH.

Temperature Range: 38-56 F

Construction Activity and Work in Process:
* Backfill at LCS/LDS manholes. Begin preparation to test.
Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.
	6" HDPE couplings	Monitoring Well	1	

Comments:

QC Signature: [signature]

Date: 10/16/97

47

dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 138

Date: October 17, 1997

Weather Conditions:
Mostly cloudy. Winds were 10.0 MPH.

Temperature Range: 42-53 F

Construction Activity and Work in Process:
* Filled 6" for test. Marking tape installed and backfilled.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.

Comments:

QC Signature: [signature]

Date: 10/17/97

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dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 139

Date: October 20, 1997

Weather Conditions:
Mostly cloudy am. Mostly sunny pm. Winds were 10.8 MPH.

Temperature Range: 36-60 F

Construction Activity and Work in Process:
* Completed G.W. -10" TACOS. Fusing 3" couplings in RIMIA. Backfill.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.
	3" HDPE Coupling	RIMIA	2	

Comments:

QC Signature: [signature]

Date: 10/20/97

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VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 140

Date: October 21, 1997

Weather Conditions:
Varible cloudiness. Winds were 10.3 MPH.

Temperature Range: 33-56 F

Construction Activity and Work in Process:
* Install markers in TACOS. Backfill manholes.

Meetings and Results:
Weekly Job Progress Meeting. Air Release M.H. to be deleted from contract.

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.

Comments:

QC Signature: [signature]

Date: 10/21/97

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VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

2195

QC DAILY SUMMARY REPORT

Report No.: 141

Date: October 22, 1997

Weather Conditions:
Killing Frost. Varible cloudiness. Winds were 7.5 MPH.

Temperature Range: 25-47 F

Construction Activity and Work in Process:
* Backfilling. Piping in PLS. Test failed on 6" LCS.
Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.
Hydro-Test	6" LCS	RIMIA		X

Comments:

QC Signature: [signature]

Date: 10/22/97

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VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 142

Date: October 23, 1997

Weather Conditions:
Varible cloudiness. Winds were 7.0 MPH.

Temperature Range: 22-51 F

Construction Activity and Work in Process:
* Began to fill 6" line but stopped to drian water from cell #1.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.

Comments:

QC Signature: [signature]

Date: 10/23/97

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VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 143

Date: October 27, 1997

Weather Conditions:

Temperature Range: 34-43 F

Mostly cloudy. Gradual clearing by evening. Winds were 14.2 MPH.

Construction Activity and Work in Process:

* Piping in Lift Station

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.
Pneumatic Test	6" Gas	TACOS	X	

Comments:

QC Signature: [signature]

Date: 10/27/97

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dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

2195

QC DAILY SUMMARY REPORT

Report No.: 144

Date: October 28, 1997

Weather Conditions:
Mostly sunny. Winds were 8.9 MPH.

Temperature Range: 24-49 F

Construction Activity and Work in Process:
* Set pumps and rails in Lift Station.

Meetings and Results:
Weekly Job Progress Meeting

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.

Comments:

QC Signature: [signature]

Date: 10/28/97

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VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 145

Date: October 29, 1997

Weather Conditions:
Mostly sunny. Winds were 6.3 MPH.

Temperature Range: 31-59 F

Construction Activity and Work in Process:
* Forms set for LCS/LDS cover slabs. Capped 6" Gas line. Excavated 12" G.W. line.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.

Comments:

QC Signature: [signature]

Date: 10/29/97

55

dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 146

Date: October 30, 1997

Weather Conditions:

Temperature Range: 27-64 F

Dense fog. Otherwise mostly sunny. Winds were 10.8 MPH.

Construction Activity and Work in Process:

* Filled 6" LCS for test. Flanged 12" G.W. line for tie-in at TACOS.
Reworked concrete rebar for pad at B.S.L.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.

Comments:

QC Signature: [signature]

Date: 10/30/97

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dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 147

Date: October 31, 1997

Weather Conditions:
Early showers. Mostly cloudy. Winds were 11.7 MPH.

Temperature Range: 44-64 F

Construction Activity and Work in Process:
* Tested 6" LCS- could not reach test pressure.
Hydro- seeding RIMIA. Filled 10" G.W. for test.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.
Test	6" LCS	RIMIA		X

Comments:

QC Signature: [signature]

Date: 10/31/97

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dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

2195

QC DAILY SUMMARY REPORT

Report No.: 148

Date: November 3, 1997

Weather Conditions:
Overcast am. Rain/showers mixed. Windswere 12.3 MPH.

Temperature Range: 34-43 F

Construction Activity and Work in Process:
* Repaired leaks at valves on 6" LCS and refilled. 10" G.W. line filled & Vented.
Piped C.O.M.H.-5.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.

Comments:

QC Signature: [signature]

Date: 11/3/97

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dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

2195

QC DAILY SUMMARY REPORT

Report No.: 149

Date: November 4, 1997

Weather Conditions:
Overcast am. Rain/showers mixed. Windswere 12.3 MPH.

Temperature Range: 34-43 F

Construction Activity and Work in Process:
* Test on 6" LCS failed-last 24# in 40 minutes. Poured support pad at BS.L.
/est

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.
Test	6" LCS	RIMIA		X
	Concrete Pad	B.L.S.	X	

Comments:

QC Signature: [signature]

Date: 11/4/97

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dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 150

Date: November 5, 1997

Weather Conditions: Temperature Range: 38-54 F

Mostly sunny. Clouds moved in during the evening. Winds were 7.8 MPH.

Construction Activity and Work in Process:

* Filling 6" LCS. Pumping 10" G. W. in TACOS.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.

Comments:

QC Signature: [signature]

Date: 11/5/97

60

dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 151

Date: November 6, 1997

Weather Conditions: Temperature Range: 38-54 F
Cloudy. Some light rain/showers in the evening. Winds were 9.1 MPH.

Construction Activity and Work in Process:
* Drained 6" LCS after failed test. Tie-in splash pipe at B.S.L.

Meetings and Results:
Weekly Job Progress Meeting

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.
	4/8" LCS	BSL	1	

Comments:

QC Signature: [signature]

Date: 11/6/97

61

dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 152

Date: November 7, 1997

Weather Conditions:
Mostly cloudy. Evening showers. Winds were 11.5 MPH.

Temperature Range: 37-48 F

Construction Activity and Work in Process:
* Filled 6" LCS to Station 16. and inserted dye. Excavated cleanouts at LCS/LDS manholes at cover slabs.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.

Comments:

QC Signature: [signature]

Date: 11/7/97

62

dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 153

Date: November 8, 1997

Weather Conditions: Temperature Range: 39-50 F
Overcast. Rain showers very early am. Winds were 12.5 MPH.

Construction Activity and Work in Process:
* Filled 10" G.W. line and pumped up to 75# Dye Testing 6" LCS line.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.

Comments:

QC Signature: [signature]

Date: 11/8/97

43

dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

2195

QC DAILY SUMMARY REPORT

Report No.: 154

Date: November 10, 1997

Weather Conditions:
Cloudy with few spinkles. Winds were 8.9 MPH.

Temperature Range: 39-46 F

Construction Activity and Work in Process:
* Final connection at C.O.M.H. -11.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.
Hydro-Test	6" LCS	PLS to MH-3		X
LCS Coupling	4/8" LCS	C.O.M.H. -11	X	

Comments:

QC Signature: [signature]

Date: 11/10/97

64

dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

2195

QC DAILY SUMMARY REPORT

Report No.: 155

Date: November 11, 1997

Weather Conditions: Temperature Range: 36-44 F
Varible cloudiness. Some am. sun, Clouds by mid afternoon. Winds were 10.9 MPH.

Construction Activity and Work in Process:
* Testing 4" LCS in TACOS. Testing 6" in RIMIA.
  Grading in RIMIA. Hydro-seeding

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.
LCS Hydro	4/8"	TACOS		X
LCS Hydro	LCS -6"	RIMIA		X

Comments:

QC Signature: [signature]

Date: 11/11/97

65

dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 156

Date: November 12, 1997

Weather Conditions:
Mostly cloudy. Winds were 11.0 MPH.

Temperature Range: 24-36 F

Construction Activity and Work in Process:
* Rework rebar at LCS/LDS. Sealed, drilled and tapped 10" in LCS -3. Hydro-seeding.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.

Comments:
Pipe i.d. tape has been dug up by others from LCS/LDS 1-3.

QC Signature: [signature]

Date: 11/12/97

66

dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT 2195

Report No.: 157

Date: November 13, 1997

Weather Conditions: Temperature Range: 25-39 F

Cloudy. Rain by mid afternoon through the evening. Winds were 10.9 MPH.

Construction Activity and Work in Process:

* Pipe stands in C.O.M.H. -5 and 11. Filled 12" G.W. line. Hydro- Seeded.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.

Comments:

Pipe i.d. tape has been dug up by others from LCS/LDS 1-3.

QC Signature: [signature]

Date: 11/13/97

67

dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO: 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 158

Date: November 14, 1997

Weather Conditions:
Overcast, cold. Light early am rain. Winds were 9.7 MPH.

Temperature Range: 32-35 F

Construction Activity and Work in Process:
* Tested 10" G.W. Modified and installed support at B.S.L.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.
Hydro-Test	10" G.W.	TACOS	X	
Hydro-Test	4" LCS	PLS-C.O.M.H.-11		X *

Comments:
*Test lost 1/2# - Should be acceptable.

QC Signature: [signature]

Date: 11/14/97

68

dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20116/1708
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 159

Date: November 15, 1997

Weather Conditions:

Temperature Range: F

Construction Activity and Work in Process:
* Filled 10" LCS for leak detection - inserted camera.
  Filled 4" LCS at C.O.M.H.-8 for test.
  Repaired C.O.M.H.-4 for test.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.
LCS	4"	C.O.M.H.-8		X *

Comments:
*Test lost 1-3/4# - should be acceptable.

QC Signature: [signature]

Date: 11/15/97

69

dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 160

Date: November 16, 1997

Weather Conditions:
Overcast flurries and light snow showers. Winds were 9.2 MPH.

Temperature Range: 23-32 F

Construction Activity and Work in Process:
* Filled and pressurized 6" LCS from Sta. 23.5 to 16. Found leak in 6" @ C.O. #12.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.

Comments:
*

QC Signature: [signature]

Date: 11/16/97

70

dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

2195

QC DAILY SUMMARY REPORT

Report No.: 161

Date: November 17, 1997

Weather Conditions:
Mostly Sunny. Winds were 7.5 MPH.

Temperature Range: 16-36 F

Construction Activity and Work in Process:
* Testing 4" and 6". Excavated for leak repair at station 12.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.
Hydro-Test	6"	Sta. 23.5&16.	X	
Hydro-Test	4"	C.O.M.H.-11 to PLS	X	

Comments:

QC Signature: [signature]

Date: 11/17/97

71

dlysum.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

QC DAILY SUMMARY REPORT

2195

Report No.: 162

Date: November 18, 1997

Weather Conditions:
Dense am fog. Otherwise, sunny. Winds were 12.1 MPH.

Temperature Range: 14-44 F

Construction Activity and Work in Process:
* Fill and vent 12" G.W. in TACOS.
  Making final connections at LCS/LDS for Petro.
  Leak repairs.

Meetings and Results:

Inspection and Monitoring:

Inspection	Mat/Equip.	Location	Sat.	Unsat.

Comments:

QC Signature: [signature]

Date: 11/18/97

72

dlysum.

VBS Daily Reports

2195

DATE: October 10, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE:52-79 F	WEATHER CONDITIONS: Mostly cloudy, with chance of sprinkles in afternoon. Winds were 5 to 10 MPH.	

NO. OF PIPEFITTERS: 3 LABORERS: 5 OPERATORS: 5 SUBCONTRACTOR: 2
VBS SUPERVISORS: 3 VBS OFFICE: 2 VISITORS: TEAMSTER: 1

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Replaced bolts in LCS/LDS-1.
Test on monitoring well #1.
Prepared for test on 6/10" LCS from PLS to MH#3.

COMMENTS:

CURRENT DAY WORK FORCE:	
21	SUBCONTRACTOR SIGNATURE

74

subdab.

Ken Zickel — Certified to do welding of electrofusion couplings

2195

DATE: October 16, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE: 38-56 F	WEATHER CONDITIONS: Variable cloudiness. Winds were 12.3 MPH.	

NO. OF PIPEFITTERS: 6 LABORERS: 5 OPERATORS: 6 SUBCONTRACTOR: 2
VBS SUPERVISORS: 6 VBS OFFICE: 2 VISITORS: TEAMSTER: 1

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:
Waiting for turnover of Post Indicator for C.O. #5 work. Waiting for instruction on fence removal at Air Release Manholes.

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Backfill LCS/LDS 1, 2&3 and C.O.M.H -5.
Test monitoring well #2 and passed.
1 coupling weld at monitoring well.
Begin filling 6" for test..

COMMENTS:

CURRENT DAY WORK FORCE:

28

SUBCONTRACTOR SIGNATURE

subdab.

75

2195

DATE: October 17, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE: 42-53 F	WEATHER CONDITIONS: Mostly Cloudy Winds were 10.0 MPH.	

NO. OF PIPEFITTERS: 5 LABORERS: 5 OPERATORS: 6 SUBCONTRACTOR:
VBS SUPERVISORS: 2 VBS OFFICE: 1 VISITORS: TEAMSTER: 1

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:
Asked about PIV and fence removal by Air Release Manholes.

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Filled 6" LCS.
Set Monitoring Well #3.
Placed marking tape and backfilled in TACOS and S. RIMIA...

COMMENTS:

CURRENT DAY WORK FORCE:

20

SUBCONTRACTOR SIGNATURE

subdeb.

76

DATE: October 21, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700

TEMPERATURE RANGE: 33-56 F	WEATHER CONDITIONS: Variable cloudiness. Winds were 10.3 MPH.

NO. OF PIPEFITTERS: 7 LABORERS: 5 OPERATORS: 6 SUBCONTRACTOR:
VBS SUPERVISORS: 3 VBS OFFICE: 2 VISITORS: TEAMSTER: 1

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:
Asked about PIV and fence at Air Release Manholes.

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Install I.D. signs in TACOS.
Installed test flanges on G.W. -10.
Backfilled LCS/LDS manholes.
Reworked elevation on 6/10" lines at LCS/LDS #1.

COMMENTS:

CURRENT DAY WORK FORCE: 24	SUBCONTRACTOR SIGNATURE

subdeb.

77

2195

DATE: October 22, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE: 25-47 F	WEATHER CONDITIONS: Killing frost. Variable cloudiness. Winds were 7.5 MPH.	

NO. OF PIPEFITTERS: 7 LABORERS: 5 OPERATORS: 6 SUBCONTRACTOR: 2
VBS SUPERVISORS: 4 VBS OFFICE: 2 VISITORS: TEAMSTER: 1

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Bolted valves and spool piece together for P.L.S.
Filled 6" Leachate and attempted to test - 2" plugs Failed at 20# pressure.
Backfilled LCS/LDS manholes.

COMMENTS:
Waiting on post indicator to be furnished by F.D.F.

CURRENT DAY WORK FORCE:	
27	SUBCONTRACTOR SIGNATURE

subdab.

78

2195

DATE: October 30, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE: 27-64 F	WEATHER CONDITIONS: Dense fog. Otherwise mostly sunny. Winds were 10.8 MPH.	

NO. OF PIPEFITTERS: 4 LABORERS: 2 OPERATORS: 3 SUBCONTRACTOR: 2
VBS SUPERVISORS: 3 VBS OFFICE: 2 VISITORS: TEAMSTER: 1

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:
Waiting on post indicator to be furnished by F.D.F. Petro not completing backfill around LCS/LDS holding up electricians.

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Filled 10" G.W. line in TACO and 6" LCS in RIMIA.
Rework form for pipe support pier at B.S.L.
Located and flanged 12" G.W. line for tie-in.

COMMENTS:

CURRENT DAY WORK FORCE:	
17	SUBCONTRACTOR SIGNATURE

subdeb.

79

2195

DATE: October 31, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700

TEMPERATURE RANGE: 44-64 F	WEATHER CONDITIONS: Early showers. Mostly cloudy. Winds were 11.7 MPH

NO. OF PIPEFITTERS: 4 LABORERS: 3 OPERATORS: SUBCONTRACTOR:
VBS SUPERVISORS: 2 VBS OFFICE: 1 VISITORS: TEAMSTER: 1

SAFETY PROBLEMS ENCOUNTERED:
IH stopped laborers and gave talk about PPE for epoxy use.

SCHEDULE ISSUES AND CONCERN:
Waiting for post indicator to be furnished by F.D.F. Petro not backfilled at LCS/LDS holding up setting of poles.

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Hydro seeded in RIMIA, coated rebar with epoxy at B.S.L. support.
Tested 6" LCS in RIMIA, Filled 10" line in TACO.

COMMENTS:

CURRENT DAY WORK FORCE: 10	SUBCONTRACTOR SIGNATURE

subdab.

80

2195

DATE: November 3, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE: 34-43 F	WEATHER CONDITIONS: Overcast am. Rain/snow showers mixed. Winds were 12.3 MPH.	

NO. OF PIPEFITTERS: 5 LABORERS: 3 OPERATORS: 2 SUBCONTRACTOR:
VBS SUPERVISORS: 4 VBS OFFICE: 2 VISITORS: TEAMSTER:

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:
Waiting for post indicator to be furnished by F.D.F. Need LCS/LDS backfilled so B&J can set poles and Diaz can form M.H. cover slabs.

DESCRIPTION OF WORK/OVERTIME PERFORMED:
6" LCS leaks repaired & prepared for test.
10" G.W. line in TACOS filled & vented.
C.O.M.H. 5 piped complete.

COMMENTS:
M.H. #1 filled with rain water - Petro requested we leave pipe open so cell would drain. pumped all day.

CURRENT DAY WORK FORCE:	
17	SUBCONTRACTOR SIGNATURE

subdsb.

81

2195

DATE: November 4, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700

TEMPERATURE RANGE: 34-40 F	WEATHER CONDITIONS: Overcast with a snow flurry or two. Winds were 9.3 MPH.

NO. OF PIPEFITTERS: 4 LABORERS: 2 OPERATORS: 2 SUBCONTRACTOR:
VBS SUPERVISORS: 4 VBS OFFICE: 2 VISITORS: TEAMSTER:

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Testing in RIMIA and TACOS.
Poured support pads at B.S.L.
Demobilizing equipment.

COMMENTS:

CURRENT DAY WORK FORCE: 14	SUBCONTRACTOR SIGNATURE

subdeb.

82

2195

DATE: November 5, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700

TEMPERATURE RANGE: 38-54 F	WEATHER CONDITIONS: Mostly sunny. Clouds moved in during the evening. Winds were 7.8 MPH.

NO. OF PIPEFITTERS: 4 LABORERS: 2 OPERATORS: 2 SUBCONTRACTOR:
VBS SUPERVISORS: 2 VBS OFFICE: 2 VISITORS: TEAMSTER:

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:
Waiting for Post Indicator to be furnished by F.D.F. Waiting for Petro to backfill so poles can be set.

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Testing 6" LCS and 10" G.W. lines
Pumping out LCS/LDS #3.
Demobilizing..

COMMENTS:

CURRENT DAY WORK FORCE: 12	SUBCONTRACTOR SIGNATURE

subdeb.

83

2195

DATE: November 7, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE:37-48 F	WEATHER CONDITIONS:Mostly cloudy. Evening shower. Wind were11.5 MPH.	

NO. OF PIPEFITTERS: 3 LABORERS: 2 OPERATORS: 2 SUBCONTRACTOR:
VBS SUPERVISORS: 3 VBS OFFICE: 1 VISITORS: TEAMSTER:

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:
Stopped from using water truck to fill since we didn't have an air gap on the line.

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Filling 6" LCS line from P.L.S. to Sta. 16.00 and inserting dye tablets.
Dug out for cleanouts at LCS/LDS manholes for concrete pour.

COMMENTS:

CURRENT DAY WORK FORCE: 11	SUBCONTRACTOR SIGNATURE

subdeh.

84

2195

DATE: November 8, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE:39-50 F	WEATHER CONDITIONS: Overcast. Rain showers very early am. Winds were 12.5 MPH.	

NO. OF PIPEFITTERS: 4 LABORERS: 2 OPERATORS: 2 SUBCONTRACTOR:
VBS SUPERVISORS: 2 VBS OFFICE: 1 VISITORS: TEAMSTER: 1

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:
Waiting for indicator to be finished by F.D.F.

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Filled 10" G.W. line and pumped up to 75#.
Dye testing 6" line venting flanges and cleanouts.
Digging cleanouts at LCS/LDS for concrete pour.

COMMENTS:

CURRENT DAY WORK FORCE:

11

SUBCONTRACTOR SIGNATURE

subdeb.

85

2195

DATE: November 10, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE: 39-46 F	WEATHER CONDITIONS: Cloudy with a few sprinkles. Winds were 8.9 MPH.	

NO. OF PIPEFITTERS: 4 LABORERS: 2 OPERATORS: 2 SUBCONTRACTOR:
VBS SUPERVISORS: 3 VBS OFFICE: 2 VISITORS: TEAMSTER: 1

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Made final connection at C.O.M.H. - //
Testing 6" LCS RIMIA.
Place clay at PLS.

COMMENTS:
Material received from shop per attached for change order #5 work-
F.D.F. did not supply per R.McGuire.

CURRENT DAY WORK FORCE:	
14	SUBCONTRACTOR SIGNATURE

86

2195

DATE: November 11, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700

TEMPERATURE RANGE:36-44 F	WEATHER CONDITIONS: Varible cloudiness. Some am sun, clouds in by mid afternoon. 10.9 MPH

NO. OF PIPEFITTERS: 4 **LABORERS:** 2 **OPERATORS:** 2 **SUBCONTRACTOR:**
VBS SUPERVISORS: 3 VBS OFFICE: 2 **VISITORS:** **TEAMSTER:** 1

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:
Waiting for: Post Indicator and DCN/RCI on pipe supports at B.S.L.

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Test 4/8" LCS in TACOS, 6/10" in RIMIA.
Grade RIMIA.
Hydro-seed RIMIA and TACOS.

COMMENTS:
Used Wise hydro-seeder w/2 laborers for 10 hours & 1 Teamster for 5 hours.

CURRENT DAY WORK FORCE: 14	SUBCONTRACTOR SIGNATURE

2195

DATE: November 14, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700

TEMPERATURE RANGE: 32-35 F	WEATHER CONDITIONS: Overcast, cold. Light early am rain. Winds were 9.7 MPH.

NO. OF PIPEFITTERS: 3 LABORERS: 1 OPERATORS: SUBCONTRACTOR:
VBS SUPERVISORS: 4 VBS OFFICE: 1 VISITORS: TEAMSTER: 1

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Tested 10" G.W. -Passed.
Placed signs all areas.
Insert camera and check for leaks in 6/10".
4" LCS from P.L.S. to C.O.M.H. -11 test lost 1/2#.

COMMENTS:

CURRENT DAY WORK FORCE: 10	SUBCONTRACTOR SIGNATURE

subdeb.

88

2195

DATE: November 15, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE: 29-34 F	WEATHER CONDITIONS: Overcast with light snow/fog. Wind were 11.5 MPH.	

NO. OF PIPEFITTERS: 3 LABORERS: 2 OPERATORS: 2 SUBCONTRACTOR:
VBS SUPERVISORS: 2 VBS OFFICE: 1 VISITORS: TEAMSTER:

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:
Leak in 4" LCS in C.O.M.H. #4 repaired by V.B.S., 1 hr. for 2 Pipefitters.

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Filled 10" line for leak detection - inserted camera. 4" LCS filled at C.O.M.H.-8 for test- lost 1 3/4#.
Found leak in C.O.M.H.-4, repaired and refilled.

COMMENTS:

CURRENT DAY WORK FORCE:	
10	SUBCONTRACTOR SIGNATURE

subdab.

89

2195

DATE: November 16, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700

TEMPERATURE RANGE:23-32 F	WEATHER CONDITIONS:Overcast flurries and light snow showers. Winds were 9.2 MPH.

NO. OF PIPEFITTERS: 2 LABORERS: 1 OPERATORS: SUBCONTRACTOR: 1
VBS SUPERVISORS: 1 VBS OFFICE: 1 VISITORS: TEAMSTER:

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Fill and pressurized 6" LCS from 23.5 to 16.
Found leak in 6"@ C.O. #12 -24' south of C.O.

COMMENTS:

CURRENT DAY WORK FORCE: 6	SUBCONTRACTOR SIGNATURE

subdeb.

90

2195

DATE: November 17, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE: 16-36 F	WEATHER CONDITIONS: Mostly sunny. Winds were 7.5 MPH.	

NO. OF PIPEFITTERS: 4 LABORERS: 1 OPERATORS: 2 SUBCONTRACTOR:
VBS SUPERVISORS: 4 VBS OFFICE: 2 VISITORS: TEAMSTER: 1

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:
Waiting for Post Indicator and 12" coupling for G.W. line. Gary Pope checking.

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Filled and tested 6" LCS between sta. 23.5 and 16.0.
Held for 2 hrs.
Tested 4" LCS to C.O.M.H.-11. Excavate for leak repair at +/- Sta. 12.0.

COMMENTS:

CURRENT DAY WORK FORCE:	
14	SUBCONTRACTOR SIGNATURE

subdcb.

2195

DATE: November 18, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE: 14-44 F	WEATHER CONDITIONS: Dense am fog. Sunny. Winds were 12.1 MPH.	

NO. OF PIPEFITTERS: 6 LABORERS: 2 OPERATORS: 2 SUBCONTRACTOR:
VBS SUPERVISORS: 3 VBS OFFICE: 2 VISITORS: TEAMSTER: 1

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:
Waiting for 12" coupling and post indicator.

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Filled and vented 12" in TACOS. Located leak and cut pipe North of Sta. 32.
Place covers on LCS/LDS manholes.

COMMENTS:

CURRENT DAY WORK FORCE:

16

SUBCONTRACTOR SIGNATURE

subdab.

92

2195

DATE: November 19, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE: 30-53 F	WEATHER CONDITIONS: Mostly sunny am. Variable cloudiness pm. Winds were 11.5 MPH.	

NO. OF PIPEFITTERS: 5 LABORERS: 2 OPERATORS: 2 SUBCONTRACTOR: VBS SUPERVISORS: 3 VBS OFFICE: 2 VISITORS: TEAMSTER: 1

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Make tie-in on 6/10" LCS in lower RIMIA.
Extended 3-10" lines for Petro into Cell #1.
Pumped 12" G.W. line for test.

COMMENTS:

CURRENT DAY WORK FORCE:

15

SUBCONTRACTOR SIGNATURE

subdab.

93

2195

DATE: November 20, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE:24-57 F	WEATHER CONDITIONS:Fog am., otherwise partly cloudy am/pm. Winds were13.6 MPH.	

NO. OF PIPEFITTERS: 5 LABORERS: 2 OPERATORS: 2 SUBCONTRACTOR:
VBS SUPERVISORS: 4 VBS OFFICE: 2 VISITORS: TEAMSTER: 1

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Made Petro tie-in to cell #1. Filled and pressurized 12" G.W. to 152#
in TACOS. Filled 6" LCS in RIMIA. Isolated leak in RIMIA. Backfilled RIMIA.

COMMENTS:

CURRENT DAY WORK FORCE:	
16	SUBCONTRACTOR SIGNATURE

subdeb.

94

2195

DATE: November 22, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE: 32-42 F	WEATHER CONDITIONS: Cloudiness with a chance for light snow showers. Winds were15 MPH.	

NO. OF PIPEFITTERS: 4 LABORERS: 2 OPERATORS: 1 SUBCONTRACTOR: 1
VBS SUPERVISORS: 2 VBS OFFICE: 1 VISITORS: TEAMSTER:

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Filling 6" LCS in RIMIA.
95# pressure on 6" D.W.
Filled 12" F.Q.
Insulated splash pipe at B.S.L. and put signs up.

COMMENTS:

CURRENT DAY WORK FORCE:	
11	SUBCONTRACTOR SIGNATURE

subdep.

95

2195

DATE: November 24, 1997

SUBCONTRACTOR DAILY REPORT

SUBCONTRACT #: FCC 589	VILLAGE BUILDING SERVICES, INC.	WORK ORDER NO: 1700
TEMPERATURE RANGE: 25-40 F	WEATHER CONDITIONS: Partly cloudy. Winds were North 10 MPH.	

NO. OF PIPEFITTERS: 5 LABORERS: 2 OPERATORS: 2 SUBCONTRACTOR:
VBS SUPERVISORS: 4 VBS OFFICE: 2 VISITORS: TEAMSTER: 1

SAFETY PROBLEMS ENCOUNTERED:

SCHEDULE ISSUES AND CONCERN:
Waiting for P.I. and waiting to hear on date for shut-down on 12" D.W. tie-in.

DESCRIPTION OF WORK/OVERTIME PERFORMED:
Demobilize in K-65.
Fill and pressurize 6" D.W., test passed.
12" F.Q. filled and pressurized.
Repair 10" weld at LCS #3 made 3-6" coupling welds and Petro.

COMMENTS:

CURRENT DAY WORK FORCE: 16	SUBCONTRACTOR SIGNATURE

subdab.

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GeoSyntec CQC Report Summary

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LEACHATE CONVEYANCE CONSTRUCTION 1997
(SUMMARIZED FROM ON-SITE REPORTS)

Date/report ID	Summary	Actions/Comments
10 July 1997: DB NM RP	The first shipment of 6"\10" dual containment HDPE pipe arrives on site. Pipe is improperly packaged, some out of round, and damaged.	Some pipe rejected/ sent off site.
15 July 1997 MMN	FDF introduces "recovery" schedule for completion of the LCS by 30 Sep 1997.	
16 July 1997: RP	The second shipment of 6"\10" dual containment HDPE pipe arrives on site. Pipe is improperly packaged, some out of round, and damaged.	Some pipe rejected/ sent off site.
21 July 1997: SQ RP	Butt fusion welding begins. VBS encounters problems welding due to high ambient temperatures.	
23 July 1997: DB	VBS site quality control representative resigns. QC certifications on HDPE pipe missing.	
24 July 1997: JM	FDF is informed that 100% CQC monitoring of the pipe welding operations would not be possible due to coverage of other site activities.	
SQ	VBS foreman requested that GeoSyntec make note of deficient welds when observed but allow pipe fitters to continue to weld. VBS to make repairs during pressure testing, installation, or when time allowed.	
25 July 1997: JM SQ	GeoSyntec technicians directed by CQC site manager to note deficient welds and prepare NCR's as appropriate.	In reaction to 24 July 1997.
26 July 1997: RP	VBS encounters mechanical problems welding.	
27 July 1997: CQC	Heating plate for 10" butt fusion welding has insufficient dimensions, damage to HDPE pipe marked for repair by GeoSyntec after installation.	

28 July 1997: DB	VBS mistakenly welds damaged and 'hold' pipe sections.	VBS is informed what hold tags are.
29 July 1997: DB SQ	QC certifications still missing on some of the pipe. VBS also encounters problems welding out of round sections. VBS shown how to identify hold tags.	
31 July 1997: DB SQ	The third pipe shipment arrives. The pipe receives some damage during unloading.	
CQC	Certification not submitted with pipe this day.	
	VBS encounters mechanical problems welding.	A second welding machine is deployed.
6 Aug 1997: SQ	VBS cuts out approximately 2-ft of pipe and repairs a deficient weld.	Re-welded
7 Aug 1997: SQ	Two 240-ft lengths of HDPE pipe pulled into place at station 30+17 headed north. Two pieces butt fusion welded within the trench and the weld failed due to operator error.	Re-welded
8 Aug 1997: RP SQ	FDF requests GeoSyntec obtain a sample of a butt fusion trial weld for laboratory testing.	For M. Godber
	VBS attempts flooding by spraying embedment sand for compaction due to trench restrictions.	Sand not flooded as per DCN
10 Aug 1997: CQC	Approval of hydrostatic pressure test method for in-place pipe in the process of being finalized.	
11 Aug 1997: SQ	Two 240-ft sections of HDPE pipe placed between 30+80 and 32+00. VBS welds in light rain.	
13 Aug 1997: DB RP	VBS welds in the rain under a tarp. VBS told that this practice is not to specifications and they stopped welding.	
RER	The remaining portions of the LCS are divided between VBS, Wise, and Diaz.	

RER	Several lengths of 6"/10" pipe rejected due to Damage from shipping/handling.	Sent off site.
16 Aug 1997: RP	Petro completes excavation of manhole #1 down to competent ground.	
18 Aug 1997: DB RP SQ	Lift station floats on its side from heavy weekend rain.	2.6-in recorded.
RP	Excavation for Manhole #1 flooded.	
21 Aug 1997: SQ	HDPE pipe deployed between stations 32+70 and 33+70. Pipe butt fusion welding observed near Cell #1 area.	
22 Aug 1997: SQ	VBS encounters problems welding due to operator error. Trial welds near Cell #1 appear good. Trench backfill stockpiles are saturated.	
RP	Water seeping into LTS trench. VBS uses poor backfill with high organics.	Material removed.
26 Aug 1997: SQ	VBS encounters problems welding due to excessive pipe lengths. Two 320-ft pipe lengths to heavy for welding machines hydraulics.	
RP	Backfill placed between stations 30+00 and 29+50 (Excavation #4).	
3 Sept 1997: RP	VBS encounters mechanical problems welding an out of round pipe.	
4 Sept 1997: RP	VBS encounters mechanical problems welding. Cleanout pipes and fittings delivered.	
RP SQ	Backfill begins at excavation for manhole #l.	
5 Sept 1997: RP	VBS encounters problems welding due to operator error.	

SQ	Manhole embedment fill is placed in the excavation for Manhole #1. Control points for MH #1 placed by surveyors. Excavation for MH #2 begins. VBS encounters problems electro-fusion welding the 3" pipe for the 3"/8" line between the LDS-01 and LCS-01 manholes.	Within MH #1 structure.
6 Sept 1997: SQ	3" electro-fusion coupling welded on 5 Sept was removed and replaced. Discussion of SDR types for the use of sleeves.	
RP	Wise places pipe embedment fill after dark with the illumination of a loader and in 1.5' to 2' lifts. GeoSyntec technician leaves the area (2050 hrs) due to conditions that the technician believes to be unsafe.	
7 Sept 1997: RP	600-ft pipe section butt fusion welded to the clean-out at 28+00, with difficulty. 12" sleeve extrusion welded for containment. Sleeves welded onto stub-outs of MH #1.	
RL	The LCS and LDS manholes at MH #2 are placed. Welding between the two follows.	
8 Sept 1997: NM	Trench between MH #1 and #2 not to grade due to a lack of survey control.	
RP	Technician notes VBS pipe embedment fill placement performed after nightfall and unmonitored.	VBS returned after CQC personnel left for the day.
11 Sept 1997: RP	Backfill begins between stations 28+00 and 35+00, (all day).	Excavations 4 and 5.
12 Sept 1997: RP	Extrusion weld of 12-in. diameter sleeve monitored (south of clean-out #7).	
BE	Pressure test between manhole #1 monitored. Test lost 1 psi pressure due to leak at flange fitting.	
BN	Two hydrostatic pressure tests run on 6"/10" pipe sections (Petro SDR 11). One passes, One fails.	

14 Sept 1997: CQC	Electro-fusion welder operator for VBS not certified.	
15 Sept 1997: RP	Excavation for MH #3 begins. Pipe embedment fill is placed between MH #1 and #2.	
16 Sept 1997: RP	Excavation between MH #2 and MH #3 begins. Pipe embedment fill is 'sprayed down' at Sta. 32+00 by VBS. Fill placement followed.	Excavation 5. Sand not flooded as per DCN
17 Sept 1997: RP	Pipe embedment fill, previously placed, is compacted between MH #1 and #2. Excavation ongoing between Sta 5+50 and MH #3. Backfill operation between 31+00 and 32+50 is shut down by FDF due to possible asbestos contamination (resumes later that day). Backfill over pipe embedment fill is begun between MH #1 and #2.	
18 Sept 1997: RL	GeoSyntec monitors electro-fusion welded couplings at 23+50.	
RP	Dual containment placed between MH #2 and #3. Manhole embedment fill is compacted at the bottom of MH #3. Later, pipe embedment fill and then general fill is placed between MH #2 and MH #3. 6" and 10" electro-fusion welds made at clean-out, Sta. 23+50.	
20 Sept 1997: SQ	Electro-fusion weld monitored for butterfly valve assembly at permanent lift station.	
22 Sept 1997: DB	GeoSyntec monitors 6" electro-fusion welded coupling north of the permanent lift station.	
DB	GeoSyntec monitors 10" electro-fusion welded coupling north of the permanent lift station.	
RP	GeoSyntec monitors 6" and 10" electro- fusion welded couplings on the permanent lift station elbow.	
SQ	GeoSyntec monitors preparation for electro-fusion coupling 8-ft south of MH #1. PE 2406 yellow coupling used.	First occurrence of PE 2406 couplings

23 Sept 1997: RP	Wise welds HDPE in the rain. NCR No. 1700- 007 written against Wise Construction for welding in the rain. VBS pulls 400-ft of previously welded dual containment pipe into place from 12+00 to MH #3. 6"/10" couplings welded on north side of MH #2, 10" monitored, 6" not monitored.	
MMN	Four GeoSyntec NCR's on the LTS remain open.	
24 Sept 1997: RP	Pipe embedment fill placed from Sta. 8+00 to 11+75 and first lift of backfill placed from 8+50 to 11+50. 6" coupling and 12" sleeve monitored ~35-ft north of MH #2.	
27 Sept 1997: RP	6" and 10" electro-fusion welded couplings added at station 20+00 adding to the line 400-ft (to Sta 16+00).	
28 Sept 1997: CQC	Contractor has developed method of joining 6" electro-fusion couplings by cutting holes in the 10" pipe to access electrodes.	Contractor did not make a formal Submittal.
29 Sept 1997: RP	First lift of backfill placed between 17+75 and 19+00.	
30 Sept 1997: RP	6" and 10" electro-fusion couplings added at approximately Sta 15+50.	
1 Oct 1997 RP	First lift of fill placed over pipe embedment fill between stations 15+50 and 13+75. Electro-fusion Coupling monitored at Sta. 13+75 on the 6" carrier.	
SQ	Electro-fusion couplings monitored by MH #2 on the 10" containment and at MH #3 for both the 6" and 10".	
2 Oct 1997: MMN	One NCR remains open for the LCS, improper pipe embedment fill. 5 page, 65 item punch-out list for VBS included.	
RP BE	Slabs for MH #3 poured by Wise Construction.	
6 Oct 1997: RP	Original electro-fusion connection of 6" and 10" made at Sta 13+25 (unmonitored).	
7 Oct 1997: RP	10-in. coupling observed during cool down (No. Sta. given).	

10 Oct 1997: RP	The LTS is prepared for hydrostatic testing from Manhole #1 to the permanent lift station.	
15 Oct 1997: RP	The LTS is again prepared for hydrostatic testing from manhole #1 to the permanent lift station.	
19 Nov 1997: RP	Concrete slab poured for Permanent lift station.	
21 Oct 1997: MMN	One NCR remains open for the LCS, improper pipe embedment fill. 17 items from 2 Oct punch-out list completed, 48 left.	
22 Oct 1997: BE	VBS attempts hydrostatic test of the carrier pipe	No reference of pass or fail
26 Oct 1997: RER	GeoSyntec suggests VBS run hydrostatic pressure tests on the LCS line prior to pouring manhole concrete slabs. Hydrostatic pressure test summary, monitoring wells 1, 2, and 3.	
28 Oct 1997: MMN	One NCR remains open for the LCS, improper pipe embedment fill. 22 items from 2 Oct punch-out list completed, 43 left.	
31 Oct 1997: BE	VBS attempts hydrostatic test of the carrier pipe.	No reference of pass or fail
9 Nov 1997: RER	RE expresses concern over contractors ability to properly perform pressure testing of the LTS. RCI No. 036R, generated by VBS, is rejected. RCI requested the 15 psi test for 10" containment be eliminated for undefined static test.	
19 Nov 1997: RP	VBS begins to backfill the LTS approximately 450-ft north of the permanent lift station after recovering a pneumatic test plug from the 6" carrier pipe.	~Sta 31+50 between excavations 4 & 5 The excavation was large due to trouble locating plug.
23 Nov 1997: RER/CQC	One leak found and being repaired and a second leak being located between MH #3 and the PLS after hydrostatic testing.	

30 Nov 1997: RER	Wise construction assists VBS for the LCS project. More leaks detected. GeoSyntec monitors electro-fusion welds at station 12+00 to repair a leak found by the video camera.	
4 Dec 1997: SQ	Wise repairs leaks in the containment pipe at Sta 12+50 and 13+25. All exposed electro-fusion welds are extrusion 'back' welded.	Extensive work done here in 1999.
5 Dec 1997: SQ	Repairs to the electro-fusion couplings at 13+25 continue.	
7 Dec 1997: RER	The LTS between MH #3 and the PLS has been repaired and tested. The LTS between MH #3 and #1 has been tested, both passed.	
14 Dec 1997: CQC	Several leaks found in LTS. Location and repair efforts are underway.	
21 Dec 1997: CQC	Leaks, mentioned 14 Dec, located and repaired, air air and hydro tests pass.	
23 Dec 1997: RER	FDF accepts the LTS (with GeoSyntec concurrence) ready for operation after recent completion of the standard start-up review.	
16 Jan 1998:	Construction Quality Assurance Final Report, Revision O, issued by GeoSyntec.	

Reference Standards

2195

ASTM D2657

107

Standard Practice for Heat-Joining Polyolefin Pipe and Fittings[1]

This standard is issued under the fixed designation D 2657; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

1. Scope

1.1 This practice describes general procedures for making joints with polyolefin pipe and fittings by means of heat-joining techniques in either a shop or field environment. These procedures should be regarded as general ones. Manufacturers should be requested to supply specific recommendations for heat-joining their materials or products.

1.2 The techniques covered are applicable only to joining polyolefin pipe and fittings of related polymer chemistry, for example, polyethylenes to polyethylenes, polypropylenes to polypropylenes, or polybutylenes to polybutylenes. Material, density, and flow rate must be taken into consideration in order to develop uniform melt viscosities and formation of a good fusion bond when joining the same material to itself or to other materials of related polymer chemistry.

1.3 The heat-joining techniques described can produce sound joints between polyolefin pipe and fittings, provided that the parts are within the dimensional tolerances given in present ASTM specifications.

1.4 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.5 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

F 600 Practice for Nondestructive Ultrasonic Evaluation of Socket and Butt Joints on Thermoplastic Piping[2]

F 905 Practice for Qualification of Polyethylene Saddle Fusion Joints[2]

3. Significance and Use

3.1 The procedures described in Sections 8, 9, and 10 can, when implemented using suitable equipment and procedures in either a shop or field environment, produce strong pressure-tight joints between various combinations of pipe and fittings, equal to the strength of the pipe. Some materials may be more adaptable to one technique than another. Average molecular weight and molecular weight distribution appear to be influential in establishing suitable fusion parameters; therefore, the manufacturer's recommendations should be considered in the use or development of a specific fusion procedure.

4. Operator Experience

4.1 Skill and knowledge on the part of the operator are required to obtain a good quality joint. This skill and knowledge can be obtained by making joints in accordance with proven procedures under the guidance of skilled operators. Evaluate operator proficiency by testing sample joints.

4.2 These procedures require the use of heating and cutting equipment. The person actually responsible for the joining of polyolefin pipe and fittings should ensure that detailed procedures developed in conjunction with the manufacturer of the pipe and fittings involved, including the safety precautions to be followed, are issued before actual joining operations commence.

5. Heat-Fusion Bonding Processes

5.1 Heat-fusion bonding is a combination of temperature and force resulting in two mating surfaces flowing together to produce a joint. Fusion bonding occurs when the joint cools below the melt temperature of the material. There is a temperature range within which any particular material may be satisfactorily joined. The specified temperature used requires consideration of the properties of the specific material, the fusion equipment being used, and the joining environment. With Techniques II or III (6.3 or 6.4), there is also an appropriate force to be applied, depending on the material and fusion temperature.

5.2 Adequate joint strength for testing is attained when all of the joint material cools to ambient temperature (Note 1). The joint shall not be disturbed or moved until it has cooled.

NOTE 1—Polybutylene undergoes a crystalline transformation for several days after cooling below its melt temperature. Although this phenomenon has an effect on the ultimate physical properties of the material, its effect on testing of joints has not been found to be significant. If there is any question of its effect, a comparison should be made between joints that have been conditioned for different periods of time in order to establish the conditioning-time relationship.

6. Classification

6.1 Three fusion techniques are covered in this practice:

6.2 *Technique I. Socket Fusion*—The socket-fusion technique involves simultaneously heating the outside surface of a pipe end and the inside of a fitting socket which is sized to be smaller than the smallest outside diameter of the pipe.

[1] This practice is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.20 on Joining.

Current edition approved March 30, 1990. Published May 1990. Originally published as D 2657 - 67. Last previous edition D 2657 - 87.

[2] *Annual Book of ASTM Standards*, Vol 08.04.

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After the proper melt has been generated at each face to be mated, the two components are joined by inserting one component into the other. See Fig. 1. The fusion bond is formed at the interface resulting from the interference fit. The melts from the two components flow together and fuse as the joint cools. Alignment devices may be used to hold the pipe and socket fitting in axial alignment during the joining process; such devices are recommended for use with pipe sizes 3 in. (76.2 mm) and larger.

6.3 *Technique II. Butt Fusion*—The butt-fusion technique in its simplest form consists of heating the squared ends of two pipes, a pipe and a fitting, or two fittings, by holding them against a heated plate, removing the plate when the proper melt is obtained, promptly bringing the ends together, and allowing the joint to cool while maintaining the appropriate applied force. See Fig. 2. An alignment jig shall be used to obtain and maintain suitable alignment of the ends during the fusion operation.

6.4 *Technique III. Saddle Fusion*—The saddle-fusion technique involves melting the concave surface of the base of a saddle fitting while simultaneously melting a matching pattern on the surface of the pipe, bringing the two melted surfaces together, and allowing the joint to cool while maintaining the appropriate applied force. See Fig. 3. Saddle fusions are made both by hand alignment and by using alignment jigs.

7. Apparatus: General Recommendations

7.1 *Heating Tool*—The tool may be heated by gas or electricity. Gas-fired heaters shall have heat sinks of sufficient capacity to prevent excessive draw down of the tool temperature. Electric heating plates can maintain consistent fusion temperatures when provided with an adequate power source. Electric heating plates for general fusion use shall be controlled thermostatically and capable of being adjusted over a temperature range from 300 to 575°F (150 to 300°C). Some tools may have a fixed set point for a particular application.

7.2 *Heating Tool Faces*—Heating tools may be machined from aluminum, stainless steel, or copper, or copper alloys. Copper or copper-alloy heating faces are not suitable unless chromium-plated or clad with another suitable metal because some polyolefins react with copper. Plastic materials may stick to hot metal heating surfaces. This sticking may be minimized by covering the heating surfaces with a baked-on, nonstick coating. The heating plate surfaces, coated or uncoated, shall be kept clean and free of contaminants such as dirt and grease and plastic build-up, which can cause excessive sticking and create unsatisfactory joints. Most of these contaminants can be removed from the hot tool surfaces using a clean, dry, lint-free cloth. Burlap is often recommended as being an appropriate cloth material for cleaning heating tool surfaces. *Do not use synthetic fabrics.* Some pigments, such as carbon black, may stain a heating surface and probably cannot be removed; such stains will not contaminate the joint interface.

7.3 *Temperature Indicator*—Heating tools shall be equipped with a thermometer or other built-in temperature-measuring device. Use a pyrometer periodically to verify the surface temperature of the tool. Select multiple checkpoints to assure uniform surface temperature. In the field, a temperature-indicating crayon can be used on the side of the heating tool as a check on temperature conditions. Do not place crayons in direct contact with fusion surfaces because the crayon itself will contaminate the fusion interface.

8. Technique I: Socket Fusion

8.1 *Apparatus:*

8.1.1 *Heating Tool*—In order to obtain a proper melt, it is necessary for a uniform temperature to be maintained across the heating surface. Therefore, gas-fired tools are generally restricted to use with pipe sizes of 2 in. (50.8 mm) or less.

8.1.2 *Heating Tool Faces*—The tool faces consist of two parts, a male end for the interior socket surface and a female end for the exterior pipe surface. Both parts must be made to such tolerances as to cause an interference fit. In order to

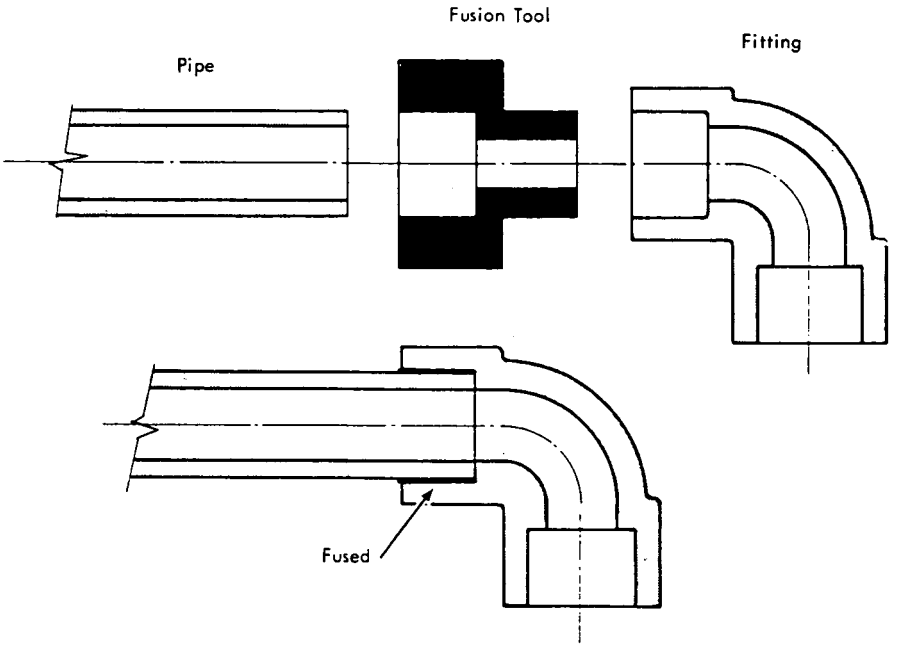

FIG. 1 Socket Fusion

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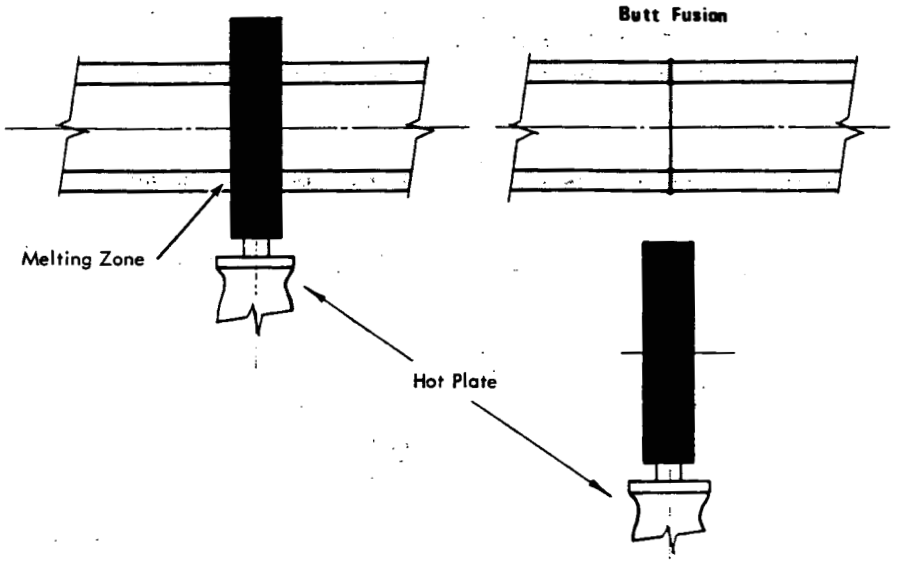

FIG. 2 Typical Butt Fusion Operation

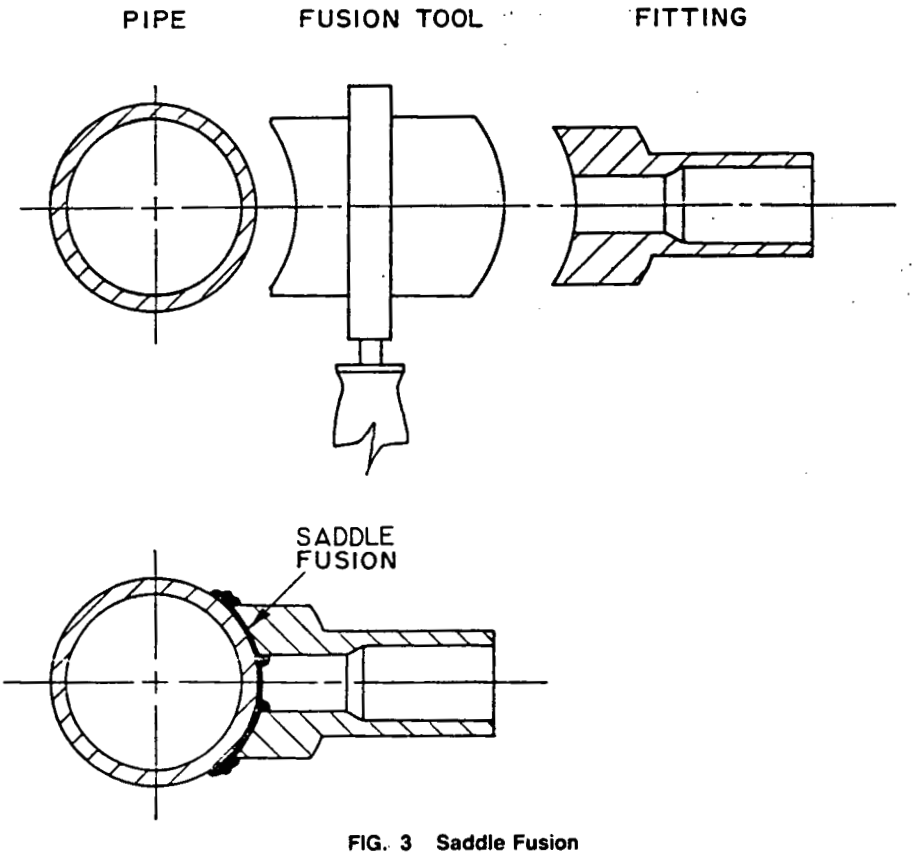

FIG. 3 Saddle Fusion

produce continuous fusion in the mating surfaces, the length of the male end should be equal to or longer than the female end.

8.1.3 *Alignment Jig*—The alignment jig should consist of one fixed and one movable clamping block to hold the two parts in axial alignment while permitting longitudinal movement for making the joint.

8.1.4 *Miscellaneous Tools*—To assist in various operations of socket fusion, the following tools are recommended:

8.1.4.1 *Rounding Clamps,* to maintain roundness of the pipe and to control the depth of pipe insertion into the socket during the joining operation.

8.1.4.2 *Depth Gage,* for proper positioning of the rounding clamp.

8.1.4.3 *Chamfering Tool,* to bevel the end of the pipe.

8.1.4.4 *Tubing Cutter,* to obtain square end cuts.

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8.1.4.5 *Fitting Puller*, to assist in the removal of the fitting from the heating tool and to hold the fitting during assembly.

8.2 *Procedure:*

8.2.1 Attach the proper size heater faces and heat the tool to the fusion temperature for the material.

8.2.2 Cut the pipe end square; clean the pipe end and fitting, both inside and outside, by wiping with a clean, lint-free cloth.

8.2.3 Slightly chamfer the outside edge of the pipe end and set the rounding clamp about the pipe as determined from the depth gage.

NOTE 2—Chamfering may not be required by some procedures using specified fusion tools. Pipe sizes 1 in. (25.4 mm) and smaller are not usually chamfered, regardless of tooling design.

NOTE 3—Some recommend using a 50 to 60-grit emery or garnet cloth to roughen the outside of the pipe and inside of the fitting as a means of minimizing any possible skin interface when making the fusion. Sandpaper is not recommended for this purpose as it might disintegrate and contaminate the joint interface.

8.2.4 Bring the preheated tool faces into contact with the outside surface of the end of the pipe and the inside surface of the socket.

8.2.5 Allow the tool pieces and plastic surfaces to remain in contact with one another until a proper melt is obtained. Proper melt is a function of material, time, tool temperature, and the size of the parts. Pipe and fittings of larger diameters require more time to reach the proper melt consistency than those of smaller diameters. Underheated or overheated materials will not form a good bond.

8.2.6 Simultaneously remove the pipe and fitting from the tool using a snap action and immediately insert the pipe squarely and fully into the socket of the fitting. Hold or block the joint in place until the melts of the mating surfaces have solidified. The exact time depends on the size of the pipe and the material being fused.

8.2.7 Clean the tool of any residual material, being careful not to damage the heating surfaces, because plastic left on the tool tends to carbonize on repeated reheating. This residue causes a loss of heater efficiency and can cause joint contamination.

8.2.8 Allowances for extremes in weather should be considered when making field joints. Heating times, operation of alignment jig, dimensional changes, and the like, can be affected by extreme conditions.

8.3 *Testing*—Evaluate sample joints in order to verify the skill and knowledge of the fusion operator. Socket joints can be examined ultrasonically to detect voids or other discontinuities; see Practice F 600. Cut joints into sections, visually examine, and test for bond continuity and strength. Bending, peeling and elongation tests are useful for this purpose.

9. Technique II: Butt Fusion

9.1 *Apparatus:*

9.1.1 *Heating Tool*—The heating tool shall have sufficient area to adequately cover the ends of the size of pipe to be joined.

9.1.2 *Alignment Jig*—The alignment jig should consist of (*1*) one fixed and one movable clamping block for holding the two parts to be fused in movable axial alignment, (*2*) a facer for simultaneously preparing the ends to be joined (Note 4), and (*3*) appropriate adapters for different pipe sizes.

NOTE 4—A facer is a rotating cutting device used to square-off the pipe or fitting ends to secure properly mating fusion surfaces.

9.2 *Procedure:*

9.2.1 Bring the heater plate surfaces to proper temperature.

9.2.2 Clean the inside and outside of the components (pipe or pipe and fitting) to be joined. Remove all foreign matter.

9.2.3 Clamp the components in the alignment jigs. Check alignment of the ends, adjust as needed, and face off the ends.

9.2.4 Bring the piping components together and check for alignment, gap, and out-of-roundness. Adjust as required. The ends of the piping components should meet squarely around their full circumference.

9.2.5 Push the ends to be joined against the heater plate with sufficient force to provide complete circumferential contact. The components may be held against the heater plate using limited force for a brief period of time to ensure that proper contact with the plate has been made. Release the force and hold in place without additional movement until a bead of molten plastic develops circumferentially around the components as a result of the thermal expansion of the material. Do not continue to push the components into heater plate as the melting progresses (Note 5).

NOTE 5—The technique for heating the component ends and then bringing them together by force may vary considerably depending on material, pipe size, equipment, and manufacturer's recommendations.

9.2.6 Move the melted piping end away from the heater plate, remove the heater plate, and bring the melted ends together immediately with sufficient force to form a uniform upset flash (bead) around the entire circumference of the joint. This step is the most critical part of the whole joining procedure. If the components are brought together with too much force, all molten material may be pushed out of the joint and cold material brought into contact forming a "cold" joint. If too little force is used, only the melt in the beads may be fused together and, as the molten material in the joint cools and contracts, voids or nonfused areas may be formed. If the softened material sticks to the heater plate, discontinue the joining procedure. Clean the heater plate, resquare the component ends, and repeat the process from the beginning (9.2.2).

9.2.7 Allow the assembly to stand at least until cool before removing the clamps or other aligning device (Note 6). Do not ditch or subject the joint to high bending stress until it has cooled to ambient air temperature (from 5 to 15 min). Do not apply internal pressure until the joint and surrounding material have reached ambient air temperature.

NOTE 6—One technique used to determine whether or not the joint can be removed from the alignment jig is to see whether or not the bead can be indented by the operator's fingernail. If it cannot be indented, the joint has sufficiently cooled to be carefully removed from the jig. Further cooling is recommended prior to ditching the pipe.

9.3 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Butt-fusion joints can be examined ultrasonically to detect voids or other discontinuities; see Practice F 600. Cut joints into sections,

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visually examine, and test for bond continuity and strength. Tests that have been found useful for this purpose include (*1*) inside face bend, (*2*) outside face bend, (*3*) elongation, (*4*) torque, and (*5*) impact. Quantifiable data can be obtained by the use of laboratory procedures and compared with data from control samples.

10. Technique III: Saddle Fusion

10.1 *Apparatus:*

10.1.1 *Heating Tool Faces*—The faces are matched sets, by pipe size, of concave and convex blocks which bolt or clamp onto a flat or round core heater.

10.1.2 *Alignment Jigs*—Various types of alignment jigs are available. They may be either manually, pneumatically, or hydraulically operated. Alignment units consist of means to (*1*) mount alignment units on the pipe, (*2*) hold fitting in unit, and (*3*) move fitting to and from heater and pipe. Alignment units are recommended for all saddle fusions for optimum results and are required for certain materials. Consult the piping manufacturer.

10.2 *Procedure:*

10.2.1 Bring heater plate and faces to proper temperature.

10.2.2 Roughen and clean the mating surface of the pipe and the concave surface of the fitting base. Emery or garnet cloth of 50 to 60 grit is recommended to remove the tough outer surface skin. It is essential to remove the pipe surface skin completely without altering the contours of the m. surfaces and to keep the surface clean. The procedure follows can either utilize the alignment unit or a hand method for placement of the fitting on the pipe.

10.2.3 Place the heater on the pipe and the fitting or heater. Exert force on fitting and heater towards the cc line of the pipe to obtain a melt on both the pipe anc fitting (Note 7).

NOTE 7—When saddle fittings are fused to pipes that are ι pressure, it is important that the surface melt be obtained qu without too much heat penetration. Otherwise, the pipe may ru from internal pressure. Consult manufacturers for their specific rec ments for fusing saddle fittings to their pipe when it is under press

10.2.4 When a proper melt is achieved, remove heater, examine the pipe and fitting to assure proper ı patterns, and quickly place the fitting on the pipe (Not Hold in place while exerting suitable force for the rec mended cooling time.

NOTE 8—If a suitable melt pattern has not been achieved, do reheat. Start over at another location.

10.3 *Testing*—Evaluate sample joints to verify the s and knowledge of the fusion operator. Saddle fusion jo can be examined ultrasonically to detect voids or ot discontinuities. Cut joints into sections, visually exami and test for bond continuity and strength; see Practice F for methods for evaluating the quality of fusion joints.

APPENDIX

(Nonmandatory Information)

X1. COLD WEATHER PROCEDURES

X1.1 *Handling—Cold Weather Handling*—Pipe should be inspected for damage. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. This can be done by gradually uncoiling the pipe and covering it with dirt at intervals to keep it from recoiling. Always use caution when cutting the straps on coils of pipe because the outside end of a coil may spring out when the strapping is removed.

X1.2 *Preparation for Socket, Sidewall, and Butt Fusion Joining:*

X1.2.1 *Pipe Condition*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or joiner may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion.

X1.2.2 *Fitting Condition*—If possible, store fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

X1.2.3 *Wind and Precipitation*—The heating tool shou be shielded in an insulated container to prevent excessi heat loss. Shield the pipe fusion area and fusion tools fro wind, snow, and rain by using a canopy or similar device.

X1.2.4 *Heating*—Work quickly once pipe and fitti have been removed from the heating tool so that melt he loss is minimized, but still take time (no more than 3 s) inspect both melt patterns. Keep the heater dry at all time Check the temperature of the heating tool regularly with pyrometer or temperature indicating crayons and kee heating tool in an insulated container between fusions.

X1.3 *Socket Fusion:*

X1.3.1 *Pipe Outside Diameter*—Pipe outside diamet contracts when cold. This may result in loose or slipping col rings. For best results, clamp one cold ring in its norm position adjacent to the depth gage. Place shim material (th is, piece of paper or rag, etc.) around the inside diameter of second rounding ring and clamp this cold ring directl behind the first cold ring to prevent slippage. The first col ring allows the pipe adjacent to the heated pipe to expand t its normal diameter during the heating cycle.

X1.3.2 *Heating*—At colder temperatures the pipe an fitting contract, thus the pipe slips more easily into th heating tool. At very cold outdoor temperatures (particularl with 2, 3, and 4 in. pipe) the pipe may barely contact th

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heating surface. Longer heating cycles are therefore used so that the pipe first expands (from tool heat) to properly contact the heating tool, then to develop complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions, pipe tolerances, and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe using the heating cycle as recommended by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used per previous suggestions), try a three second longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around pipe end, add an additional three seconds and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep heating tool in an insulated container between fusions.

X1.4 *Butt Fusion:*

X1.4.1 *Clamping Pipe*—Normally, the clamps are more than adequate to prevent pipe slipping in the clamps. However, contraction in pipe outside diameter (because of low temperature) may result in pipe slippage in the clamps. A shim layer (pressure sensitive tape or metal shim, etc.) can be placed on the clamp inside diameter to provide clamping restraint to the pipe.

X1.4.2 *Joining*—The heating cycles should be as recommended by the pipe manufacturer. It may take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater should be separated in a rapid, snap-like motion. The melted surfaces should then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

X1.5 *Sidewall Fusion:*

X1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

X1.5.2 *Melt Pattern*—Make a melt pattern on a scrap piece of pipe. A piece of wood may be used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and try again on another section of cold pipe. If the pattern is still incomplete, continue 3 s additions on fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing[1]

This standard is issued under the fixed designation F 1055; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers electrofusion polyethylene fittings for use with outside diameter-controlled polyethylene pipe, covered by Specifications D 2447, D 2513, D 2737, D 3035, and F 714. Requirements for materials, workmanship, and testing performance are included. Where applicable in this specification "pipe" shall mean "pipe" or "tubing."

1.2 The values stated in inch-pound and centigrade temperature units are to be regarded as standard. The values given in parentheses are for information only.

1.3 The following safety hazards caveat pertains only to the test method portion, Section 9, of this specification: *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing[2]

D 638 Test Method for Tensile Properties of Plastics[2]

D 1248 Specification for Polyethylene Plastics Molding and Extrusion Materials[2]

D 1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure[3]

D 1599 Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings[3]

D 1600 Terminology Relating to Abbreviations, Acronyms, and Codes for Terms Relating to Plastics[2]

D 2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings[3]

D 2447 Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter[3]

D 2513 Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings[3]

D 2737 Specification for Polyethylene (PE) Plastic Tubing[3]

D 3035 Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter[3]

D 3350 Specification for Polyethylene Plastic Pipe and Fittings Materials[4]

F 412 Terminology Relating to Plastic Piping Systems[3]

F 714 Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter[3]

F 905 Practice for Qualification of Polyethylene Saddle Fusion Joints[3]

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology F 412, and abbreviations are in accordance with Terminology D 1600, unless otherwise specified.

3.2 *Descriptions of Terms Specific to This Standard:*

3.2.1 *electrofusion*—a heat fusion joining process where the heat source is an integral part of the fitting, such that when electric current is applied, heat is produced that melts and joins the plastics.

3.2.2 *fusion interface*—surface in the heat fusion process where the plastic materials of the products being joined bond together.

3.2.3 *fusion zone length*—total length of the melted material in the fitting cross section under evaluation.

4. Materials and Manufacture

4.1 This specification covers fittings made from polyethylene compounds as defined in Specifications D 1248 or D 3350.

4.2 *Rework Material*—Clean rework polyethylene material of the same resin, free of any wire or contaminants generated from the fitting manufacturer's own production, may be used by the same manufacturer, as long as the fittings produced conform to the requirements of this specification.

4.3 *Heating Mechanism*—The heat mechanism shall be of materials not detrimental to the performance of the fitting or the pipe to which it is intended to be joined.

5. Performance Requirements

5.1 The following requirements are for electrofusion joints that have been joined using the manufacturer's recommended joining procedures. These requirements must be met by each electrofusion joint design, on each size and type of pipe material for which the manufacturer recommends use of his fitting. Any revisions to the electrofusion joint design or processing by the manufacturer after the initial testing requires retesting to ensure these requirements can still be met. Fittings intended for use in the distribution of natural gas or liquid petroleum gas shall also meet the requirements of Specification D 2513.

5.1.1 It is not required that each configuration of a fitting be tested to meet all of these qualifications (that is, 2 in. main

[1] This specification is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.10 on Fittings.

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[2] *Annual Book of ASTM Standards*, Vol 08.01.

[3] *Annual Book of ASTM Standards*, Vol 08.04.

[4] *Annual Book of ASTM Standards*, Vol 08.02.

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saddle joint with multiple outlet configurations offered) as long as the electrofusion joint design is not altered in the configuration differences.

NOTE 1—It is permissible when accomplishing these tests, to do so on the highest and lowest dimension ratio of the same pipe material. If in those tests all performance requirements are met, all dimension ratios between those tested may be considered as having met the requirements. These tests do not have to cover the full range of dimension ratios available, only the dimension ratio range on which the manufacturer recommends his fitting be used.

5.2 *Pressure Requirements:*

5.2.1 *Minimum Hydraulic Burst Pressure*—The minimum hydraulic burst pressure of the test specimen shall not be less than that required to produce 2520 psi (17.4 MPa) fiber stress in the pipe being used in the test when tested in accordance with 9.1. The test equipment, procedures, and failures definitions shall be as specified in Test Method D 1599.

5.2.2 *Sustained Pressure*—The fitting and fused joint shall not fail when tested in accordance with 9.2.

5.3 *Tensile Strength Requirements (Coupling Type Joints Only)*—The fitting or the pipe to fitting joint made on pipe shall not fail when tested in accordance with 9.3. Specimens shall be subjected to a tensile stress that causes the pipe to yield to an elongation no less than 25 % or causes the pipe to break outside the joint area. Tensile tests must be made on specimens as joined, not on straps cut from specimen. Yielding must be measured only in the pipe, independent of the fitting or joint.

5.4 *Impact Resistance (Saddle Type Joints Only)*—The joint made on the specimen shall not fail when impacted with a force sufficient to break the body or other portion of the specimen. Tests of 500 ft·lbf or higher impact with no failures noted shall be considered as a "pass" impact test. The device for testing and the methods shall be as defined in Practice F 905.

5.5 *Joint Crush*—(*Coupling or Saddle Type Joints*)—The joint made on the specimen shall meet the requirements in 9.4.5 of this specification, when tested in accordance with 9.4.

6. Dimensions, Mass, and Permissible Variations

6.1 Dimension and tolerances of electrofusion fittings must be such that allows heat fusion to outside diameter (OD) controlled PE pipes such as those listed in Specifications D 2447, D 2513, D 2737, D 3035 and F 714, such that the joints will satisfy the performance requirements in Section 5.

6.2 Because of the varying designs for electrofusion fittings, the actual spread of dimensions may be quite different from manufacturer to manufacturer. A table of dimensions and tolerances encompassing these differences would be meaningless and without value and, therefore, is omitted from this specification.

6.3 The manufacturer shall furnish to the user the electrical resistance, critical dimensions, and tolerances of his fittings. This information must include at least the following dimensions and tolerances:

6.3.1 Coupling inside diameter,

6.3.2 Temperature joining limits, and

6.3.3 Operating pressure of the fitting.

NOTE 2—There are other items which fall beyond the scope of this specification which would be of interest to the user for proper application of the fittings and is recommended as additional information to be furnished. A few of these are: (*1*) maximum pipe out of round allowed at joint area; (*2*) minimum/maximum pipe SDR capability of the fitting, and (*3*) for saddles intended for use on a live main, the maximum allowable line pressure when making the joint.

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7. Workmanship, Finish, and Appearance

7.1 The manufacture of these fittings shall be in accordance with good commercial practice so as to produce fittings meeting the requirements of this specification.

7.2 The fittings shall be homogeneous throughout, except where a heating coil or electrical connectors are incorporated, and free of cracks, holes, foreign inclusions, or injurious defects such as gouges, dents, cuts, etc. The fittings shall be as uniform as commercially practicable in opacity, density, and other physical properties. Any heating coils, connecting cables, connectors, and related electrical power source shall be designed to prevent electrical shock to the user.

8. Specimen Preparation

8.1 *Conditioning:*

8.1.1 Unless otherwise specified, condition the specimens (pipe and fittings) prior to joining at the minimum pipe temperature allowable for fusion as recommended by the manufacturer, for not less than 16 h and make the fusion joint at that temperature for those tests where conditioning is required.

8.1.2 Unless otherwise specified, condition the specimens (pipe and fittings) prior to joining at the maximum pipe temperature allowable for fusion as recommended by the manufacturer, for not less than 16 h and make the fusion joint at that temperature for those tests where conditioning is required.

8.2 *Test Conditions*—Conduct the tests at the Standard Laboratory Temperature of 23 ± 2°C (73.4 ± 3.6°F) unless otherwise specified.

8.3 *Preparation of Specimens for Testing:*

8.3.1 Prepare test specimens so that the minimum length of unreinforced pipe on one side of any fitting is equal to three times the diameter of the pipe, but in no case less than 12 in. (304 mm). It is permissible to test multiple fittings together provided they are separated by a minimum distance equal to three times the diameter of the pipe, but in no case less than 12 in. (304 mm).

8.3.2 Fuse all fitting outlets with the appropriate size pipe in accordance with the manufacturer's recommended procedures.

8.3.3 All saddle fusion joint specimens conditioned as in 8.1.2 and destined for quick burst testing as in 9.1 and sustained pressure testing as in 9.2, are to be joined with the pipe at no less than maximum allowable operating pressure of the pipe system or fitting, whichever is lowest, when being prepared for those tests. The pipe should be left under pressure for a time period not less than recommended by the manufacturer for cooling in the field prior to disturbing the joint. Saddle joint specimens destined for mechanical/destructive type tests such as impact as in 5.4 or crush tests as in 9.4, or specimens conditioned for cold temperature

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joining as in 8.1.1, may be made on unpressured pipe specimens.

9. Test Methods

9.1 *Minimum Hydraulic Burst Pressure Test:*

9.1.1 Select four fittings at random and prepare specimens in accordance with Section 8. From the four specimens, condition two specimens each in accordance with 8.1.1 and 8.1.2.

9.1.2 Test the specimens in accordance with Test Method D 1599.

9.1.3 Failure of the fitting or joint shall constitute specimen failure.

9.1.4 Failure of any one of the four specimens shall constitute failure of the test. Failure of one of the four specimens tested is cause for retest of four additional specimens, joined at the failed specimens joining temperature. Failure of any of these four additional specimens constitutes a failure of the test.

9.2 *Sustained Pressure Test:*

9.2.1 Select four fittings at random and prepare specimens in accordance with Section 8 of this specification. From the four specimens, condition two specimens each in accordance with 8.1.1 and 8.1.2.

9.2.2 Test the specimens in accordance with Test Method D 1598. All tests shall be conducted at 80 ± 2°C. The assemblies are to be subjected to pipe fiber stresses of 580 psi (4.0 mPa) for 1000 h or 670 psi (4.6 mPa) for 170 h. Joint specimens shall not fail within these time periods. Any failures within these time periods must be of the pipe, independent of the fitting or joint and must be of a "brittle" type pipe failure, not "ductile." If ductile pipe failures occur, reduce the pressure of the test and repeat until 170- or 1000-h results or pipe brittle failures are achieved.

9.2.3 Failure of the fitting or joint shall constitute specimen failure.

9.2.4 Failure of any one of the four specimens shall constitute failure of the test. Failure of one of the four specimens tested is cause for retest of four additional specimens, joined at the failed-specimens-joining temperature. Failure of any of these four additional specimens constitutes a failure of the test.

9.3 *Tensile Strength Test:*

9.3.1 Select four fittings at random and prepare specimens in accordance with Section 8 with the exception that it is permissible, on pipe sizes above 4 in. (102 mm) IPS, if limits of tensile machine will not allow 25 % elongation with pipe specimens of three-pipe diameters, to test with free pipe lengths of 20 in. (304-mm) minimum. From the four specimens, condition two specimens each in accordance with 8.1.1 and 8.1.2.

9.3.2 Test the specimens using the apparatus of Test Method D 638. Test at a pull rate of 0.20 in. (5.0 mm) per min. ±25 %.

9.3.3 Failure of the fitting or joint as defined in 5.3, shall constitute specimen failure.

9.3.4 Failure of any one of the four specimens shall constitute failure of the test. Failure of one of the four specimens tested is cause for retest of four additional specimens, joined at the failed specimens joining temperature. Failure of any of these four additional specimens constitutes a failure of the test.

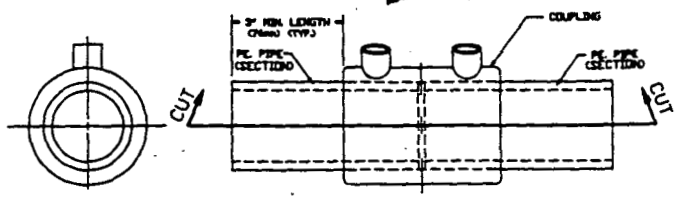

FIG. 1 Preparation of Coupling Specimen for Crush Test

9.4 *Joint Integrity Tests*—Socket type joints and saddles illustrations of joint crush tests are offered in 9.4.1 and 9.4.2 as test methods which are useful as an evaluation of bonding strength between the pipe and fitting. Similar test evaluations as agreed upon between purchaser and seller are of equal value in performing such evaluations and may be substituted with such agreements.

9.4.1 *Joint Crush Test:*

9.4.1.1 Select four fittings at random and prepare specimens in accordance with Section 8. From the four specimens, condition two specimens each in accordance with 8.1.1 and 8.1.2 (Note 3).

NOTE 3—It is permissible to utilize in joint integrity testing, specimens from the quick-burst tests conducted in 9.1 after visually determining that neither the joint area nor the pipe segment to be crushed was a part of the failure mode in the quick-burst test.

9.4.1.2 Slit socket joints longitudinally as illustrated in

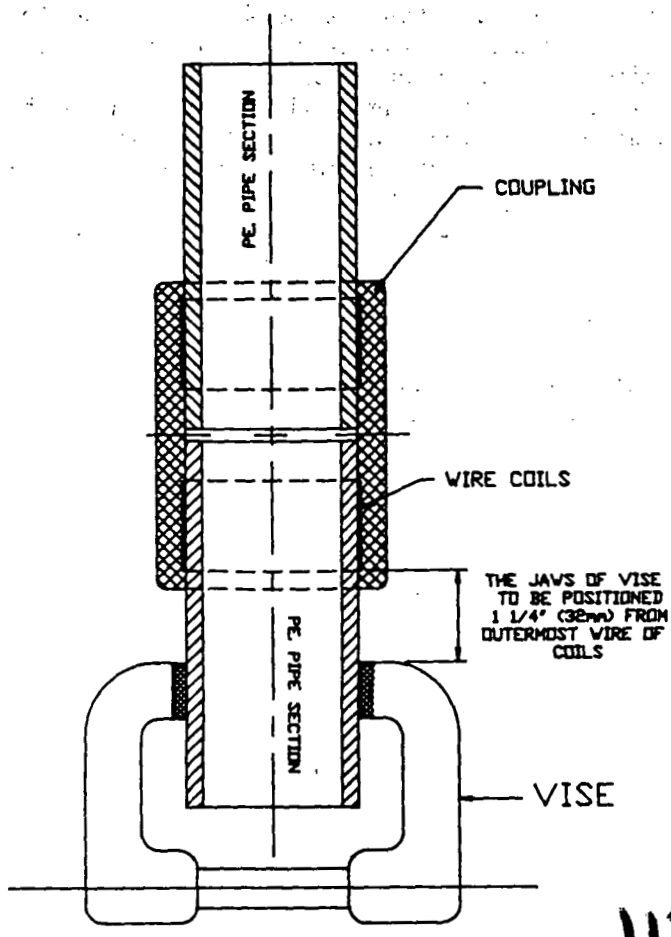

FIG. 2 Coupling Crush Test Arrangement

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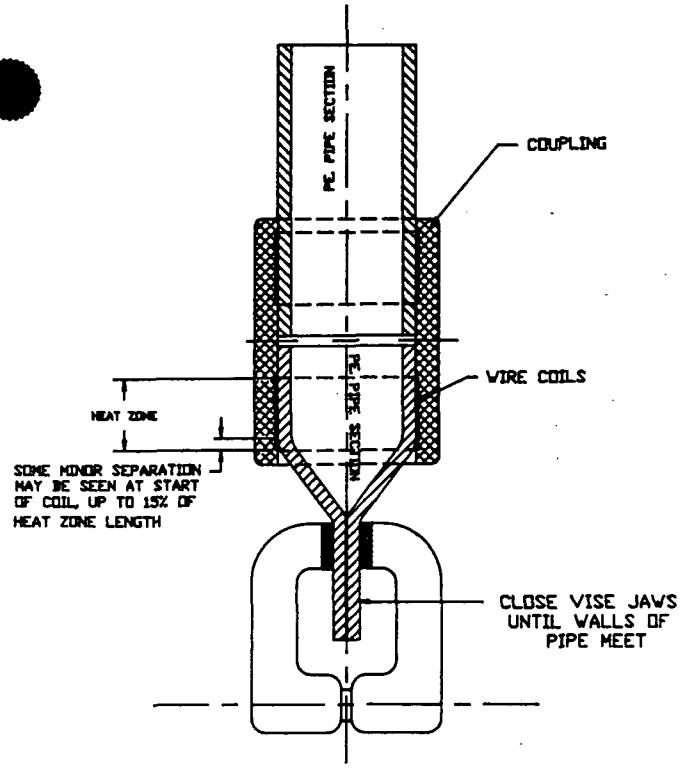

FIG. 3 Coupling Crush Test

Fig. 1 as near the centerline of the pipe as practical. Pipe lengths extending out of the socket may be cut back to a minimum of 3 in. (76 mm) for ease of placing in a vise.

9.4.1.3 Place each specimen half in a vise such that the outermost wire of coil is within 1.250 ± 0.125 in. (32 ± 3 mm) of vise jaws, with the jaws closing only on the pipe portion of the specimen (Fig. 2).

9.4.1.4 Tighten the jaws of the vise on the pipe until the inner walls of the pipe meet (Fig. 3). Repeat crush test on both halves and each end of specimen, at all ends, where a joint exists.

9.4.1.5 Separation of the fitting from the pipe at the fusion interface constitutes a failure of the test. Some minor separation at the outer limits of the fusion heat source up to 15 % of the fusion length may be seen. This does not constitute a failure. Ductile failure in the pipe, fitting, or the wire insulation material, is acceptable as long as the bond interface remains intact.

9.4.1.6 Failure of any one of the four specimens shall constitute failure of the test and is cause for retest of four additional fittings, joined at the same temperature as the failed specimens. Failure of any of these four additional specimens constitutes a failure of the test.

9.4.2 *Saddle Type Joints (Not Full-Wrap Design):*

9.4.2.1 Select four fittings at random and prepare specimens in accordance with Section 8. From the four specimens, condition two specimens each in accordance with 8.1.1 and 8.1.2 (see 9.4).

9.4.2.2 Pipe lengths extending from saddle joint may be cut back clear up to the outer edges of the saddle for convenience of handling, if desired, however, it is not necessary. The length of the pipe extending beyond the saddle is not important to this test (Fig. 4).

9.4.2.3 Place the specimen in vise jaws as shown in Fig. 5, such that vise jaws are within ½ in. of saddle bottom and the jaws will close only on the pipe portion of the specimen. Saddle designs incorporating a bottom half saddle will need the bottom half removed for this test. Saddle designs incorporating a full-wrap single piece saddle are to be tested as in 9.4 socket type joints (Figs. 2 and 3).

9.4.2.4 Tighten the jaws of the vise on the pipe until the inner walls of the pipe meet (Fig. 6).

9.4.2.5 Separation of the fitting from the pipe at the fusion interface constitutes a failure of the test. Some minor separation at the outer limits of the fusion heat source up to 15 % of the fusion length may be seen. This does not constitute a failure. Ductile failure in the pipe, fitting, or the wire insulation material, is acceptable as long as the bond interface remains intact.

9.4.2.6 Failure of any one of the four specimens shall constitute failure of the test and is cause for retest of four additional fittings, joined at the same temperature as the failed specimens. Failure of any of these four additional specimens constitutes a failure of the test.

9.5 *Evaluation for Voids*—When dissecting electrofusion joints for the integrity tests in 9.4, or any reason, voids at or near the fusion interface may be exposed. The voids, should they be present, are a phenomenon of the electrofusion process, due to trapped air and shrinking during the cooling

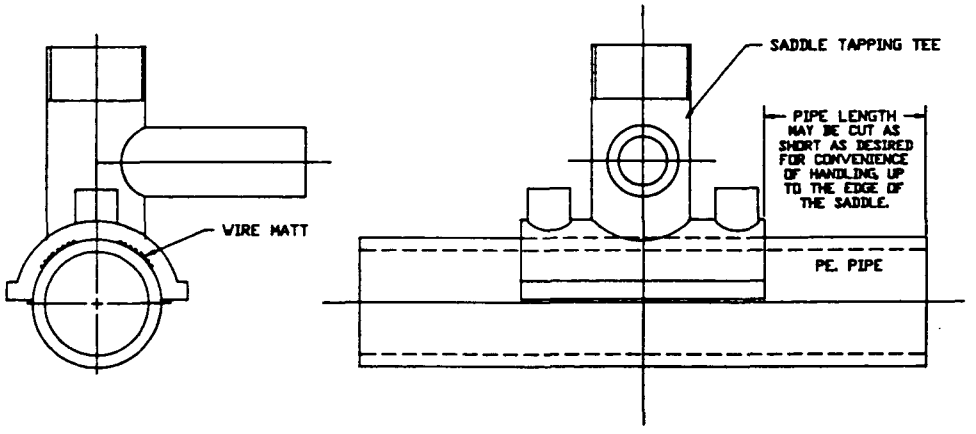

FIG. 4 Preparation of Saddle Specimen for Crush Test

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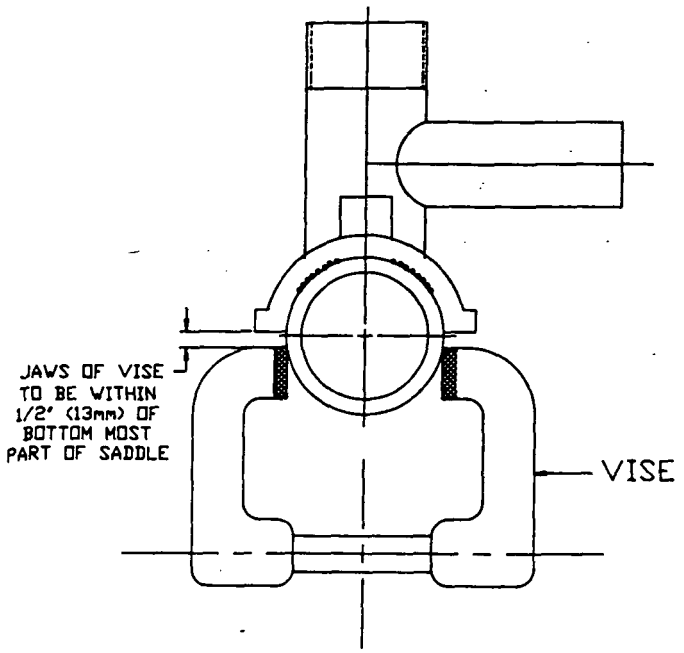

FIG. 5 Saddle Fitting Crush Test Before Crush

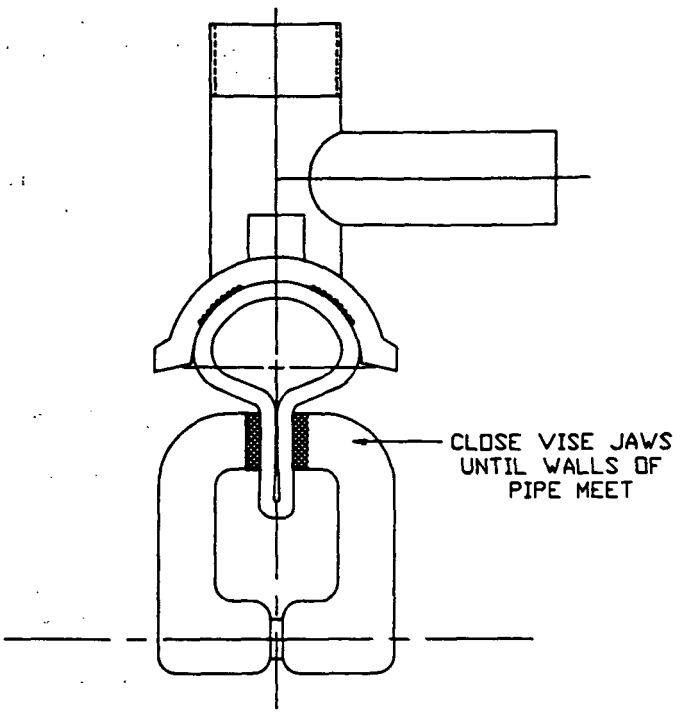

FIG. 6 Saddle Fitting Crush Test After Crush

process after the joint is made. If detected, such voids are considered acceptable only if round or elliptical in shape, with no sharp corners allowed and if they meet the limitations of 9.5.1 through 9.5.3.

9.5.1 Voids that do not exceed 10 % of the fusion zone length in size are acceptable. (See Fig. 7.)

9.5.2 Multiple voids, if present, are acceptable if the combined void sizes do not exceed 20 % of the fusion zone length. (See Fig. 7.)

9.5.3 If voids are exposed, additional longitudinal cuts should be made to ensure that the void does not follow a diametric path which connects to the pressure-containing area of the joint. (See Fig 8.)

NOTE 4—Some voids in electrofusion fitting joints may be due to the natural phenomenon described in 9.5. It is also possible the voids can be produced by not following proper fusion procedures. If voids are detected, one should ensure that all procedures were followed in making the joint.

10. Product Marking

10.1 Fittings shall be marked with the following:

10.1.1 Manufacturer's name or trademark,

10.1.2 Material designation (for example, PE2306, PE3408, etc.),

10.1.3 For fittings intended for transporting potable water, the seal of approval of an accredited laboratory, for fittings complying with Specification D 2513 and intended for gas distribution, the word "gas" or if space does not permit, the letter "G,"

10.1.4 Size, followed by "IPS" or "CTS" designation,

10.1.5 This designation ASTM F 1055,

10.1.6 The fittings shall bear an appropriate code number that will assure identification on the fittings as to date of production and resin formulas used in the production of said fittings. The manufacturer shall maintain such additional records as are necessary to confirm identification of all coded fittings, and

10.1.7 Where the size of the fitting does not allow complete marking, identification marking may be omitted in the following sequence: ASTM designation number, and material designation.

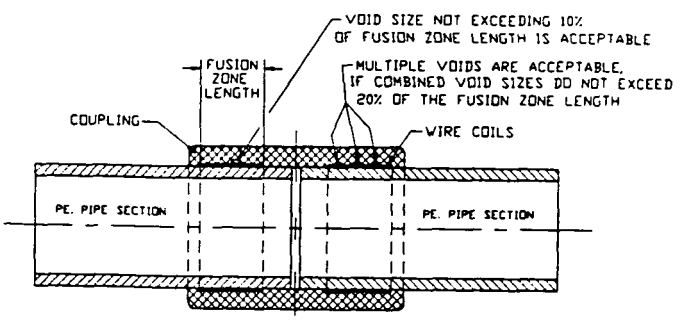

FIG. 7 Coupling Fusion Assembly With Possible Void Characteristics

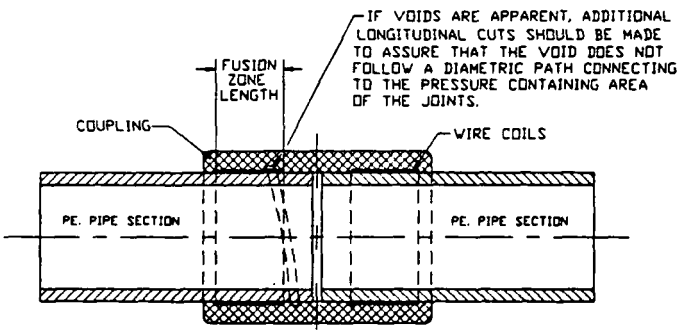

FIG. 8 Coupling Fusion Assembly—Further Examination Guidance

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10.2 All required markings shall be legible and so applied as to remain legible under normal handling and installation practices. If indentation is used, it shall be demonstrated that these marks have no effect on the long term strength of the fitting.

10.3 When the product is marked with this ASTM designation "F 1055," the manufacturer affirms that the product was manufactured, inspected, sampled, and tested in accordance with this specification and has been found to meet the requirements of this specification.

11. Quality Assurance

11.1 When the product is marked with this designation, F 1055 the manufacturer affirms that the product was manufactured, inspected, sampled, and tested in accordance with this specification and has been found to meet the requirements of this specification.

ANNEX

(Mandatory Information)

A1. IN-PLANT QUALITY CONTROL PROGRAM FOR ELECTROFUSION FITTINGS

A1.1 *Introduction:*

A1.1.1 Use the following in-plant quality control program, covering material and performance requirements in manufacture to provide reasonable assurance that the product meets the requirements of this specification and normally anticipated field performance requirements.

A1.2 *Fittings Tests:*

A1.2.1 Conduct the fittings tests at the frequencies indicated as follows:

NOTE A1.1—When any failure to meet the requirements of this specification occurs, make additional tests to ascertain those fittings that are acceptable, back to the last acceptable ones. Those that do not meet the requirements must be rejected.

A1.2.2 Dimensions of fusion area with heating element in place:

A1.2.2.1 *Socket Diameters*—Immediately proceeding production start up, then once per h, or one out of ten fittings, whichever is less frequent.

A1.2.2.2 *Saddle Sizes*—Main sizes and branching outlet sizes, immediately proceeding production start up, then once per h, or one out of ten fittings, whichever is less frequent.

A1.2.2.3 *Heating Element Resistance*—Immediately proceeding production start up, then once per h, or one out of ten fittings, whichever is less frequent.

A1.2.3 *Molding or Extrusion Quality*—Make the following tests on each cavity in the mold or each extrusion line being used. Test at the start of each production run, whenever production conditions have changed or when the resin lot has changed, but not less than once per 500 fittings thereafter.

A1.2.3.1 *Voids in Part*—Inspect for voids in the fitting by means of X-ray or dissection of the fitting in 0.25-in. (6-mm) wide strips.

A1.2.3.2 *Molding Knit Line Strength*—Test by one of the following tests, or other suitable tests:

(*a*) By crushing a fitting or a portion of a fitting in a manner that applies load in a direction normal to the knit line.

(*b*) By performing an apparent tensile strength test of a ring cut from a fitting with the load oriented normal to the knit line.

(*c*) By performing a burst test of the fitting in accordance with Test Method D 1599.

NOTE A1.2—Separation in the knit line of any of these tests constitutes a failure of the test.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

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ASME B 31.9
937.1 – 937.5

ASME Code for Pressure Piping, B31
An American National Standard

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ASME/ANSI B31.9-1988

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
345 East 47th Street
New York, New York 10017

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FOREWORD

The need for a national code for pressure piping became increasingly evident from 1915 to 1925. The American Standards Association initiated the B31 Project in March 1926 to meet that need. The American Society of Mechanical Engineers proposed the work and has served as sponsor since its inception.

The first edition was published in 1935 as the American Tentative Standard Code for Pressure Piping. To keep the Code abreast of developments in design, welding, and of new standards and specifications, as well as of developments in service conditions, new or supplementary editions were issued as follows:

B31.1-1942, American Standard Code for Pressure Piping

B31.1a-1944, Supplement 1

B31.1b-1947, Supplement 2

B31.1-1951, American Standard Code for Pressure Piping

B31.1a-1953, Supplement 1 to B31.1-1951

B31.1-1955, American Standard Code for Pressure Piping

In 1955, a decision was made to develop and publish separate Code Sections for various industries. The current Sections are:

B31.1, Power Piping

B31.3, Chemical Plant and Petroleum Refinery Piping

B31.4, Liquid Petroleum Transportation Piping Systems

B31.5, Refrigeration Piping

B31.8, Gas Transmission and Distribution Piping Systems

B31.9, Building Services Piping

In 1969, the American Standards Association, renamed the United States of America Standards Institute, became the American National Standards Institute (ANSI), and the B31 Sectional Committee became the B31 Standards Committee. In 1978, The American Society of Mechanical Engineers was granted accreditation by ANSI to organize the B31 Committee as the ASME Code for Pressure Piping, with Code Sections designated as ANSI/ASME B31.

Need for a separate Building Services Section of the Code for Pressure Piping was recognized for several years. This new Code Section, ASME/ANSI B31.9 Building Services Piping, first issued in 1982, was developed to fill that need.

The Code has intentionally been written on a conservative basis in order to avoid the necessity for complex design, fabrication, and inspection criteria. For this reason, application of this Code is expected to be simple and straightforward.

Following approval by the B31 Main Committee and the ASME Board on Pressure Technology Codes and Standards, and after public review, this Code Section was approved by the American National Standards Institute on August 23, 1988.

not be more than 20% of the circumference of the pipe, or of the total length of the weld, and no more than 1½ in. in any 6 in. of weld.

(c) Incomplete Penetration. The total joint penetration shall not be less than the thickness of the thinner of the components being joined, except that incomplete root penetration is acceptable if it does not exceed the lesser of 1/32 in. or 20% of the required thickness, and its extent is not more than 1½ in. in any 6 in. of weld.

(d) Undercut and Reinforcement. Undercut shall not exceed the lesser of 1/32 in. or 12½% of wall thickness. Thickness of weld reinforcement shall not exceed 3/16 in.

(e) Concave Root. Concavity of the root surface shall not reduce the total thickness of the joint, including reinforcement, to less than the thickness of the thinner of the components being joined.

(f) Excess Root Penetration. The excess shall not exceed the lesser of ⅛ in. or 5% of the inside diameter of the pipe.

(g) Weld Surfaces. There shall be no overlaps or abrupt ridges and valleys.

936.6.2 Fillet Welds. Limitations on imperfections in fillet, socket, and seal welds are the same as in para. 936.6.1 for cracks, lack of fusion, undercut, and weld surfaces.

936.6.3 Brazed and Soldered Joints. Limitations on imperfections in brazed and soldered joints are as follows.

(a) Penetration of filler metal inside the pipe shall not exceed 100% of the wall thickness.

(b) There shall be no visible unfilled joint space.

(c) There shall be no visible evidence of excessive overheating.

936.6.4 Threaded Joints. Limitations on imperfections for ANSI/ASME B1.20.1 threaded pipe joints are as follows.

(a) No more than six and no less than two threads shall be visible after makeup of the joint.

(b) There shall be no severe chipping or tearing of visible threads.

936.6.5 Caulked and Leaded Joints. Limitations on imperfections in caulked and leaded joints are as follows.

(a) The finished joint shall be within ¼ in. of the rim of the bell.

(b) In the finished joint, the spigot shall be centered in the bell within ⅛ in.

(c) The joint shall be made in a continuous pour.

936.6.6 Flanged Joints. Limitations on imperfections in flanged joints are as follows.

(a) When observed during assembly, the flange faces shall be parallel within 1 deg., and the force required to align pipe axes shall not exceed 10 lb/ft per in. of NPS.

(b) Bolts and nuts shall be fully engaged.

936.6.7 Flared, Flareless, and Compression Joints. Limitations on imperfections in flared, flareless, and compression joints are as follows.

(a) There shall be no cracks in flare or tube end.

(b) Tube ends shall be cut square (visual).

(c) Tube ends shall be free of distortion or grooves that would hinder assembly or sealing.

(d) Negligible force shall be required to align ends.

936.6.8 Mechanical and Proprietary Joints. Imperfections in mechanical and proprietary joints shall be within the limitations established by the manufacturer.

936.6.9 Solvent-Cemented, Adhesive, and Heat-Fusion Joints. Limitations on imperfections in solvent-cemented, adhesive and heat-fusion joints are as follows.

(a) Internal protrusion shall not exceed 50% of wall thickness for solvent-cemented and 25% for adhesive and heat-fusion joints.

(b) There shall be no visible unfilled or unbonded areas.

936.6.10 Hand Lay-up Joints. Limitations on imperfections in hand lay-up joints are as follows.

(a) There shall be no visible evidence of lack of bonding.

(b) The length of the laid-up joint shall be at least the lesser of 4 in. or the nominal diameter of the pipe.

(c) The thickness of the laid-up joint shall be at least equal to the wall thickness of the thinner pipe.

937 LEAK TESTING

937.1 General

Prior to initial operation, each piping system shall be tested for leakage. Hydrostatic testing in accordance with para. 937.3 shall be employed if possible. Pneumatic testing may be used in lieu of hydrostatic testing only in accordance with the limitations in para. 937.4. Initial service testing may be used within the limitations of para. 937.5.

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937.2 Preparation for Testing

937.2.1 Exposure of Joints. All joints including welds shall be left uninsulated and exposed for examination during the test.

937.2.2 Temporary Supports. Piping designed for vapor or gas may be provided with temporary supports if necessary to support the weight of test liquid.

937.2.3 Expansion Joints. Expansion joints which cannot sustain the reactions due to test pressure shall be provided with temporary restraint, or they may be isolated from testing.

937.2.4 Equipment Not Subject to Testing. Equipment that is not to be subjected to the test pressure shall be isolated from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.

937.2.5 Precautions Against Overpressure. If the test pressure is to be maintained for a period of time during which the test fluid is subject to thermal expansion or any other source of overpressurizing during the test, precautions such as the installation of a relief device shall be taken to avoid excessive pressure.

937.3 Hydrostatic Testing

937.3.1 Test Medium. Water at ambient temperature shall be used as the test medium except where there is risk of damage due to freezing. Another liquid may be used if it is safe for workmen and compatible with the piping.

937.3.2 Vents and Drains. Vents shall be provided at high points in the system to release trapped air while filling the system. Drains shall be provided at low points for complete removal of the test liquid.

937.3.3 Preliminary Check. The system shall be examined to see that all equipment and parts that cannot withstand the test pressure are properly isolated. Test equipment shall be examined to ensure that it is tight and that low pressure filling lines are disconnected.

937.3.4 Hydrostatic Test Pressure

(a) Minimum Pressure. Except as limited in (b) below, a piping system shall be subjected to a hydrostatic test pressure which at every point in the system is not less than 1.5 times the design pressure.

(b) Maximum Pressure. The test pressure shall not exceed the maximum test pressure for any vessel, pump, valve, or other component in the system under test. A check shall be made to verify that the stress due to pressure at the bottom of vertical runs does not exceed either of the following:

(1) 90% of specified minimum yield strength;

(2) 1.7 times the *SE* value in Appendix A (for brittle materials).

937.3.5 Examination for Leakage. Following the application of hydrostatic test pressure for at least 10 min, examination shall be made for leakage of the piping, and at all joints and connections. If leaks are found, they shall be eliminated by tightening, repair, or replacement, as appropriate, and the hydrostatic test repeated until no leakage is found.

937.4 Pneumatic Testing

937.4.1 General. Compressed gas poses the risk of sudden release of stored energy. For that reason, pneumatic testing shall be used only within the following limitations.

(a) The piping system does not contain cast iron pipe.

(b) It does not contain soldered joints over 2 in..

(c) The test pressure does not exceed 150 psig.

(d) If nonmetallic, it is not larger than NPS 2.

(e) The system will be used in gas service, or for other reasons cannot be filled with water.

(f) Traces of a test liquid would be detrimental to the intended use of the piping.

937.4.2 Test Medium. The gas shall be nonflammable and nontoxic.

937.4.4 Preliminary Test. Prior to application of full pneumatic test pressure, a preliminary test of not more than 10 psig shall be applied to reveal possible major leaks. (This preliminary test is not subject to the limitations in para. 937.4.1, and may be used in conjunction with hydrostatic testing or initial service testing.)

937.4.5 Pneumatic Test Pressure

(a) Except as limited in (b) below, the test pressure shall not exceed 1.25 times the design pressure. Pressure shall be applied in several stages, allowing time for the system to reach equilibrium at each stage.

(b) The test pressure shall not exceed the maximum allowable pneumatic test pressure for any vessel, pump, valve, or other component in the system under test.

937.4.8 Examination for Leakage. After the preliminary test, pressure shall be raised in stages of not more than 25% up to full pneumatic test pressure, allowing time for equalization of strains and detection of major leaks at each stage. Following the application of test

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NOTES:

(1) In general, the issue date shown immediately following the hyphen after the number of the standard (e.g., B16.10-73, A47-84, J514-80) is the effective date of the issue (edition) of the standard. Any additional number shown following the issue date and prefixed by the letter "R" is the latest date of reaffirmation (e.g., B1.20.3-76(R82), D1503-73(R78)).

A component or pipe conforming to an earlier material specification edition purchased by the user prior to the date of issuance of this Edition of the Code may be used, provided the component or pipe is inspected and determined to be satisfactory for the service intended.

(2) Out-of-print.

Specifications and standards of the following organizations appear in this Appendix:

AGA American Gas Association
1515 Wilson Blvd, Arlington, Virginia 22209
703 841-8558

API American Petroleum Institute
Publications and Distribution Section
1220 L Street, N.W., Washington, D.C. 20005
202 682-8375

ASME The American Society of Mechanical Engineers
Order Department
22 Law Drive, P.O. Box 2300, Fairfield, New Jersey 07007-2300
201 882-1167

ASTM American Society for Testing and Materials
1916 Race Street, Philadelphia, Pennsylvania 19103
215 299-5400

AWS American Welding Society
550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida 33135
305 443-9353

AWWA American Water Works Association
6666 W. Quincy Avenue, Denver, Colorado 80235
303 794-7711

. . . Federal Specifications: Superintendent of Documents
United States Government Printing Office
Washington, D.C. 20402
202 783-3238

CDA Copper Development Association
Box 1840, Greenwich Office Park 2, Greenwich, Connecticut 06836
203 625-8210

MSS Manufacturers Standardization Society of the Valve and Fittings Industry
127 Park Street, N.E., Vienna, Virginia 22180
703 281-6613

NFPA National Fire Protection Association
Batterymarch Park, Quincy, Massachusetts 02269
617 770-7000

SAE Society of Automotive Engineers
400 Commonwealth Drive, Warrendale, Pennsylvania 15096
412 776-4841

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Designation: F 1290 – 93

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Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings[1]

This standard is issued under the fixed designation F 1290; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice describes general procedures for making joints with polyolefin pipe and fittings by means of electrofusion joining techniques. These should be regarded as general procedures and not as a substitute for the installation procedures specified by the manufacturers. Manufacturers should be requested to supply specific recommendations for joining their products.

NOTE 1—Reference to the manufacturer in this practice is defined as the electrofusion fitting manufacturer.

1.2 The techniques covered are applicable only to joining polyolefin pipe and fittings of related polymer chemistry, for example, polyethylenes to polyethylenes using a polyethylene electrofusion fitting. Consult the manufacturer's recommendations for compatibility of the electrofusion fitting with the specific pipe or fitting material to be joined.

1.3 The electrofusion joining technique described can produce sound joints between polyolefin pipe and fittings, provided that all products involved (that is, pipe and fittings) meet the appropriate ASTM specifications.

1.4 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 1600 Terminology for Abbreviated Terms Relating to Plastics[2]

F 412 Terminology Relating to Plastic Piping Systems[3]

F 1055 Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing[3]

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology F 412, and abbreviations are in accordance with Terminology D 1600, unless otherwise specified.

3.2 *Description of Term Specific to This Standard:*

3.2.1 *control box*—the apparatus placed between the power source and the electrofusion fitting to regulate energy input to the fitting.

4. Significance and Use

4.1 Using the procedures in Sections 8 and 9, the manufacturer's instructions and equipment, pressure-tight joints can be made between manufacturer-recommended combinations of pipe that are as strong as the pipe itself.

5. Operator Experience

5.1 Skill and knowledge on the part of the operator are required to obtain a good quality joint. Each operator shall be qualified in accordance with recommended procedures and any regulatory agency or industry organization that has jurisdiction over these practices.

5.2 These procedures require the use of electrical and mechanical equipment. The person responsible for the joining of polyolefin pipe and fittings should ensure that recommended procedures developed for the electrofusion fittings involved, including the safety precaution to be followed, are issued before joining operations commence. It is especially important that the operator be aware of specific instructions regarding the use of electrical equipment in the presence of a potentially explosive environment.

6. Electrofusion Joining Processes

6.1 Electrofusion is a heat-fusion joining process where a heat source is an integral part of the fitting. When electric current is applied, heat is produced, melting and joining the components. Fusion occurs when the joint cools below the melt temperature of the material. The specified fusion cycle used requires consideration of the properties of the materials being joined, the design of the fitting being used, and the environmental conditions. See Specification F 1055 for performance requirements of polyethylene electrofusion fittings.

6.2 Adequate joint strength for field testing is attained when the fitting is not disturbed or moved until the joint material cools (Note 2). Bond strength can be affected if the joint is not allowed to cool sufficently.

NOTE 2—Polybutylene undergoes a crystalline transformation for several days after cooling below its melt temperature. Although this phenomenon has an effect on the ultimate physical properties of the material, its effect on testing of joints has not been found to be significant. If there is any question concerning the effects of crystallization, tests should be conducted on joints that have been conditioned for different periods of time in order to establish the conditioning-time relationship.

7. Classification

7.1 *Technique 1: Coupling Type*—The electrofusion coupling technique involves heat fusion of pipes with a tubular fitting with pipe sections inserted in each end of the fitting.

[1] This practice is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.20 on Joining.

Current edition approved March 15, 1993. Published July 1993. Originally published as F 1290 – 90. Last previous edition F 1290 – 90.

[2] *Annual Book of ASTM Standards*, Vol 08.01.

[3] *Annual Book of ASTM Standards*, Vol 08.04.

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The coupling contains an internal heat source. The heat source can be: (*1*) a resistance wire coil located on the inner surface of the fitting, or (*2*) the fitting itself can be made of an electrically conductive material. When electric current is applied, heat is produced in the fitting melting the inside of the fitting and the outside of the pipe. The melted material from the two components flow together and fuse as the joint cools. A device should be used to secure the joint and hold it in axial alignment during the joining process. The device may be either an external clamp or one which is integral to the coupling.

7.2 *Technique 2: Saddle Type*—The electrofusion saddle technique involves heat fusion of a saddle fitting to the outer surface of a pipe. The heat source is located on the fusion surface of the concave base of the saddle fitting and can be either: (*1*) a resistance wire coil, or (*2*) a conductive polymer. When electric current is applied, heat is produced at the interface of the pipe and fitting, melting the surface of the two components. The fusion bond occurs when the melted materials of the two components flow together and cool below the melting temperature of the material. During the fusion process, a clamping device should be used to hold the fitting in place on the pipe. This device may be either an external clamp or one that is integral to the saddle fitting itself.

8. Apparatus

8.1 *General Recommendations:*

8.1.1 *Power Source*—An adequate source of electricity is required. Consult the manufacturer's recommendations for the type of power (ac or dc), input voltage, frequency (Hertz) and power output (KW) required for proper fusion of fittings. A transformer may be required if the source voltage differs from the voltage recommended by the manufacturer.

8.1.2 *Extension Cord*—If the power source is remote from the installation site, an extension cord may be required. Select an extension cord of sufficient conductor size to deliver the required voltage to the control box.

8.1.3 *Control Box*—A control box is required to deliver the appropriate amount of energy to the electrofusion fitting. Semi-automatic and fully automatic control boxes may incorporate either timers or sensing circuits which monitor temperatures, current, or pressures in the fittings during the fusion process. Not all control boxes are compatible with all electrofusion fittings. Consult the manufacturer to determine the compatibility of control boxes not made by the same manufacturer as the fitting.

8.1.4 *Alignment Devices*—Various types of alignment devices are available and may be required for a particular fitting. The alignment device should prevent movement of the components being joined during the fusion and cooling cycles.

8.1.5 *Surface Preparation Equipment*—The purpose of surface preparation is to remove surface contamination and oxidation from pipe or fitting spigot (Note 3).

NOTE 3—Surface preparation is very important to assure total fusion.

8.1.5.1 *Tools*—A surface cleaning tool is required for certain fitting designs to remove the outer layer or skin of material on the pipe or fitting spigot surface prior to fusion. Tools used for that purpose are commonly called scrapers. Only qualified procedures and approved tools should be used. Emery cloth or sandpaper is not recommended.

8.1.6 *Miscellaneous*—The following equipment may be useful to assist in the electrofusion joining procedure:

8.1.6.1 *Tubing Cutter*—Used to obtain square end cuts on pipe.

8.1.6.2 *Marking Pen*—Used to mark the fitting location on the pipe surface for certain fitting designs. It may be useful to mark the pipe to define the boundaries before scraping or abrading the pipe surface.

8.1.6.3 *Wiping Cloth*—A clean, dry, non-synthetic, lint-free cloth or paper towel should be used for removing surface preparation residue from the joining surfaces. Considerations of the hazards of static electricity should be applied in selection of a wiping cloth material.

9. Joining Procedure

9.1 **Precaution**—Fusion quality can be affected if extreme weather conditions exist. Therefore, the ambient temperature limits should be considered when making field joints. Observe normal precautions in the use of electrical equipment, especially in wet environments.

9.2 *Technique 1: Coupling Procedure:*

NOTE 4—When fittings are to be used to repair pipe under conditions where line pressure buildup is anticipated, pressure should be blocked off or vented to prevent excessive pressure buildup during the joining and cooling cycle.

9.2.1 Cut the pipe ends squarely and remove burrs or shavings. Clean and dry the pipe by wiping with a clean paper towel or cloth.

9.2.2 Remove the outer surface of the pipe using recommended procedure and tools. Avoid gouging or removing excessive material from the pipe surface. Care should be taken to maintain the specified minimum wall for the pipe.

NOTE 5—For certain non-pressure applications, removal of the pipe outer surface material may not be required. Consult the manufacturer for recommendations.

9.2.3 If pipe inserts are supplied with the electrofusion fitting, install these inserts into the pipe ends.

NOTE 6—Care should be taken to ensure that fitting and pipe joint surfaces are properly handled and maintained free of contamination, such as dirt, debris, or other sources of contamination such as oil from the operator's hands which could have a deleterious effect on joint quality.

9.2.4 Center the fitting on the pipe ends. The gap between the pipe ends should not exceed the recommended value.

9.2.5 Secure the fitting and pipe in place to prevent movement during the fusion and cooling cycles using the recommended alignment tool.

9.2.6 Attach leads from the control box to the fitting. Follow recommended procedures to ensure leads are connected and working properly.

9.2.7 Activate the fusion cycle in accordance with the installation instructions. When the cycle is complete, follow the recommended procedures for disconnecting the leads from the fitting.

9.2.8 Allow the assembly to cool before removing the alignment tool. Consult instructions for recommended cooling procedures.

9.2.9 *Joint Acceptance*—Assure the fusion cycle was com-

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pleted without interruption for the prescribed time for fitting type and size being joined.

9.3 *Technique 2: Saddle Procedure:*

9.3.1 Clean and dry the joining surface of the pipe by wiping with a clean paper towel or cloth.

9.3.2 Remove the outer surface of the pipe using recommended procedure and tools. Surface preparation is only required in the area where the fitting is to be installed. Avoid gouging or removing excessive material from the pipe surface. Be careful not to alter the contour of the pipe during this procedure.

9.3.3 Position the saddle fitting on the prepared surface of the pipe. Secure the fitting in place to prevent movement during the fusion and cooling cycles. Handle the fitting carefully to avoid contamination of the fusion surfaces (Note 6).

9.3.4 Attach leads from the control box to the fitting. Follow recommended procedures to ensure that the leads are connected and working properly.

9.3.5 Activate the fusion cycle in accordance with the installation instructions. When the cycle is complete, follow the recommended procedures for disconnecting the leads from the fitting.

9.3.6 Allow the assembly to stand until it is cool before removing pipe from the alignment or clamping device. Consult instructions for recommended cooling procedures.

9.3.7 *Joint Acceptance*—Assure the fusion cycle was completed without interruption for the prescribed time for fitting type and size being joined.

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This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, PA 19103.

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Central Plastics Electrofusion Manual

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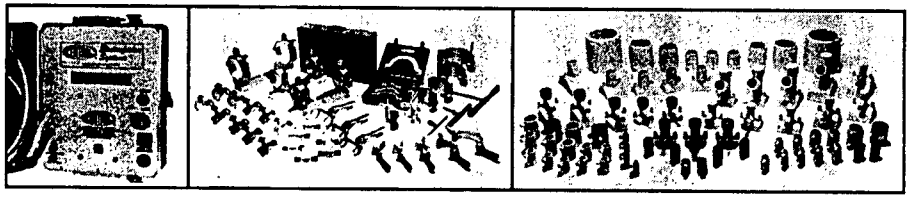
All components of the Central Electrofusion System are manufactured in the USA (control box, accessories, fittings) to assure consistent quality and fast, dependable service.



CENTRAL® Electrofusion Systems
Computer Controlled Fusion

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CENTRAL® Electrofusion Systems
Computer Controlled Fusion

OPERATION AND TRAINING MANUAL

21195

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The information contained herein is technical data and specifications for the Central Electrofusion System. Operation of the Central Electrofusion System should be done by qualified operating personnel only.

This publication was written to assist the training of personnel in the appropriate procedures and operating techniques for joining polyethylene pipe with the Central Electrofusion System. It was designed as a training and operations tool and should be used solely for that purpose. Permanent field installation should be done only by operators who have been properly trained and certified in accordance with the requirements of the Department of Transportation.

The recommended joining procedures for the Central Electrofusion System detailed in this manual have been qualified in accordance with D.O.T. 192.283.

All information contained in this manual should be carefully studied before attempting field operation of the Central Electrofusion System.

The following procedures were written to assist field personnel in the use of the Central Electrofusion System and Central Electrofusion Fittings. While technical data and advice contained herein is based upon tests and information believed to be reliable, user should not rely upon it absolutely for specific applications. All data is given and accepted at user's risk and confirmation of its validity and suitability in particular cases should be obtained independently. Central Plastics Company makes no guarantee of results and assumes no obligation or liability in connection with its advice. The integrity of the piping system is the ultimate responsibility of the installer. This publication is not to be taken as a license to operate under, or recommendation to infringe any patents.

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System Operations

The Central Electrofusion System is an automatic system for joining plastic pipe that consists of specially designed electrofusion fittings and a sequence processor or control box.

The sequence processor is computerized to provide precision control of time, temperature, and joining pressure. Fusion functions of the system are achieved through a one button operation on the sequence processor. If any discrepancies in electrical specification, voltage, or fitting connection occur, the sequence processor will automatically terminate the fusion cycle and alert the operator of the problem.

The computer control of the system provides additional security through computerized monitoring of joint integrity and, data storage and retrieval.

Computer functions of the sequence processor include:

Field Operations
User prompts are verbose, resulting in greater ease of use and reduced operator dependency. An algorithm is used to detect bad fusion, resulting in a high success rate for detecting failed couplings.

Self-Diagnostic
The sequence processor performs some basic self-diagnostic checks automatically during power up. If any critical functions are found to be in error, a unit error code message indicating service is needed is displayed and the unit will not allow operation to continue. Extensive diagnostic can be achieved by holding the START BUTTON down during the power-up or through a portable computer.

Memory
Multiple fusions can be stored in memory. Fittings are given I.D. numbers. The number is incremented for every attempted fusion whether successful or unsuccessful. The processor has the capability to store up to 350 twenty second (20 sec.) fittings.

Data Storage
Stored with the current fitting data are the sampling period at which the data was taken (in seconds) and the status of the fusion. That is, whether or not the fusion was successful and if not, the reason for termination.

Records are stored of the highest generator voltage seen by the sequence processor and the total number of seconds that the processor has spent fusing fittings. This data is useful in pin-pointing the frequence of fittings and processor failures and to determine routine service intervals for individual units.

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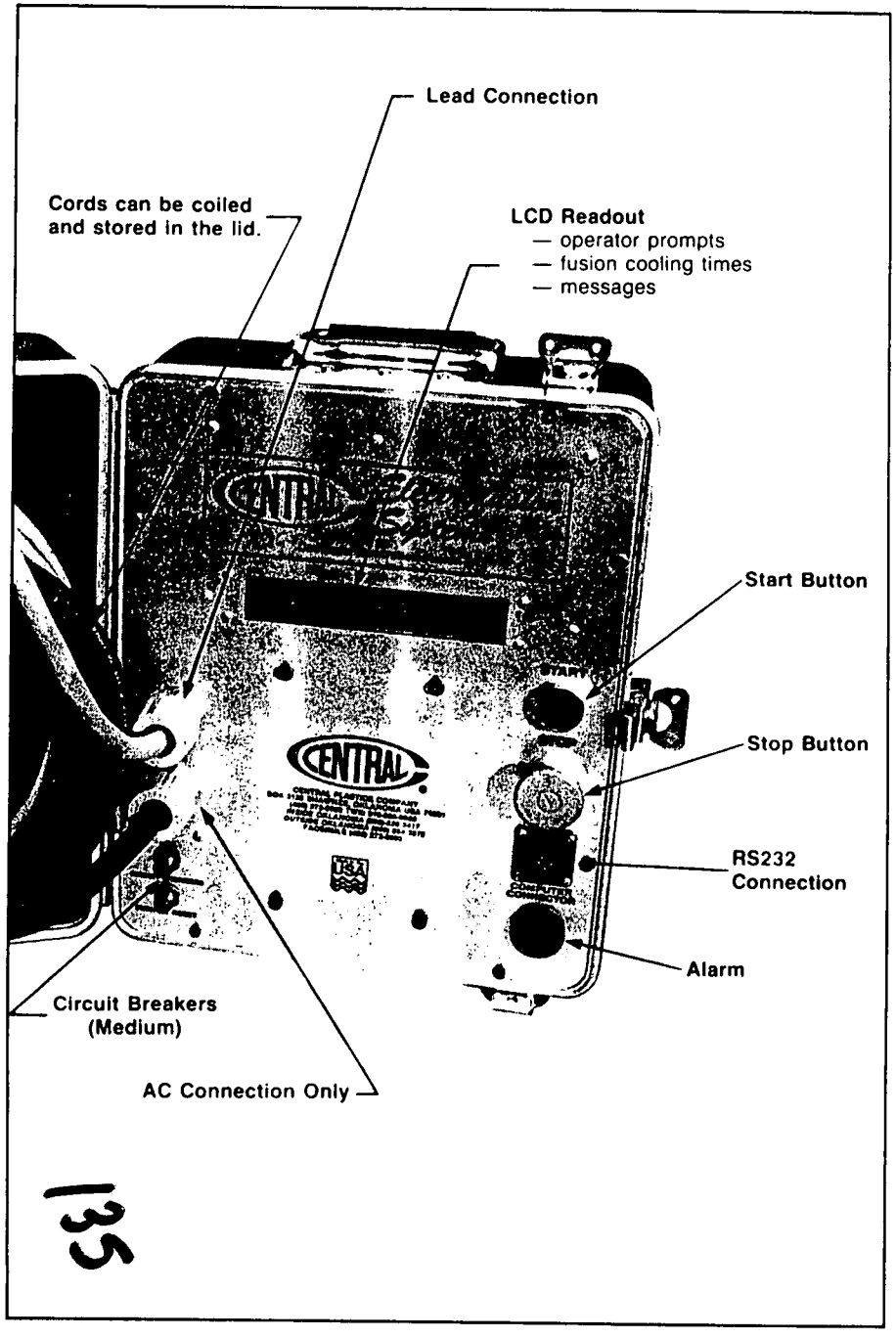
The following illustrations point out the key elements for operating the Central Electrofusion System.



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Sequence Processor Operations

1. Field Operation

Upon power up, the computerized sequence processor performs a limited set of self-diagnostics to assure reasonable device operation, then automatically continues into regular operations.

Messages appearing on the LCD display prompt the operator through the sequenced operation of steps required in the electrofusion process. After self-diagnostics are complete, a prompt will appear to attach fitting. The processor will then go into a waiting mode until a valid fitting connection is made and identified.

Once fitting is attached, the processor identifies the fitting, and displays the fusion time of fitting in seconds, the I.D. number of the fitting, and a message prompting the operator to press the start button.

Note: If the I.D. number does not appear, the EEROM is full of fusion data and does not have room for the intended coupling. In this event, "Memory Full" is displayed in the lower right corner of the display.

Fusion data can be retrieved and documented from the memory through the use of a laptop computer (see data retrieval on page 4) or a personal computer, (refer to the operation instructions provided with the Central Plastics Electrofusion Software for personal computer data retrieval systems). If computer interface and data retrieval is not necessary, fusion operations can be continued. Additional fusions will sequence as usual, but will not be stored in memory.

During fusion, the LCD display will show the I.D. number, the time remaining in seconds, the current in amps, and the fitting voltage. This display is updated at one second (1 sec.) intervals, yet the processor is analyzing these parameters at much faster intervals. Generator voltage is also monitored but not displayed.

If any of these fusion parameters is out of specifications for a predetermined period of time, the processor will terminate the fusion process and sound an alarm. A message will then be displayed as to the reason for termination and a prompt for the operator to press the stop button. In the case of generator fault, the only way to stop the alarm is to remove power from the processor.

When the stop button is pressed, the processor displays the last parameters that it was able to register. This display remains until the fitting is removed. At this point, the operator is prompted to attach a

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coupling and the entire process is repeated. There are three (3) types of messages that can be displayed: Fusion Messages, Fault Messages, and Testing or Diagnostic Messages. (Refer to pages 8 and 9.)

2. **Data Retrieval Operation**

Stored data can be obtained from the sequence processor through a personal computer or a laptop computer. Data retrieval via computer does require a Central Software Package for personal computers or Central Software Chip for laptop computers. Since laptop computers are utilized in the field, a basic description of retrieval operations, laptop only, is given below. For detailed or specific computer retrieval operations, contact Central Plastics.

Data can be retrieved from the sequence processor through a communications mode. The communications mode can be entered in one of two ways; by attaching an RS-232C cable and then powering up the sequence processor, or attaching the RS-232C cable when the LCD prompts the operator to attach a coupling. The difference between these two is that the first method bypasses the self-diagnostic test at power up and disables continuous generator voltage checking. This is primarily useful in diagnostic mode.

Upon sensing connection with the sequence processor the laptop will request the number of seconds in operation, the total number of couplings in memory, the number of bad couplings in memory, and the maximum generator voltage seen by the sequence processor. A menu of six (6) different operations is displayed for the operator to select from:

1. Wake-up
2. Send Record
3. List Bad I.D. Numbers
4. Diagnostics
5. Plot Record
6. Clear Memory

The operator can choose which function he wants by tapping the space bar or using the cursor keys to highlight the function desired, and then pressing the enter key. In case of "Diagnostics" or "Clear Memory", the user is prompted with an "Are You Sure" message. This prevents inadvertent clearing of fusion memory, as well as, getting stuck in Diagnostic mode.

3. **Diagnostic Operations**

The computerized sequence processor provides extensive self-diagnostics which can aid the operator in detecting functional faults, as well as, general confidence testing. Diagnostic mode can be entered in two ways:

1. Diagnostics can be requested from a computer.
2. Holding down the start button at power up.

The only difference in these two modes is that the RS-232 port is additionally checked using method two.

Upon entering the Diagnostics mode the sequence processor displays a message as each test is being performed. The results of most tests are not displayed, but rather saved in memory until later for analysis by the laptop or personal computer. A few of the tests require operator intervention for accurate results. A few of the tests timeout and show the individual device as bad after a given amount of time, primarily to avoid locking the sequence processor in an endless loop waiting for a given event to occur.

A fitting should not be left attached during the test as this will cause an error in the ohmmeter range tests.

The individual tests performed are listed below, as well as requirements for operator intervention and timeout length. The tests are performed in the order shown.

Test	Operation Intervention Required	Timeout Length
EPROM Checksum	No	—
Storage	No	—
LCD Display	No	—
A/D Converter	No	—
A/D Converter Latch	No	—
D/A Converter	No	—
Start Button	Yes	15 Seconds
Stop Button	Yes	15 Seconds
Alarm	No (Listen for Alarm)	—
Generator Voltage	No	—
Ohmmeter Range	Yes	
Tests	No	45 Seconds each range
Contactor	No	—
RS-232	Attach Test Plug to RS-232	Infinite

All tests requiring operator intervention can be skipped by pressing the start button. This is required for each of the 5 parts Ohmmeter Range Test. If any test times out, the tested function is reported as bad. If the test is aborted due to pressing the start button, the test is reported as good.

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Diagnostic Messages

The following lists the test messages displayed during the diagnostic check and a description of the test activity taking place.

Testing Program
Adds up all Bytes of the program chip and checks the answer against a value to make sure nothing has been forgotten.

Testing Fusion Memory
Writes to and reads from the fusion memory chip in a reserved spot to verify that the chip is still working.

Testing LCD Display
Verifies that the LDC display electronics will talk to the processor. It does not check for broken glass, etc.

Testing A/D Converter
A/D converter reads the analog output volts, output current (converted to volts), generator volts, and ohmmeter volts; and converts this to digited information which the processor can use.

Testing A/D Converter Latch
Converter latch holds the digital information from the A/D converter for the processor to read.

Testing D/A Converter
D/A converter changes the digital information from the processor to analog voltage for the output voltage control circuit to use.

***Testing Start Button**
Press Start (operator prompt)
Checking operation of the start button

***Testing Stop Button**
Press Stop Button (operator prompt)
and
***Testing Stop Button (operator prompt)**
Release Stop Button (operator prompt)
Checking the operation of the stop button.

***Testing Alarm**
Checks operation of alarm. This test is prompted by the processor but not really valid for the processor because if the alarm does not work, the processor does not know it. Therefore, operator should listen for alarm to assure operation.

* Require operator intervention.

Testing Generator Voltage
Generator Value
The "value" represents the accumulated generator voltages for engineering and trouble shooting uses only, and is not the present input voltage.

Testing Ohmmeter Range Values
This test consists of five (5) consecutive prompt messages to attach fittings.

Following each fitting prompt a Range Good Value _____ or Range Bad Value _____ will appear. This "Value" represents engineering information for trouble shooting only and is not the current input resistance.

Testing Contactor
A four second (4 sec.) test in which the processor checks the relay for proper action. If the STOP BUTTON is down, the test will not run. Instead, the processor will display a "Release Stop Button" message. Tests will continue automatically once the STOP BUTTON is released.

***Testing Computer Connection**
Connect Computer Diagnostic Plug (operator prompt)
This tests the RS-232 input and output circuit. Operator will need to attach the test plug to the RS-232 port. This is an additional check and need not be completed if not utilizing computer communication. To by-pass, simply push the START BUTTON to proceed with remaining diagnostics.

Self-Diagnostic Test Failure
Unit Error Code _____
Reports any diagnostic test functions that failed. This error code is engineering information for trouble shooting purposes only.

For detailed or specific information on data retrieval, computer communication, fault explanations, or diagnostics, please contact Central Plastics.

* Require operator intervention.

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Fault Message

Fault/Remedy	Probable Cause
Fault — Fitting Current Out of Range Press Stop — Cut Out Fitting	Fitting current is 10% above the lowest range — Short Stab
Fault — Output Voltage Out of Range Press Stop — Cut Out Fitting	Output volts are greater than 41 volts during Ramp Up or less than 39 volts after Ramp Up
Fault — Input Voltage Below 90 Volts Cannot Guarantee Reliable Operation	Generator Voltage Out of Range Extension cord or power source is faulty or inadequate
Fault — Input Voltage Above 165 Volts Unplug Unit Immediately	Generator Voltage Out of Range
Operator Stop Remove Fitting	Operator has engaged Stop Switch for some reason
Processor Voltage Output Fault — Processor Requires Service	SCR's are shorted out
Fitting Fault — Excess Current Press Stop — Cut Out Fitting	Current was greater than 50 after RAMP Up time
Fitting Shorted Out Press Stop — Cut Out Fitting	Greater than 50 amps after 2 seconds
Fitting Amps Low Check Leads	Fitting Resistance too high , Less than 2 amps after RAMP Up
Fitting Volts Low — Check Leads Let Fitting Cool — Reattach Fitting	Loose or damaged lead connections, Coupling should be reusable
Fitting Fault — Current Increasing Press Stop — Cut Out Fitting	Misaligned Pipe, short stab
Fitting Volts Low — Check Leads Press Stop — Cut Out Fitting	Loose or damaged leads Coupling probably not salvagable

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Fusion Messages

Message	Description
Central Electrofusion Systems Software Version 1.0 Serial # _____	Software version and serial number of individual unit.
Attach Fitting	Operator prompt.
I.D. # _____ Fuse Time _____ Press Start	Valid fitting time, proceed with fusion.
I.D. # _____ Fuse Time _____ Release Stop Button	Stop button depressed, release to continue.
I.D. # _____ Time Remaining _____ Current _____ Voltage _____	Displayed and updated each second during fusion cycle.
Unknown Fitting — Try another fitting	Time resistor of the fitting cannot be recognized by the processor.
Fusion Complete Cooling Time _____	Successful fusion completed
Memory Full	Memory is full. Fusion can be made but will not be stored in memory.
Memory 75% Full	Memory is approaching capacity. If retrieval and computer extraction of the fusion data is desired, memory should be extracted to insure all fusion data is retained. (Refer to Field Operations, page 3)

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1. **Sequence Processor**

Input Voltage:	90 to 150 VAC; 50 to 70 HZ
Output Voltage:	40 Volts ± .2 Volts
Input Current:	20 Amps Average Maximum
Output Current:	50 Amps Maximum (Automatically limited by the processor)
Operating Temperature:	−10°F to 120°F (−23°C to 49°C)
Timer Range:	15 to 600 Seconds
Input Protection:	Dual Circuit Breakers
Output Safety Trip:	41 Volts
Weight:	52 lbs. (23.6 kg)
Dimensions:	12" x 15" x 10" (30.48 cm x 38.1 cm x 25.4 cm)

2. **Cable Length**

Input Cable:	15 ft. (4.6m) 30 Amp 125V Twistlock Plug (Std) NEMA L-5
Output Cable:	15 ft. (3.7m) and 25 ft. (7.6m) Other output lengths available upon request

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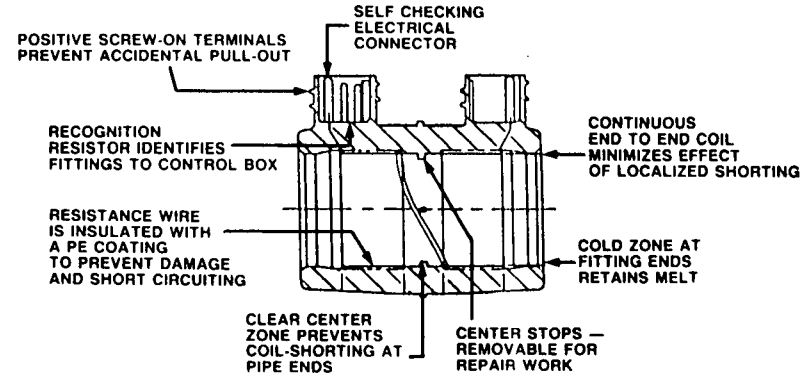
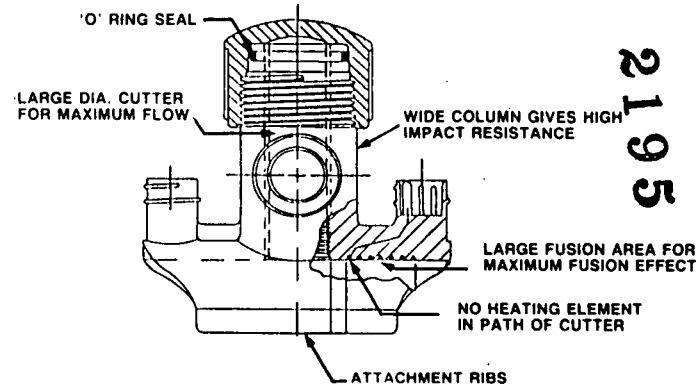
Material: BP Rigidex PE2406

Property	Method of Test	Value	Units
Melt Flow Rate	ASTM D1238-79 Condition E	0.2	g/10min
Density	ASTM D1505	940	Kg/m
Tensile Strength At Yield	ASTM D638-80 Type 4 50 mm/min	19	MN/m
Elongation At Break	ASTM D638-80 Type 4 50 mm/min	300	%
Impact Strength		93	J/m notch

Fitting Diagrams:





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Performance

Central Electrofusion Fittings typically achieve the following performance test results.

Temperature	Internal Pressure	Hours to Failure
176°F (80°C)	130 PSI	1000 +
68°F (20°C)	275 PSI	2500 +

Saddle Impact: Falling Weight 10 lb. from 7 ft.

Safe Operating Temperature: 10°F to 120°F (23°C to 49°C)

Safe Operating Pressure: 125 PSI

Compliance With Standards: Central Electrofusion Fittings meet the performance requirements of ASTM F1055 and ASTM D2513.

Electrical Requirements and Cooling Times

Fitting	Fusion time in seconds	Clamped time in minutes	Total cooling time	KVA	Generator Breaker minimum	Extension cord size 25 ft.	Extension cord size 50 ft.
COUPLINGS:							
1/2 CTS	20	5	30	1.0	10	#12/3	#10/3
1/2 IPS	20	5	30	1.0	10	#12/3	#10/3
3/4 IPS	25	5	30	1.0	10	#12/3	#10/3
1 CTS	25	5	30	1.0	10	#12/3	#10/3
1 IPS	40	5	30	1.0	10	#12/3	#10/3
1 1/4 IPS	45	10	30	1.5	10	#12/3	#10/3
2 IPS	45	10	30	2.5	20	#10/3	# 8/3
3 IPS	90	10	30	2.5	20	#10/3	# 8/3
4 IPS	120	10	45	2.5	20	#10/3	# 8/3
6 IPS	500	15	1 hour	2.5	20	#10/3	# 8/3
REDUCERS:							
3/4 x 1/2 CTS	20	5	30	1.0	10	#12/3	#10/3
1 IPS x 1/2 CTS	25	5	30	1.0	10	#12/3	#10/3
1 IPS x 1/2 IPS	30	5	30	1.0	10	#12/3	#10/3
1 IPS x 3/4 IPS	30	5	30	1.0	10	#12/3	#10/3
1 IPS x 1 CTS	30	5	30	1.0	10	#12/3	#10/3
TAPPING TEES:							
1 1/4 x 1	45	10	30	1.0	10	#12/3	#10/3
2 x 1	90	10	30	1.0	10	#12/3	#10/3
3 x 1	90	10	30	1.0	10	#12/3	#10/3
4 x 1							
6 x 1							
VOLTAGES:	90 Volt Minimum		150 Volt Maximum				
FREQUENCY:	45 to 75 Hertz						
INVERTERS:	Yes. (Model B)						

WARNING: A.C. current only. D.C. current can result in damage to processor.

Certification Requirements

The recommended joining procedures for the Central Electrofusion System detailed in this manual have been qualified in accordance with D.O.T. 192.283.

Persons responsible for the joining of polyethylene pipe by fusion methods must qualify according to the requirement of Title 49 of the Code of Federal Regulations, Section 192.285.

The regulations require that each operator performing fusion joining be qualified in the use of the recommended fusion procedure(s) by the following:

I. Appropriate training or experience in the use of the applicable fusion procedures, and . . .

II. Making a sample joint according to the said procedure that passes the following inspections and tests:

A. The joint must be visually examined during and after joining and found to have the same appearance as a photograph or sample of an acceptable joint that was joined in accordance with the applicable procedure; and . . .

B. The joint must be tested or examined by an authorized instructor using one of the following methods:
1. Pressure and tensile test as described in 49 C.F.R. § 192.283; or
2. Cut into at least three longitudinal straps, each of which is:
   a. Visually examined and found to be free of voids or unbonded areas on the cut surface of the joint, and . . .
   b. Deformed by bending, torque or impact and if failure occurs, it must not initiate in the joint area.

C. A person must be requalified under an applicable procedure if, during any twelve-month period, he —
1. Does not make any joints under the applicable procedures or
2. Has three joints or three percent of the joints he has made, whichever is greater, that are found unacceptable by testing under 40 C.F.R. § 192.513.

Photographs of acceptable and unacceptable joints and illustrations showing the use of cut straps for inspection and testing of the joint are provided in the Qualification Procedures on Page 25 of this manual.

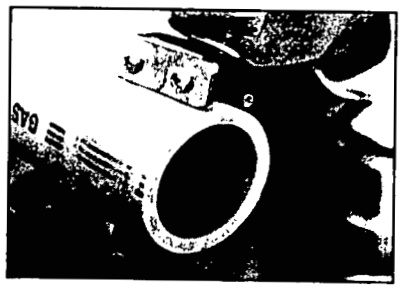
Individuals who demonstrate their ability to follow the recommended joining procedures and produce acceptable electrofusion joints as illustrated in this manual should meet the requirements for qualification under 49 C.F.R. § 192.285 and be eligible for certification.

Standard Joining Procedures

Standard joining procedures describe the steps necessary to join similar or dissimilar polyethylene piping materials with the Central Electrofusion System. For pipe sizes 2" and over, Central recommends using Repair Procedures (page 17) for standard joining due to the difficulty of stabbing larger diameter pipes.

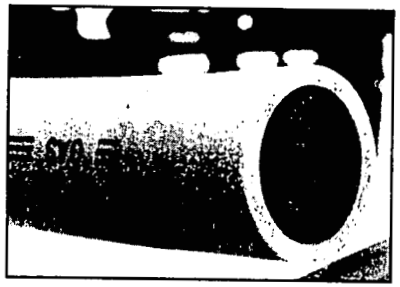
1. The pipe must have a square, even cut.
2. Remove any burrs or shaving from the pipe ends that may have developed during the cutting process.
3. Clean pipe ends inside and out with a clean cloth to remove any dirt or contaminants.

   Pipe preparation and contamination are very important considerations in the electrofusion process. Therefore, careful attention should be given to proper scraping and cleaning procedures.



Refer to **Note** on page 16.

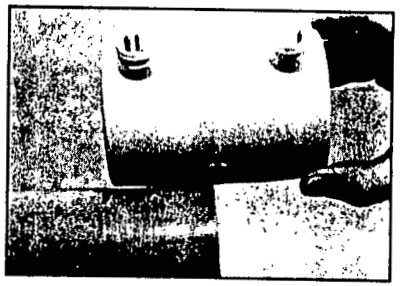
4. Scrape pipe ends to remove any oxidation or suface contamination. For best results, secure tool on pipe and make two revolutions.



5. Remove scraping tools and clean blade area with a clean, dry cloth. Repeat this procedure several times during the scraping operation to remove build-up of material.

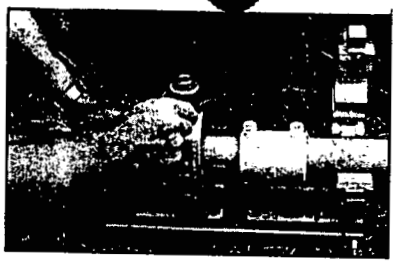
6. Continue scraping until only a virgin surface remains.

   Caution: Avoid all possible recontamination of the prepared surface. Do not touch inside of fitting or scraped pipe surfaces with your hands as perspiration and body oils could contaminate jointing areas and affect joint performance.



7. To determine stab depth, measure half the length of the coupling and mark the pipe ends an equivalent length. For ease of installation, a stab depth indicator and internal fitting stops are a molded part of Central Electrofusion couplings and reducers.

8. Slide fitting onto pipe until pipe ends meet with the stops in the I.D. of the fitting. Check measurement mark for proper stab depth.

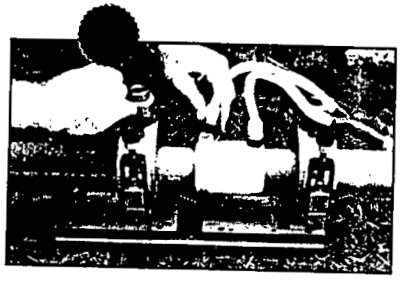


9. Maintaining stab depth, place into the proper clamping tool to secure the pipe from movement during the fusion cycle. For best results, alignment clamps should be placed as close to the fitting as possible. For coiled pipe larger than 1" (or other binding installations), the use of two clamps on each side of the coupling is recommended.
10. The sequence processor should be connected to an adequate AC power source (110 volt).

    Note: If utilizing a generator, the generator should be engaged before plugging the sequence processor in.

    Refer to the Electrical Data shown on page 12 for the precise electrical requirements of the size and type of Central Electrofusion fitting being joined.

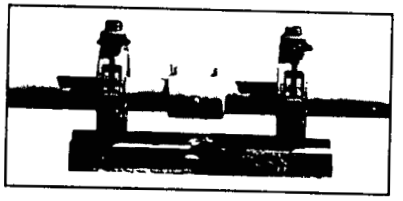
11. The sequence processor will automatically run a quick diagnostic check of its operational functions (voltage input/output, etc.). When diagnostic check is complete "Attach Fitting" will appear on the visual display.



12. Attach leads from the sequence processor to the fitting terminals. When proper connection is made, the required "Fusion Cycle Time" will appear on the visual display.

13. Press start button to begin fusion cycle. Fusion cycle time will countdown on the visual display. Proper voltage readout should remain between 39.8 and 40.2 volts.

14. When the fusion cycle is complete, "Fusion Complete and Recommended Clamped Cooling Time" will appear on the visual display.



15. Disconnect leads from fitting. Clamping device should remain in place to secure pipe and fitting during the recommended cooling time. After removing clamp, additional cooling time should be allowed before subjecting the joint to bending, burying, pressure testing, or similar handling and backfill stress.

Refer to page 12 for the recommended cooling times for the size and type of Central Electrofusion Fitting being joined.

NOTE: In the event of out-of-round pipe, it is important to assure an adequate and even scrape is achieved around the entire circumference of the pipe. A rubber pipe stopper can be placed in the end of the pipe to aid in rounding the area to be scraped.

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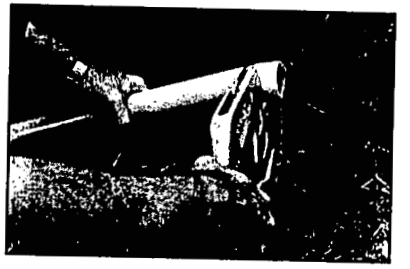
Repair Procedures

Repair procedures describe the steps necessary to repair and join damaged polyethylene lines of similar or dissimilar materials. The repair procedure does require two electrofusion couplings.

Caution: Central's Electrofusion System is an electronic device and is not explosion proof. In cases where 100% shut off is not available, escaping gas should be vented away from the electric device.

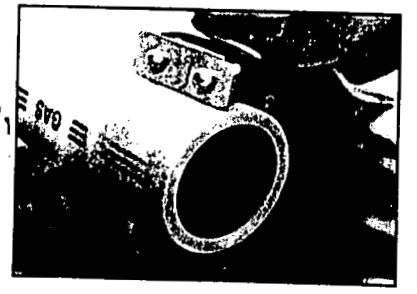


1. Cut out and remove section of damaged pipe. Be sure pipe ends have a square and even cut. Remove any burrs or shavings from the pipe ends that may have developed during the cutting process.

2. Measure for repair section. Repair section should have a square, even cut within ± 1/16" (1.6 mm) of open section length.

3. Clean pipe ends inside and out with a clean cloth to remove any dirt and contaminants.

Pipe preparation and contamination are very important considerations in the electrofusion process. Therefore, careful attention should be given to proper scraping and cleaning procedures.



Refer to **Note** on page 20.

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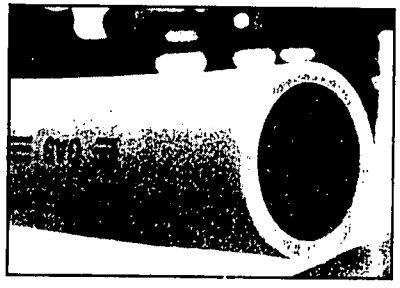
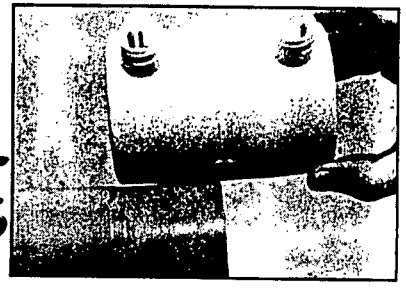
4. Scrape pipe ends to remove any oxidation or surface contamination. For best results, secure tool on pipe and make two revolutions.

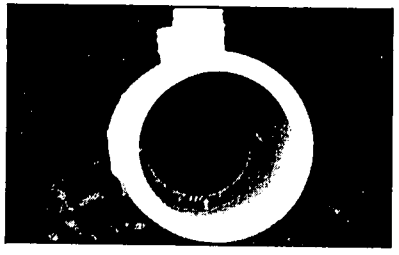


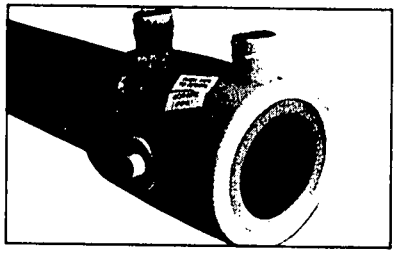
5. Remove scraping tool and clean blade area with a clean, dry cloth. Repeat this procedure several times during the scraping operation to remove build-up of material.

6. Continue scraping until surface material is removed and new material is exposed.



7. To determine stab depth, measure half the length of the coupling and mark the pipe ends an equivalent length. For ease of installation, a stab depth indicator and internal fitting stops are a molded part of Central Electrofusion couplings and reducers.

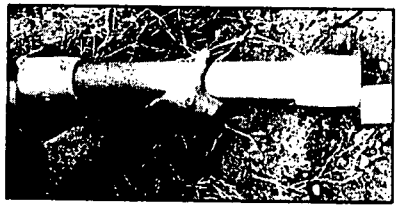




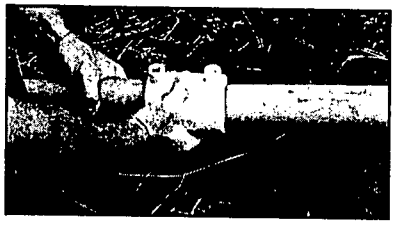
8. To remove internal fitting stops from the I.D. of the coupling, bottom pipe end to stops.

9. Apply a sudden thrust to the end of the coupling to cleanly snap out fitting stops. For best results, you should assure that stops are completely removed from the I.D. of the fitting.

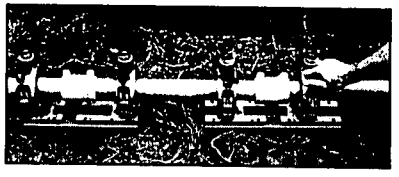
Caution: Some care should be used to avoid damage to internal coils.



10. Place repair section in opening.



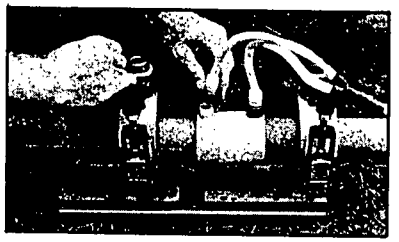
11. Slide coupling over pipe junction until both measurement marks are visible. Measurement marks should not extend more than 1/16" (1.66 mm) from coupling end. Repeat on opposite end of the repair section.



12. Maintaining the stab depth, place both pipe junctions into the proper clamping tools to secure the pipe from movement during the fusion cycle. For best results, alignment clamps should be placed as close to the fitting as possible. For coiled pipe larger than 1" (or other binding installations), the use of two clamps on each side of the coupling is recommended.

13. The sequence processor should be connected to an adequate AC power source (110 volt).

14. The sequence processor will automatically run a quick diagnostic check on its operational functions (voltage input/output, etc.). When diagnostic check is complete, "Attach Coupling" will appear on the visual display.



15. Attach leads from sequence processor to fitting terminals. When proper connection is made, the required "Fusion Cycle Time" will appear on the visual display.

16. Press start button to begin fusion cycle. Fusion cycle time will countdown on the visual display. Proper voltage readout should remain between 39.8 and 40.2 volts.

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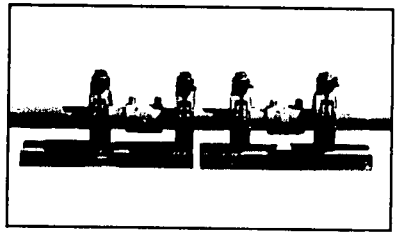
17. When the fusion cycle is complete, "Fusion Complete and Recommended Clamped Cooling Time" will appear on the visual display.



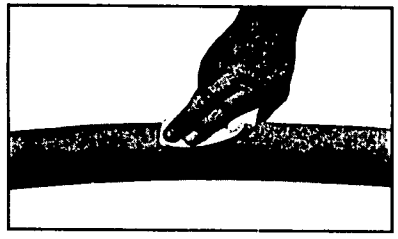
18. Disconnect the leads from the fitting. Repeat the procedure to opposite end of repair section.
19. Clamping device should remain in place to secure pipe and fitting during the recommended cooling time. After removing clamps, additional cooling time should be allowed before subjecting the joint to bending, burying, pressure testing, or similar handling and backfill stress.

    Refer to page 12 for the recommended cooling times for the size and type of Central Electrofusion Fitting being joined.

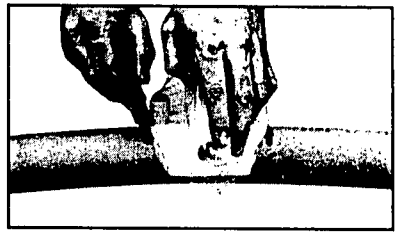
NOTE: In the event of out-of-round pipe, it is important to assure an adequate and even scrape is achieved around the entire circumference of the pipe. A rubber pipe stopper can be placed in the end of the pipe to aid in rounding the area to be scraped.

Saddle Joining Procedures

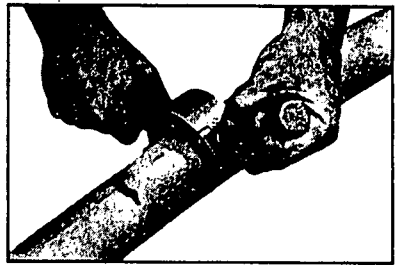
Saddle joining procedures should be used on all Central Saddle and Sidewall Electrofusion Fittings (Branch Saddles, Tapping Tees, Service Tees, etc.)



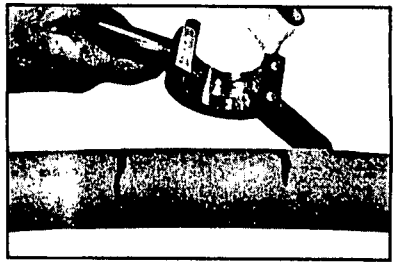
1. Clean joining surface with a clean cloth to remove any dirt or contaminates.



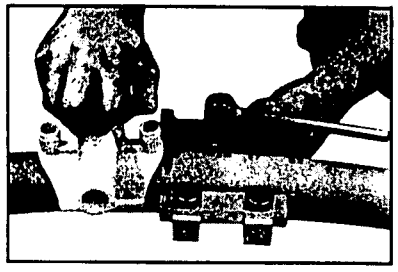
2. Center fitting on pipe to determine required fusion area. Mark the pipe an equivalent length.



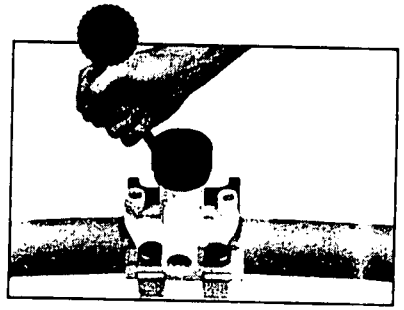
3. Scrape entire pipe surface required for saddle fitting to remove oxidation and contaminants. For best results, secure tool on pipe and make two revolutions.



4. Remove scraping tool and clean blade area with a clean, dry cloth. Repeat this procedure several times during the scraping operation to remove build-up of material.
5. Continue scraping until surface material is removed and new material is exposed.

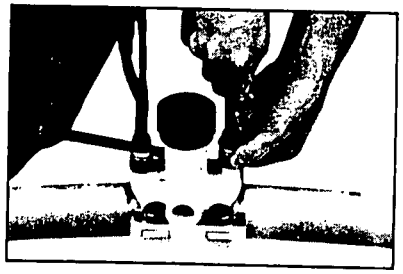


6. Position saddle on freshly scraped surface and place open saddle clamp under pipe adjacent to the saddle fitting.

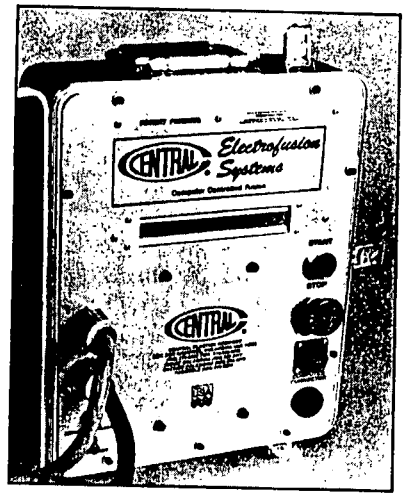


7. Slide clamping tool onto edges of saddle fitting until clamp is squarely aligned beneath the fitting. Tighten clamp to secure fitting in place.
8. The sequence processor should be connected to an adequate AC power source (110 volt).

   Note: If utilizing a generator, the generator should be engaged before plugging the sequence processor in.
9. The sequence processor will automatically run a quick diagnostic check of its operational functions (voltage input/output, etc.). When diagnostic check is complete, "Attach Fitting" will appear on the visual display.

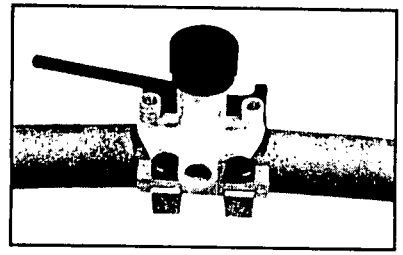


10. Attach leads from sequence processor to fitting terminals. When proper connection is made, the required "Fusion Cycle Time" will appear on the visual display.



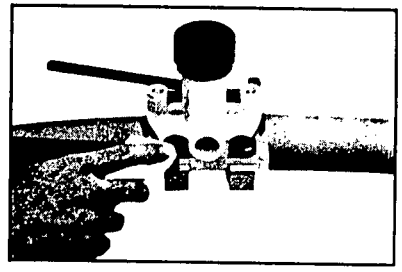
11. Press start button to begin fusion cycle. Fusion cycle time will countdown on the visual display. Proper voltage readout should remain between 39.8 and 40.2 volts.

12. When the fusion cycle is complete, "Fusion Complete and Recommended Clamped Cooling Time" will appear on the visual display.

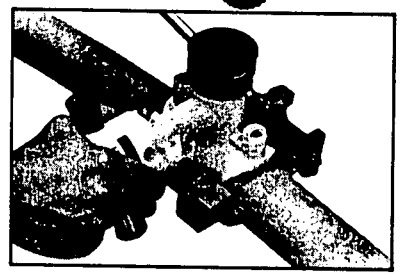


13. Leads can be disconnected from the fitting and preparations made for the outlet connection. Clamping device should remain in place to secure pipe and fitting during the cooling period. Central recommends that the clamping device remain in place on saddle fittings throughout any punching or tapping operations that may be required.

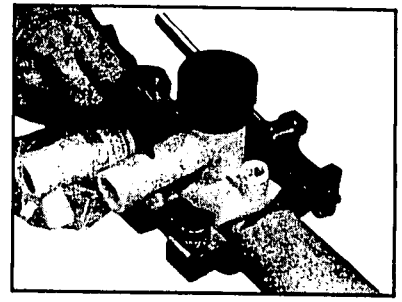
    Refer to page 12 for the recommended cooling times for the size and type of Central Electrofusion Fitting being joined.



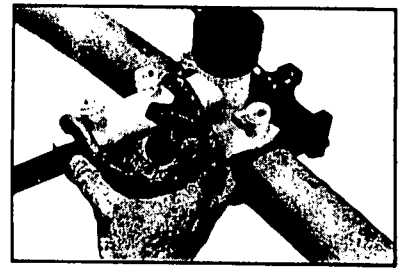
14. To make outlet connection, cut pipe end square and even. Clean pipe and outlet with a clean, dry cloth.



15. Scrape pipe end and outlet to remove any oxidation or surface contaminants.



16. Measure and mark stab depth on pipe and outlet. Stab depth is determined by measuring half the fitting length. To ease installation, a stab depth indicator is a molded part of Central Electrofusion couplings and reducers.
17. Slide fitting onto outlet until outlet end is square with internal fitting stops. Repeat procedure for pipe end.

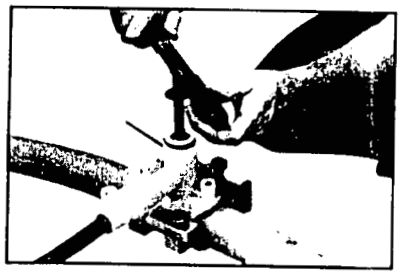


18. Place proper clamping device onto outlet and pipe to secure from movement during the fusion cycle.
19. Follow the same fusion procedures used on the saddle fitting (steps 10 thru 13) to complete the outlet joint.

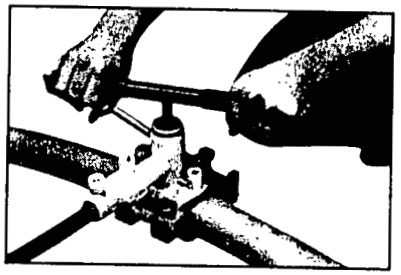
    Do not attempt to "punch" the main until connection is properly cooled.

    Note: Be sure joint has completely cooled before subjecting to bending, burying, pressure testing, or similar handling and backfill stress.

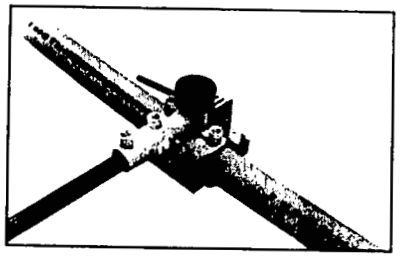
Tapping the Main



1. To "punch" the main, remove the cap of the saddle fitting and insert the tapping tool.
2. A stop is provided on the tapping tool. Tapping tool should be bottomed out to the provided stop to assure a complete and proper "punch" has been achieved.



3. Back tapping tool out to return "punch" to its original position, flush with top of body. This must be done to assure "punch" does not restrict gas flow.
4. Cap should be hand tightened only. We do not recommend the use of wrenches or other mechanical assist tools.



5. A protective sleeve can be slipped over the outlet of the tapping tee to reduce stress on the outlet connection.

Qualification Procedures

The recommended joining procedures for the Central Electrofusion System detailed in this manual have been qualified in accordance with D.O.T. 192.283.

Persons responsible for the joining of polyethylene pipe by fusion methods must qualify according to the requirements of Title 49 of the Code of Federal Regulations, Section 192.285.

Photographs of acceptable and unacceptable electrofusion joints as well as inspection and testing techniques are illustrated on the following pages. The photographs are presented as guidelines to assist in proper evaluation and qualification of electrofusion joints.

Individuals who demonstrate their ability to follow the recommended procedures and produce acceptable electrofusion joints as illustrated in this manual should meet the requirements for qualifications under 49 C.F.R. § 192.285 and be eligible for certification.

Qualification and installer certification requirements shown in this manual are in accordance with Government regulations set forth in the U.S.A. Persons utilizing Central Electrofusion in other countries should refer to the regulations for polyethylene piping installation set forth by the governing party in their country of origin.

Acceptable Electrofusion Joint (Std) 2" (60 mm)

The electrofusion joint must be tested or examined by one of the following methods:

(A) Pressure and tensile test as described in Title 49 of the Code of Federal Regulations, Section 192.283.

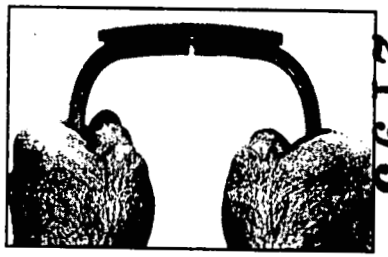
Prepare the electrofusion coupling in accordance with standard joining procedures.

(B) Bend Test

Prepare the electrofusion coupling in accordance with standard joining procedures.

Allow the joint to cool for at least one hour before subjecting to a severe bend test.

Cut into three longitudinal 1" (25.4 mm) wide straps about 8" (203.2 mm) long.



Bend the ends of each strap as shown. Inspect the fusion area to be free from any cracks or voids caused from bending per requirements of ASTM F1055.

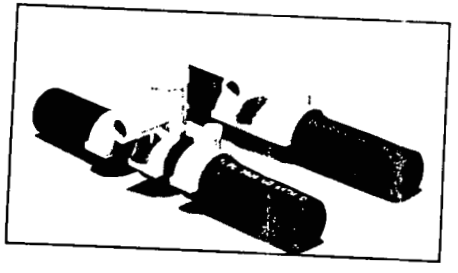
Electrofusion joints will have an unfused area at each end of the coupling. This unfused area was designed to relieve stress in the pipe and to contain molten material. This unfused area is not considered a separation or defect of the joint.

A joint is considered satisfactory if all bent samples are completely free of cracks or voids in the fusion area as described in ASTM F1055.

Acceptable Electrofusion Joint (saddle) 2" (60mm)

Qualification of Electrofusion Saddle Joint

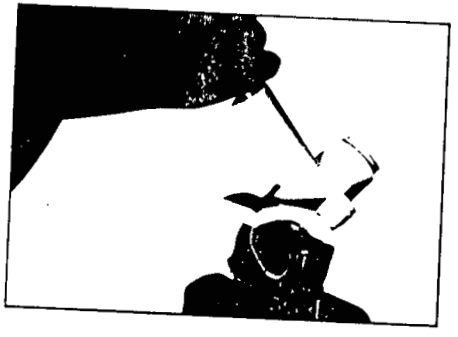
Prepare the electrofusion saddle fitting in accordance with saddle joining procedures. Allow proper cooling time before testing.



Cut the saddle joint into three rings as shown.

Visually examine to be free from voids or gaps.

Compress in vice as shown. Fusion area should remain free of cracks or voids.



Deform by bending, torque, or impact as shown.

Visually examine, if failure occurs, it must not initiate in joint area.

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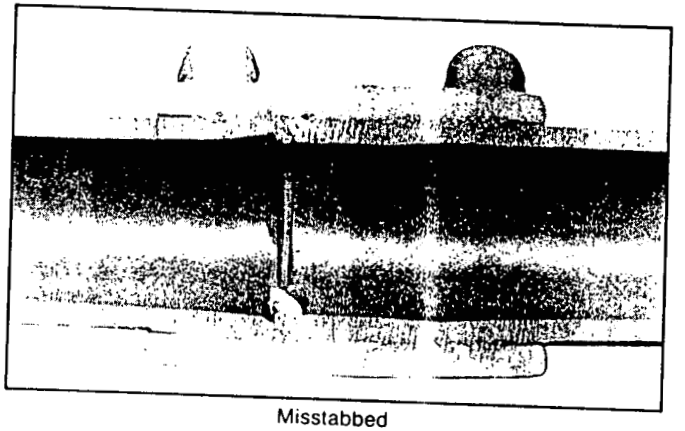
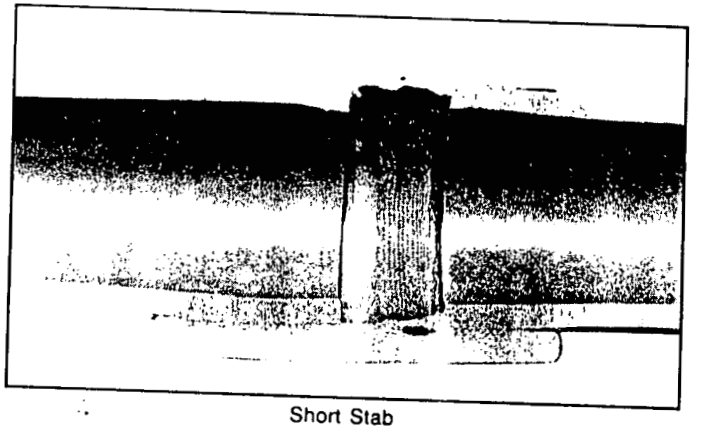
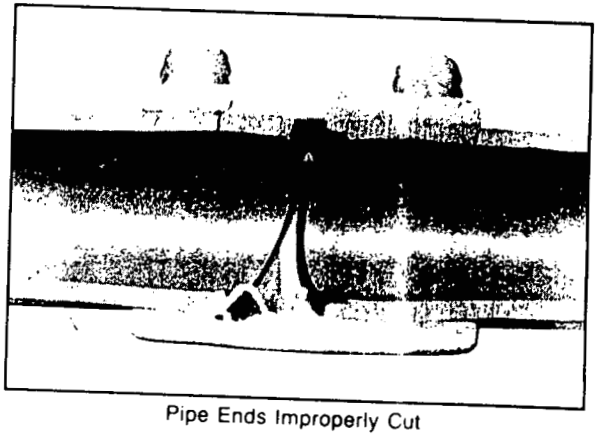
The pictorial examples on the following pages demonstrate electrofusion joints which have been improperly fabricated and are, therefore, not recommended by Central Plastics for use in a gaseous environment.



Misstabbed



Short Stab



Pipe Ends Improperly Cut

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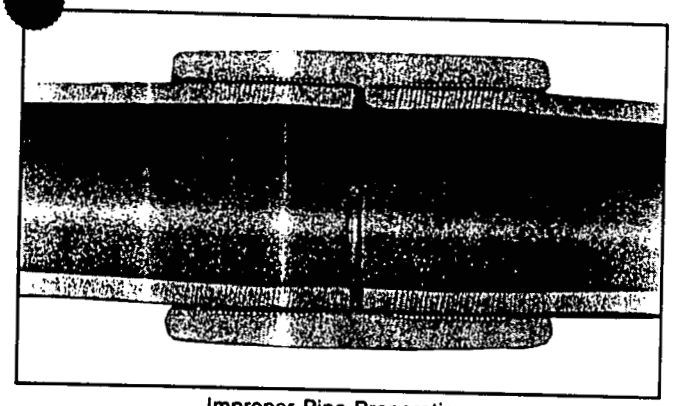
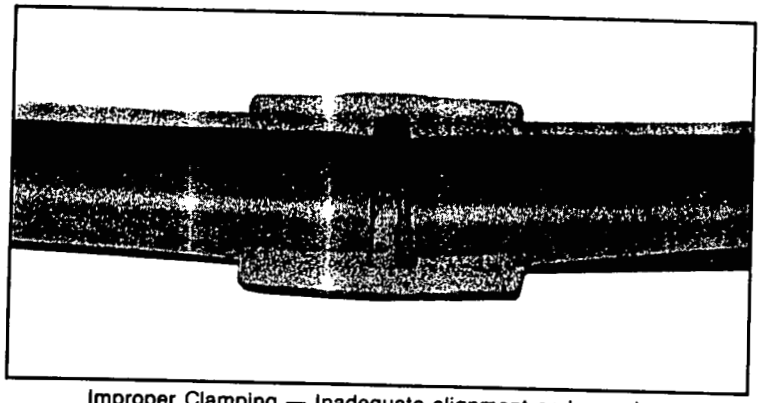


Improper Pipe Preparation
Pipe end was not properly scraped or was contaminated after preparation.



Improper Clamping — Inadequate alignment and securing

Improper pipe preparation or inadequate scraping produced a lack of bonding due to surface contamination.

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Pipe Pressure Testing Submittals

#90 R2 FNF

FERMCO SUBMITTAL DISTRIBUTION

ORIG QTY.	COPY QTY.	DISTRIBUTION TO:	MS	Please sign & date ORIGINAL FILE COPY Return to CDC ms/44	REMARKS
1	1	Jim Jenkins	64		REVIEW COORDINATOR
	1	DYAN RHEA	44	CONSTRUCTION DOCUMENT CONTROL	FILE COPY
	1	Geosyntec	64		
	1	Parsons	Bin		
	1	Rick McGuire	64		
	1	Mike Godber	64		
	1	Tracy Russell	64		

RECEIVED BY: James C. Jenkins DATE: 6/5/97

(SIGN/DATE AND RETURN A COPY TO CDC, MS44)

RECEIVED JUN 10 1997 OGB

FORWARD COMMENTS TO REVIEW COORDINATOR

☒ NO COMMENTS ☐ COMMENTS RECEIVED J. C. Jenkins DATE: 6/5/97

REVIEW COORDINATOR

2195

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FILE COPY

[redacted]

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

HYDROSTATIC TESTING FOR PROJECT PIPING

INFORMATION ONLY

Procedure to perform hydrostatic testing necessary to meet pressure leak testing of the LCS and utility HDPE,carbon steel and ductile iron piping and fittings. Section 02605; Part 3.07, Section 02667; Part 3.4, and DCN No.1700-033.

1.0 Hydrostatic Testing

1.1 Identify and provide all required testing equipment apparatus and materials including pumps, hoses, calibrated gauges, taps, plugs, drains, temporary connections, fittings, applicable PPE & test logs necessary to complete specified test(s) prior to placing backfill.

Pipe may be tested outside of trench.

HYDROSTATIC TESTING CAN BE DANGEROUS, USE CAUTION WHILE PRESSURIZING, INSPECTING AND DEPRESSURIZING. DO NOT FUSE, WELD, HEAT, OR CUT ANY SYSTEM OR COMPONENT WHILE UNDER PRESSURE.

1.2 Notify all pertinent parties a minimum of 24 hours prior to the start of test.

1.3 Prior to testing, an inspection shall be performed to ensure all fusing and/or welding has been completed, all bolted connections have been properly blanked-off and all equipment which could be damaged by the hydro test have been removed or isolated.

1.4 Vents and drains of proper size and rating shall be installed to ensure proper venting and to allow complete drainage after testing.

1.5 A calibrated pressure gauge shall be installed where it can be seen by the hydro pump operator. If this is not possible, two gauges may be used, one of which is calibrated and installed on the system. (A reference gauge may be installed during preliminary tests as to prevent damage to the calibrated gauge prior to final testing).

1.6 The system must be filled with water. Water can be obtained from a hydrant at the N. Acccess Rd. The air must be expelled from the system and the pressure safely raised to the specified hydrostatic test pressure.

1.7 When the specified hydrostatic pressure has been reached, the hydrostatic pump must be disconnected and the system allowed to stand for the specified duration. Pressure may not drop except for pressure expansion and temperature fluctuation allowance, nor may it be raised with the hydrostatic pump during this time. The system will be inspected for leakage, deformation, and/or distortion.

1.8 If leakage or other defects are found during any part of testing, the test shall be discontinued and the defect repaired. Only after repair is complete may the system by retested.

1.9 Once the complete system has been inspected and accepted, the system must be safely depressurized and will be drained directly onto the ground.

2.0 ACCEPTANCE CRITERIA

2.1 Acceptance criteria for hydrostatic testing is zero leakage for the stabilized pressure for the minimum duration of the test. Reference specifications for expansion leakage allowance.

2.2 Document test results as per the attached test record and retained as a Project Quality Record.

3.0 REFERENCES:

3.1 Project Techical Specification 20110/1700, Section 02605; Part 3.07; Item C and Section 02667; Part 3.4, Items A&B.

3.2 ASME B31.9; Section 937.1 Through 937.3.

3.3 AWWA C600.

3.4 Manufacturers Suggested Testing Documentation.

3.5 Driscopipe Technical Note #35 March 9, 1993. Hydrostatic Testing of HDPE Pressure Pipelines.

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

2195

PRESSURE TEST RECORD

TEST RECORD NO._____ DATE _____

LINE SERVICE/ NO.:	LINE MEDIUM:
MAX. OPERATING PRESSURE:	TEST PRESSURE:
SPEC../CODE:	TEST MEDIUM:

REFERENCE DRAWINGS/TEST BOUNDARIES:

PIPE IN TRENCH ☐ YES ☐ NO

BACKFILL CONDITIONS:

ALL REQUIRED GAUGES/INST. ISOLATED: CONFIRMATION:_____ DATE:_____

CQC NOTIFIED_____ DATE/TIME_____

TEST GAUGE IDENT.	CALIBRATION DUE DATE:
TEST START TIME:	TEST GAUGE READING:
TEST FINISH TIME:	TEST GAUGE READING:

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR:			
CLIENT/QC:			
CODE INSPECTOR:			

REMARKS/COMMENTS:

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TESTED BY:_____ DATE:_____

2195

LTS NCRs

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FIGURE 1

RECEIVED SEP 02 1997

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GeoSyntec Consultants

CONSTRUCTION NONCONFORMANCE REPORT

1 ORIGINATOR:	2 TITLE/ORGANIZATION:	3 NCR NUMBER:	4 DATE DISCOVERED:
Rob Peddicord	Technician / GeoSyntec	1700-002	10 July 1997

5 RESPONSIBLE ORGANIZATION/PROJECT:	6 ASSESSMENT ACTIVITY:	7 HOLD TAG:
VBS & Wise Const. / LCS Construction	Construction Quality Control	( ) YES ( ) NO
		8 REMOVED (Initial/Date): NA

9 REQUIREMENTS (Identify requirement from document [e.g., CQA plan, specification, drawing, etc.]):
DCN-033, - "AT pipe locations documented and approved in writing by the Construction Manager the subcontractor may, at his own risk, pressure test pipe after placing fill over the pipes. Locations of all joints, fittings, etc shall be documented before backfilling. The test procedure shall be as specified, except the test duration shall be minimum. Since the approval of pipe locations to be tested after backfilling should be evaluated on a case by case basis and where a definite need to delay testing has been established. Also: Refer to Section 02665-11 Part 3.07.C.2.a of the LCS Technical Specifications

10 NONCONFORMANCE TYPE: Construction Nonconformance (✓) Material Deviation ( )

11 NONCONFORMANCE (Fully describe as it relates to requirements. Use supplemental sheets as required):
LCS line - from CO#12 to MH#11, and approximately 40' south of MH#11, pipe embedment fill (PEF) as well as soil backfill was placed and compacted over the dual containment pipe system.

12 ORIGINATOR'S SIGNATURE:	13 DATE PROVIDED TO RESPONSIBLE MANAGER:
Rob Peddicord	14 July 1997

14 RESPONSIBLE MANAGER'S PROPOSED CORRECTIVE ACTION: Use As-Is ( ) Reject ( ) Other (X) See below Repair ( ) Rework ( )

Obtain written authorization from Construction Manager listing area or area(s) that are approved for pressure testing per DCN 1700-033. Refer to DCN.

15 RESPONSIBLE MANAGER (NAME, TITLE, ORGANIZATION):
Daniel Boline, Resident Engineer, GeoSyntec

16 RESPONSIBLE MANAGER'S SIGNATURE:	17 PROPOSED COMPLETION DATE:	18 DATE FORWARDED TO APPROVAL AUTHORITY:
Daniel Boline	Open	24 July 1997

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FIGURE 2

2195

GeoSyntec Consultants

CONSTRUCTION NONCONFORMANCE REPORT

19 EVALUATION OF PROPOSED CORRECTIVE ACTION: Accept (X) Reject ( )
Comments ( ) See attached memo giving authorization to hydro-test.

20 APPROVAL AUTHORITY SIGNATURE: James C Jackson

21 DATE: 9/02/97

22 VERIFICATION OF CORRECTIVE ACTION (Describe who, what, when, where):
REFER ATTACHMENT

23 VERIFIER'S SIGNATURE: Michael W Moller J Fmsh

24 DATE: 9/2/97 9/2/97

25 APPROVAL AUTHORITY SIGNATURE: James C. Jackson

26 DATE CLOSED: 9/02/97

27 CONTINUATION FROM BLOCK ___:

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G. Install flanged connections of HDPE pipe and fittings as shown on the Construction Drawings and as follows:
   1. Thermal butt-fuse HDPE flange connection (flange adapter) to HDPE pipe.
   2. Use Type 316 stainless steel lap joint flange. Outside diameter and drillings shall comply with American National Standards Institute (ANSI) B16.1.
   3. Use Type 316 stainless steel flange bolts, nuts and washers that meets the requirements of ANSI B16.1. Lubricate bolt threads prior to attaching nuts. Tighten bolts to a torque of 100 ±5 foot-pounds.

Hydro s
Te

H. Bolt HDPE flange adapter and stainless steel lap joint flanges at the ambient temperature of the surrounding soil to prevent relaxation of the flange bolts and loosening of the joint due to thermal contraction of the polyethylene. Draw bolts up evenly and in line. Retighten bolts 1 and 4 hours after initial tightening.

3.07 FIELD TESTING AND INSPECTION

A. Notify the CQC Consultant a minimum of 24 hours in advance of any manhole or pipe testing or pipe inspection.

B. HDPE Manhole Hydrostatic Testing:
   1. Provide testing apparatus, including pumps, hoses, gauges, taps, plugs, drains, temporary connections, and fittings to perform testing in accordance with this Section.
   2. Hydrostatically test each HDPE manhole and primary containment after final pipe connections have been completed and after backfilling. Hydrostatically test each HDPE manhole, each primary containment vessel of each LDS manhole, and the primary containment of the permanent lift station using the following method.
      a. Perform each test in the presence of the CQC Consultant and in accordance with the detailed procedure approved under this Section.
      b. Temporarily seal any holes or gaps.
      c. Fill the HDPE manhole to 6 inches below its top with clean water.
      d. Monitor the level of water for a 4-hour period.
      e. Identify any leaks, remove the water, and make repairs to the HDPE manhole or primary containment. A leak is defined as any water level drop over the test period except for an anticipated drop due to material relaxation and expansion. The anticipated drop must be demonstrated in the approved test procedure submitted by the Subcontractor in accordance with this Section.
      f. Retest the HDPE manhole or primary containment until a passing test is achieved.

1 hr test out of ground
3 hr test buried

Refer to DCN 1700-033

g. After completion of the test, remove temporary seals, pump the HDPE manhole or primary containment dry, and dispose of test water.

C. HDPE Pipe and Fittings Hydrostatic Testing:

Testing

1. Provide testing apparatus, including pumps, hoses, gauges, taps, plugs, drains, temporary connections, and fittings to perform testing in accordance with this Section.
2. HDPE pipe hydrostatic testing:
   a. Pressure test all installed HDPE solid wall, carrier, and containment pipe prior to placing fill over the pipes.
   b. Perform tests in the presence of the CQC Consultant and in accordance with the detailed test procedure submitted by the Subcontractor in accordance with this Section.
   c. Test HDPE solid wall and carrier pipe at ~~120~~ 50 psi internal pressure for gravity pipe systems and at ~~150~~ 95 psi internal pressure for force main system. Test pipes in accordance with ASME B31.9 §937.1 through §937.3.
   d. Test HDPE containment pipe at 15 psi internal pressure. Test containment pipe in accordance with ASME B31.9 §937.1 through §937.3.
   e. Test pipes at the required internal pressure for a minimum of one hour after the pressure in the pipe has stabilized. The test duration does not include the initial expansion phase after the pipe is first pressurized. The duration of the expansion phase shall be as recommended by the Manufacturer.
   f. Identify any leaks, remove the water, and make repairs to the pipe.
   g. Retest the pipe until acceptance criteria are achieved in accordance with the approved procedures for testing prior to placing backfill over the pipe.
   h. Test gauges shall be calibrated within one year of date of test. Calibration shall be traceable to national or industry standards where possible.
   i. Acceptance criteria for hydrostatic testing is zero leakage for the stabilized pressure for the minimum duration of the test.

3 hrs

~~150~~ 50 - 8"
95 - 4"

D. Subcontractor may substitute air testing in lieu of hydrostatic testing if authorized in writing by the Construction Manager. Submit detailed work plan for review and approval by the Construction Manager.

E. HDPE Pipe Inspection
1. Inspect fusion joints for evidence of excess or insufficient bead size, contamination, offset, or any other evidence of inadequate joining. The surface of the HDPE pipe shall be clean at the time of inspection. Wipe or wash the HDPE pipe surface if surface contamination inhibits inspection.
2. Repair any pipe sections where greater than 4 percent pipe diameter deflection from vertical is observed.

REQUEST FOR CLARIFICATIONOF INFORMATION/ DESIGN CHANGE NOTICE-

RGB

(1)WP / WO NO.: 1700	(2)S/C NO.: FSC-589	(3)Pg 1 OF 12	(5)DATE 5/28/97

(3)S/C TITLE: LEACHATE CONVEYANCE SYSTEM	(11)RCI NO.:
(4) RESPONSIBLE DISCIPLINE: E☐ M☐ C☒ OTHER☐ / (4A)RCI/DCN TITLE: PIPE HYDROSTATIC TESTING	(11)DCN NO.: 1700-033

(7)DOCUMENTS AFFECTED	(7)DOCUMENT NOS.	(7)REV.	(8)OTHER
SPECIFICATIONS	SEC. 02605	0	
20110-TS-0001.			

(9)☐ RCI - INQUIRY ☐ USOD SCREENING BY PROJECT ENGINEER (9)☒DCN-JUSTIFICATION,EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

- SEC. 02605, 3.07, ~~B~~C.2 REQUIRES TESTING BEFORE BACKFILLING PIPE TRENCH.
- REQUEST LATITUDE TO PERFORM TESTING AFTER BACKFILLING IN AREAS DEEMED NECESSARY TO MEET SCHEDULED INSTALLATION DATES AND COORDINATION WITH OTHER PROJECTS IN COMMON CONSTRUCTION AREAS.
- ~~ALL OTHER ARTICLES OF 02605, 3.07 REMAIN UNCHANGED~~ RGB 30 May 97

(10)REQUESTOR: J.C. Jenkins	COMPANY:	DATE: 5/28/97	(12)FCE / PE J.C. Jenkins	DATE: 5/28/97

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐ NO ☐ YES (14)FOR DCN: ☐ APPROVED ☐ APPROVED AS NOTED ☐ DISAPPROVED

See Page 2 of 2 for Response

2195

(GEOSYNTEC) RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL: Daniel Bodine 30 May 97	DATE:	(20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: N.A.

(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE:

PERFORMANCE GRADE: (17)___

(18)CONSTRUCTION CONCURRENCE:	DATE:	(21)WORK COMPLETED: (SIGNOFF BY FCE OR PE)	DATE:
PURCHASE REQUISITION REQUIRED: ☐ YES ☐ NO (19)		-	

F-4259 (10/01/96)

ORIGINAL 159

LEACHATE CONVEYANCE SYSTEM
Pipe Hydrostatic Testing

(13) RESPONSE

Technical Specification Section 2605 Part 3.07 shall be changed as follows:

Article C.2.a. Add sentences "At pipe locations documented and approved in writing by the Construction Manager the Subcontractor may, at his own risk, pressure test pipe after placing fill over the pipes. Locations of all joints, fittings, etc., shall be documented before backfilling. The test procedure shall be as specified, except the test duration shall be minimum 3 hours. "

Article C.2.c. Replace "120 psi " with " 50 psi " and " 130 psi internal pressure for " with " 95 psi internal pressure for the LCS ".
Add sentence " Test pressures for other pipe systems shall be in accordance with ASME B31.9 937.3.4 and as otherwise specified. "

All other Articles of Section 02605 Part 3.07 remain unchanged.

The approval of pipe locations to be tested after backfilling should be evaluated on a case by case basis and where a definite need to delay testing has been established. When properly prepared, the subcontractor can complete testing rather quickly and efficiently and even during weather conditions when backfilling may not be suitable.

Daniel Bittner
30 May 97

FIGURE 1

2195

GeoSyntec Consultants

CONSTRUCTION NONCONFORMANCE REPORT

1 ORIGINATOR	2 TITLE/ORGANIZATION:	3 NCR NUMBER:	4 DATE DISCOVERED:
Rob Peddicord	Technician / GeoSyntec	1700-003	07 Sept 1997

5 RESPONSIBLE ORGANIZATION/PROJECT:	6 ASSESSMENT ACTIVITY:	7 HOLD TAG:
FDF LCS Construction	Construction Q.C.	( ) YES (X) NO 8 REMOVED (Initial/Date):

9 REQUIREMENTS (Identify requirement from document [e.g., CQA plan, specification, drawing, etc.]):

LCS Technical Specifications
Section 02215-3.03.C

10 NONCONFORMANCE TYPE: Construction Nonconformance (✓) Material Deviation ( )

11 NONCONFORMANCE (Fully describe as it relates to requirements. Use supplemental sheets as required):

In the LCS trench, approximately from station 25+55 to station 24+75 of drawing 6-00058, the pipe embedment fill was placed in approximate 7" lifts under the pipe, around the pipe, and over the pipe. Each lift (3 total) was sprayed with water from a Dodge truck with attached water tank and water pump. Each lift was sprayed to fair saturation, but no standing water puddles were created at any point, which meant, obviously, that no lift was ever flooded and flushed. Nor was any other means of mechanical or manual form of compaction used on any of the lifts placed under, around, & over the 10" pipe.

12 ORIGINATOR'S SIGNATURE:	13 DATE PROVIDED TO RESPONSIBLE MANAGER:
Rob Peddicord	09 Sept 1997

14 RESPONSIBLE MANAGER'S PROPOSED CORRECTIVE ACTION: Use As-Is ( ) Reject ( ) Other (✓) Repair ( ) Rework ( )

THE ABOVE NOTED AREA DOES NOT COMPLY WITH SPECIFICATION 02215 SECTION 3.03 C 2. 3. 4. . IT IS UNDERSTOOD THAT SAFETY CONCERNS WERE (ARE) EXPRESSED DUE TO THE PROXIMITY AND DEPTH OF THE TRENCH IN RELATIONSHIP TO AN EXISTING SOILS STOCKPILE WEST OF AND ADJACENT TO THE SECTION OF TRENCH AS NOTED ABOVE, THEREFORE, IT IS REQUESTED THAT ENGINEERING ~~EVALUATE~~ 09/09/97 CONDUCT AN EVALUATION WITH RECOMMENDATIONS AS TO THE ACCEPTABILITY AND OR CORRECTIVE ACTION(S) REQUIRED.

15 RESPONSIBLE MANAGER (NAME, TITLE, ORGANIZATION):

J.F. McMICHEN, QUALITY CONTROL SITE MANAGER, GEOSYNTEC CONSULTANTS

RESPONSIBLE MANAGER'S SIGNATURE:	17 PROPOSED COMPLETION DATE:	18 DATE FORWARDED TO APPROVAL AUTHORITY:
J.F. McMichen	10 SEPTEMBER 1997	07 SEPTEMBER 1997

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GeoSyntec Consultants

CONSTRUCTION NONCONFORMANCE REPORT

19 EVALUATION OF PROPOSED CORRECTIVE ACTION: Accept (X) Reject ( )
Comments ( )

- ASSUME THE LCS LINE MEETS GRADE AS DESIGNED.
- SINCE EACH LIFT WAS "FAIRLY" SATURATED AND FLOODING IS AN APPROVED ODOT METHOD FOR CONDUIT BACKFILLING, THE INTEGRITY OF THE BEDDING IS HIGHLY FAVORABLE. IN ADDITION THIS PART OF THE TEMPORARY LINE WHICH HAS A RELATIVELY SHORT LIFE.
- THE REMAINING TRENCH BACKFILL SHALL BE PLACED AS SPECIFIED.
- SAFETY OF PERSONNEL TAKES PRESIDENCE.

20 APPROVAL AUTHORITY SIGNATURE: James C. Jenkins

21 DATE: 9/10/97

22 VERIFICATION OF CORRECTIVE ACTION (Describe who, what, when, where):

23 VERIFIER'S SIGNATURE: N/A

24 DATE: NA

25 APPROVAL AUTHORITY SIGNATURE: James C. Jenkins

26 DATE CLOSED: 9/10/97

27 CONTINUATION FROM BLOCK ____:

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FIGURE 1

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GeoSyntec Consultants

CONSTRUCTION NONCONFORMANCE REPORT

1 ORIGINATOR:	2 TITLE/ORGANIZATION:	3 NCR NUMBER:	4 DATE DISCOVERED:
Rob Reddicord	Technician / GeoSyntec	1200-004	07 Sept 1997

5 RESPONSIBLE ORGANIZATION/PROJECT:	6 ASSESSMENT ACTIVITY:	7 HOLD TAG: ( ) YES ( ) NO
VBS LCS Construction	Construction Q.C.	8 REMOVED (Initial/Date):

9 REQUIREMENTS (Identify requirement from document [e.g., CQA plan, specification, drawing, etc.]):

LCS Transmission System Gravity Line and Manhole Details IV
DWG # 90X-6000-M-00066
Sheet # M-6B
- the cleanout lateral is to be facing upstream, in the opposite direction of the designed flow

10 NONCONFORMANCE TYPE: Construction Nonconformance (✓) Material Deviation ( )

11 NONCONFORMANCE (Fully describe as it relates to requirements. Use supplemental sheets as required):

TEMPORARY CO# NA at approximate station 28+00 was placed with the cleanout lateral facing downstream, in the same direction as the designed flow.

12 ORIGINATOR'S SIGNATURE:	13 DATE PROVIDED TO RESPONSIBLE MANAGER:
Rob Reddicord	10 Sept 1997

14 RESPONSIBLE MANAGER'S PROPOSED CORRECTIVE ACTION — Use As-Is (X) Reject ( ) Other ( ) Repair ( ) Rework ( )

IF THE SECTION OF 6" (INCH) DIAMETER PIPE UPGRADIENT OF THIS CLEANOUT BECOMES CLOGGED IT CAN BE CLEANED (DISLODGED) FROM THE CLEANOUT LOCATED AT STATION 32+00. THE PIPE IN THIS AREA IS TEMPORARY AND IS NOT LIKELY TO BECOME CLOGGED DURING ITS SHORT PERIOD OF USE.

15 RESPONSIBLE MANAGER (NAME, TITLE, ORGANIZATION):

J.F. McMICHEN, QUALITY CONTROL SITE MANAGER, GEOSYNTEC CONSULTANTS

16 RESPONSIBLE MANAGER'S SIGNATURE:	17 PROPOSED COMPLETION DATE:	18 DATE FORWARDED TO APPROVAL AUTHORITY:
J.F. McMichen	18 SEPTEMBER 1997	17 SEPTEMBER 1997

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FIGURE 2

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GeoSyntec Consultants

CONSTRUCTION NONCONFORMANCE REPORT

EVALUATION OF PROPOSED CORRECTIVE ACTION: Accept (✓) Reject ( )
Comments ( )

APPROVAL AUTHORITY SIGNATURE: Richard L. McPhee / J. C. Jenkins 9/29/97

DATE: 9-27-97

VERIFICATION OF CORRECTIVE ACTION (Describe who, what, when, where):
NA

VERIFIER'S SIGNATURE: ~~NA~~ J. Fmnl

DATE: ~~NA~~ 29 Sept. 1997

APPROVAL AUTHORITY SIGNATURE: Richard L. McPhee ~~NA~~

DATE CLOSED: ~~NA~~ 30 Sept. 1997

CONTINUATION FROM BLOCK ____:

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FIGURE 1

RECEIVED OCT 09 1997 2195

GeoSyntec Consultants

CONSTRUCTION NONCONFORMANCE REPORT

1 ORIGINATOR:	2 TITLE/ORGANIZATION:	3 NCR NUMBER:	4 DATE DISCOVERED:
Rob Pedlicord	Technician / GeoSyntec	1700-005	16 Sept 1997

5 RESPONSIBLE ORGANIZATION/PROJECT:	6 ASSESSMENT ACTIVITY:	7 HOLD TAG: ( ) YES ( ) NO
Fluor Daniel Fernald specifically Rick McGuire	Construction Q.C.	8 REMOVED (Initial/Date):

9 REQUIREMENTS (Identify requirement from document [e.g., CQA plan, specification, drawing, etc.]):

LCS Technical Specifications
Section 02215-3.03.C

10 NONCONFORMANCE TYPE: Construction Nonconformance (✓) Material Deviation ( )

11 NONCONFORMANCE (Fully describe as it relates to requirements. Use supplemental sheets as required):

In the LCS trench, approximately between stations 31+00 to station 32+50 of drawing G-00059, the pipe embedment fill was placed over the LCS pipe in a lift approximately 8"-12" thick. This top lift was then sprayed to dampness, not saturated or flooded, with water from a water tank on the back of a flat bed truck. After this lift was sprayed, it was compacted with a hand tamp around the cleanout at station 32+00, but nowhere else. No other form of compaction was used on the material before it was backfilled over.

Further investigation into the matter revealed that Rick McGuire (FDF) authorized & initiated the action. Mr McGuire stated that he wanted to speed up the process before it rained. At the time of his comment, it was approximately 75°, the sun was shining, & no clouds were visible.

12 ORIGINATOR'S SIGNATURE:	13 DATE PROVIDED TO RESPONSIBLE MANAGER:
Rob Pedlicord	17 Sept 1997

14 RESPONSIBLE MANAGER'S PROPOSED CORRECTIVE ACTION: Use As-Is ( ) Repair ( ) Reject (X) AND Rework (X) Other ( )

ABOVE NOTED DOES NOT COMPLY WITH APPLICABLE PORTIONS OF THE SPECIFICATION AS DEFINED IN ITEM NING AND OR DCN 1700-058. THEREFORE THE AREA REQUIRES REWORK TO COMPLY WITH THE APPLICABLE DOCUMENTS.

15 RESPONSIBLE MANAGER (NAME, TITLE, ORGANIZATION):

J.F. McMICHEN, QUALITY CONTROL SITE MANAGER, GEOSYNTEC CONSULTANTS

16 RESPONSIBLE MANAGER'S SIGNATURE:	17 PROPOSED COMPLETION DATE:	18 DATE FORWARDED TO APPROVAL AUTHORITY:
J.F. McMichen	18/19 SEPTEMBER 1997	17 SEPTEMBER 1997

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FIGURE 2

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GeoSyntec Consultants

CONSTRUCTION NONCONFORMANCE REPORT

17 EVALUATION OF PROPOSED CORRECTIVE ACTION: Accept ( ) Reject (X)
Comments (X)

See attached Continuation Sheet (1 Page)

18 APPROVAL AUTHORITY SIGNATURE: Richard L. McGuire, J. C. Jackson 10/7/97

19 DATE: 10/6/97

20 VERIFICATION OF CORRECTIVE ACTION (Describe who, what, when, where):

21 VERIFIER'S SIGNATURE: J. Smith

22 DATE: 17 DECEMBER 1997

23 APPROVAL AUTHORITY SIGNATURE: Richard L. McGuire, James C. Jackson

24 DATE CLOSED: 12/17/97

25 CONTINUATION FROM BLOCK 19:

SEE ATTACHED CONTINUATION SHEET.

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Apparently, the subcontractor's field personnel were unaware of FDF's instruction to follow DCN 1700-058, as verified by VBS's statements and the actions by VBS in the field. DCN 1700-058 requires a specific procedure for compacting by flooding and that procedure was not initiated by VBS or FDF at this location. The GeoSyntec Site Manager and Resident Engineer were notified of the field actions on the date of the occurrence and did not note any attempt to initiate a flooding procedure per the DCN. Density measurements were not performed, because the flooding procedure was not initiated and the pipe embedment fill was immediately covered with clay. VBS field supervisor stated that they were directed to do so by FDF and Rick McGuire confirmed the action when contacted from the field. The non-conformance was warranted.

Since FDF construction approved the construction area under question, FDF (Engineering, Management, QA etc.) should decide if they want to investigate the pipe embedment fill in-place density to determine, if, after confinement and placement and compaction of clay cover fill, the in-place density meets the requirements of the DCN. The minimum density requirement, determined per DCN 1700-058, is 108.1 lbs/ft3. If test pits are used a minimum of 3 test pits are recommended.

Jeph McMichen
Site QC Manager

Daniel Bodine
Resident Engineer

RESPONSE TO CONSTRUCTION NONCONFORMANCE REPORT NO. 1700-005

19. EVALUATION OF PROPOSED CORRECTIVE ACTION (CONTINUATION SHEET)

FDF disputes several of the items described in Section 11 (*Nonconformance*) of this Construction Nonconformance Report (1700-005). The subcontractor was instructed that he could follow the requirements of DCN No. 1700-058 and flood the pipe bedding material as called for on the DCN. This decision was not made to "speed up the process, before it rained" as stated in the nonconformance report, but was made because FDF Industrial Hygiene did not have enough working carbon monoxide (CO) monitors to support the use of a vibratory plate compactor in all the areas that the Subcontractor was working at the time.

DCN 1700-058 calls for the water levels in the trench to be visually verified by CQC personnel (GeoSyntec) and for the fill to be inspected and the dry density measured by the CQC personnel. The nonconformance report does state why this was not done, prior to placement of clay. The Subcontractor was not instructed by Construction Management to place clay material prior to inspection and testing as implied in the nonconformance report. The nonconformance report does not state whether any density measurements were performed to determine if the density requirements defined in Paragraph 8.h of the attachment to DCN No. 1700-058 were met. In the absence of such a test, Construction does not believe that a nonconformance is warranted.

Construction believes that the density of the bedding is at least as good as that required by DCN No. 1700-058. If the CQC Engineer must validate the density, it is recommended that test pits be excavated at random locations in the affected area.

27. **Continuation from Block 19:**

12/17/97

Subsequent to this NCR and initial responses by FDF and the CQC Consultant, GeoSyntec, pressure testing of the 6-inch gravity line near Sta. 31 + 55 was performed. A test plug became lodged in the pipe and required excavation for removal.

At the time of excavation, FDF Engineering and Construction personnel (J. Jenkins and R. McGuire) viewed the excavation and backfill and have concluded that it meets the intent of the specification and is satisfactory. The temporary gravity line in this area has been backfilled for approximately three months and there appears to be no evidence of ground subsidence or settlement. The 10-inch containment pipe and 6-inch carrier pipe have also passed pressure testing. The carrier pipe has been photographed and, again, there appears to be no evidence of settlement (see attached photographs). FDF therefore believes the pipe embedment is satisfactory, no additional work is necessary, and the temporary gravity line is "acceptable "as-is."

J. C. Jenkins 12/17/97
J. C. Jenkins - FDF Engineering

Richard L. McGuire 12/17/97
R. L. McGuire - FDF Construction

FIGURE 1

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GeoSyntec Consultants

Page 1 of 2/4

CONSTRUCTION NONCONFORMANCE REPORT

1 ORIGINATOR	2 TITLE/ORGANIZATION:	3 NCR NUMBER:	4 DATE DISCOVERED:
Rob Reddicord	Technician / GeoSyntec	1700-006	22-09-97

5 RESPONSIBLE ORGANIZATION/PROJECT:	6 ASSESSMENT ACTIVITY:	7 HOLD TAG:
FDF	Construction Q.C.	( ) YES (x) NO
		8 REMOVED (Initial/Date):

9 REQUIREMENTS (Identify requirement from document [e.g., CQA plan, specification, drawing, etc.]):

LCS Technical Specifications, Section 02605-2.04.E and Section 02605-2.02.B

10 NONCONFORMANCE TYPE: Construction Nonconformance (X) Material Deviation ( )

11 NONCONFORMANCE (Fully describe as it relates to requirements. Use supplemental sheets as required):

On this date, in two locations, PE 2406 Electrofusion couplings were used rather than the specified PE 3408 electrofusion couplings. The first was on the north end of the "elbow" at the north end of the Lift Station, and the second was approximately 6' south of the LCS-01 tank on the 6" carrier line. Both couplings, actually, were on the 6" carrier line of the LCS

12 ORIGINATOR'S SIGNATURE:	13 DATE PROVIDED TO RESPONSIBLE MANAGER:
Rob Reddicord	* 25 SEPTEMBER 1997

14 RESPONSIBLE MANAGER'S PROPOSED CORRECTIVE ACTION: 25/09/97 Use As-Is (✓) Reject ( ) Other ( ) Repair ( ) Rework ( )

* NOTE: MADE AWARE 23 SEPT. 97 ADVISED FDF OF Q.A. DEPARTMENT OF FORTHCOMMING NCR. PROCEEDED TO CONTACT MANUFACTURERS FOR COMMENT.

BASED ON THE DATA AND COMMENTS PROVIDED BY THE COUPLING MANUFACTURER A RECOMMENDATION OF USE-AS-IS HAS BEEN MADE. HOWEVER, FOR ~~THE~~ FUTURE COUPLINGS PE 3408 ARE TO BE USED. 25/01/97

REFER ATTACHMENTS.

15 RESPONSIBLE MANAGER (NAME, TITLE, ORGANIZATION):

J.F. McMICHEN, QUALITY CONTROL SITE MANAGER, GEOSYNTEC CONSULTANTS

16 RESPONSIBLE MANAGER'S SIGNATURE:	17 PROPOSED COMPLETION DATE:	18 DATE FORWARDED TO APPROVAL AUTHORITY:
J.F. McMichen	25 SEPTEMBER 1997	25 SEPTEMBER 1997

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Comments on Non-conformance 1700-006

Use of PE 2406 Electrofusion couplings raises two design questions relative to their acceptable use. One is compatibility with PE 3408 pipe and the second is design properties of the coupling. Coupling manufacturer, Central Plastics, has confirmed that their couplings are compatible with a whole range of polyethylene materials from a low end of the medium density (PE 2406) range to a high end of the high density (PE3408) range. See attached manufacturer literature obtained from their technical department.

The second concern is the hydrostatic design pressure rating. The PE 2406 standard ratings are less than those for PE 3408, the specified grade. However, the couplings are designed to have a safe operating pressure of atleast 125 psi and have been tested without failure at higher pressures and temperatures. The safe operating pressure is approximately twice the operating pressure for the SDR 26 pipe being used (64 psi) and 2 1/2 times the specified test pressure for the gravity pipe systems (DCN No. 1700-033). As always, the pipe and fitting is subject to a hydrostatic pressure test before acceptance. Attached is manufacturers documentation on safe operating pressure obtained from their installation procedures manual.

24 Sept 97

April 15, 1996

Memo To: Sales Department

From: Clay Hamilton
Technical Services Manager

Subject: Electrofusion: Fusing of Dissimilar PE Materials

Central's electrofusion fittings are all tested in accordance with ASTM F1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing. Before any fitting is released for production to be used in the gas industry, it must first meet the minimum requirements of ASTM F1055 as well as our own internal specifications. In addition, all electrofusion fittings must be tested through the application temperature range established by Central Plastics (-10°F to 120°F) and for the whole range of polyethylene (PE) materials that are in use in the gas field. These materials range from Uponor Aldyl-A pipe, on the low end of the medium density (PE 2406) range to Phillips Driscopipe M-8000 pipe on the high end of the high density (PE 3408) range.

One of the strong points of electrofusion is its ability to join between dissimilar PE materials. For example, you can fuse high density pipe on one side of a coupling and medium density on the other side with the same results. This is why many gas utilities use electrofusion if they have several different PE pipe materials in their systems, especially for sidewall fusion applications.

Received by R. Bolin
on 23 Sept 97

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Performance:

Central Electrofusion Fittings typically achieve the following performance test results.

Temperature	Internal Pressure	Hours to Failure
176°F (80°C)	130 PSI	1000+
68°F (20°C)	275 PSI	2500+

Saddle Impact: Falling Weight 10 lb. from 7 ft.

Safe Operating Temperature: −10°F to 120°F (−23°C to 49°C)

Safe Operating Pressure: 125 PSI

Compliance With Standards: Central Electrofusion Fittings meet the requirements of ASTM F1055.

Electrical Requirements and Cooling Times

Fitting	Fusion time in seconds	Clamped time in minutes	Total cooling time	KVA	Generator Breaker minimum	Extension cord size 25 ft.	Extension cord size 50 ft.
COUPLINGS:							
1/2 CTS	20	5	30	1.0	10	#12/3	#10/3
1/2 IPS	20	5	30	1.0	10	#12/3	#10/3
3/4 IPS	25	5	30	1.0	10	#12/3	#10/3
1 CTS	25	5	30	1.0	10	#12/3	10
1 IPS	40	5	30	1.0	10	#12/3	10
1 1/4 IPS	45	10	30	1.5	10	#12/3	#10/3
2 IPS	45	10	30	2.5	20	#10/3	# 8/3
3 IPS	90	10	30	2.5	20	#10/3	# 8/3
4 IPS	120	10	45	2.5	20	#10/3	# 8/3
6 IPS	500	15	1 hour	2.5	20	#10/3	# 8/3
REDUCERS:							
3/4 x 1/2 CTS	20	5	30	1.0	10	#12/3	#10/3
1 IPS x 1/2 CTS	25	5	30	1.0	10	#12/3	10
1 IPS x 1/2 IPS	30	5	30	1.0	10	#12/3	#10/3
1 IPS x 3/4 IPS	30	5	30	1.0	10	#12/3	#10/3
1 IPS x 1 CTS	30	5	30	1.0	10	#12/3	#10/3
TAPPING TEES:							
1 1/4 x 1	45	10	30	1.0	10	#12/3	#10/3
2 x 1	90	10	30	1.0	10	#12/3	#10/3
3 x 1	90	10	30	1.0	10	#12/3	#10/3
4 x 1	90	10	30	1.0	10	#12/3	#10/3
6 x 1	90	10	30	1.0	10	#12/3	#10/3
VOLTAGES:	90 Volt Minimum		150 Volt Maximum				
FREQUENCY:	45 to 75 Hertz						
INVERTERS:	Yes.						

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Report by
Central Plastics

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CENTRAL PLASTICS COMPANY
1901 West Independence
P.O. Box 3129
Shawnee, Oklahoma 74801
Phone: (405) 273-6302
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Rick E. Springer, P.E.
Product Engineering Manager
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Email: rspringer@centralplastics.com

SEP 01 1998
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Recieved by R. Bonaparte (GeoSynTec)
19 March 1999

August 25, 1998

Mr. Rick McGuire
Fluor Daniel Fernald
P.O. Box 538704
Cincinnati, OH 45253-8704

Reference: Village Building Services
Leachate Conveyance System
Fernald, OH
Subcontract No.: FSC 589
VBS Job No.: 0197

Dear Mr. McGuire:

Attached please find a copy of our failure analysis report concerning the failures experienced by Village Building Services on a dual containment system at the above referenced job site.

Two sets of failed joints (a set consisting of one 6" coupler on the carrier pipe and one 10" coupler on the containment pipe) were subjected to numerous tests in our Engineering Lab. Our resulting conclusion is that the joints failed due to improper installation techniques, consisting of insufficient pipe preparation and the introduction of holes in the 10" pipe located directly under the fusion zone resulting in insufficient interfacial pressure.

It is our understanding that Village Building Services experienced only 12 failures of the 10" couplers during their installation, and subsequently repaired those by extrusion welding the couplers to the pipe. Apparently, there were no failures of the 6" couplers. Based on the results of our analysis, we believe that <u>all</u> joints created using these installation techniques are suspect and could potentially fail due to any number of factors including (but not limited to) pipe expansion/contraction and ground movement.

Both the contractor Village Building Services and our distributor ISCO Industries have been notified of these findings.

If you have any questions or comments concerning this report or it's content please let me know.

Sincerely,

Rick E. Springer, P.E.
Product Engineering Manager

Copy: Phill Pourchot
Bob Sehorn
Rocky Wade
Dane Johnson
Terry Stiles
Terry Stiles
Rick Hart
Clay Hamilton
Jimmy Kirchdorfer, Jr. - ISCO

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CENTRAL PLASTICS COMPANY
ENGINEERING TEST REPORT

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Subject:	Evaluation of 10"IPS and 6"IPS Electrofusion Couplings Returned By Village Building Services, Inc. Due to Leaks Pipe SDR =
Prepared By:	Clay Hamilton - Technical Services Manager
Date:	June 10, 1998
File Number:	FA-98-010

I. Introduction

The scope of this project was to evaluate two 10"IPS electrofusion couplings used on a dual containment line that were leaking and determine the cause of the leaks. Also included in this study were two 6"IPS electrofusion couplings that were joining the carrier pipe situated inside the 10" containment pipe. The fittings were installed on a leachate conveyance system at the US Department of Energy Fernald Environmental Management Project at Fernald, Ohio.

II. Background

The 10"IPS containment pipe for the leachate conveyance system was pressurized to 15 psig. During this pressure test, leaks were detected in the 10" electrofusion coupling joints. Repairs were made to some of the 10" couplings via extrusion welding around the ends of the couplings. Two samples were returned to Central Plastics for evaluation as to the cause of the leaks.

III. Procedure

The couplings were labeled in two sets: Set A consisted of 1-10"IPS electrofusion coupling (A-10) and 1-6"IPS electrofusion coupling (A-6). Set B consisted of 1-10"IPS electrofusion coupling (B-10) and 1-6"IPS electrofusion coupling (B-6). The part numbers and lot numbers of each fitting were recorded as well as the coil resistance and identification resistance of each coupling (if able to measure) were also recorded.

Pressure Testing:

A pressure test was conducted on one of the 10" couplings (A-10). The other couplings did not have enough exposed pipe to butt fuse end caps onto for the pressure test. Caps were fused to the exposed sections of 10" pipe. The assembly was pressurized to 30 psig and leak detection fluid was used to isolate any leaks. At 30 psig, a sectional area of the coupling was leaking. The leaking area was marked and photographs were taken of the leaking coupling.

Destructive Testing:

The destructive testing that was performed on couplings consisted of both bend/strip testing and joint crush testing.

* For a bend/strip test, thin sections are cut from the dissected coupling/pipe joint. One half of the thin section is secured and the other is bent from 90° to 180° around. This allows a good visual view of the overall joint area. It also shows how well the fitting is bonded to the pipe and the strength of the joint itself.
* The crush test (see Appendix 2) was performed according to ASTM F1055 Sec. 9.4.1 *Joint Crush Test*. The pipe sections were situated in the jaws of a hydraulic press and crushed to reveal the strength of the electrofusion joint.

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IV. Results / Discussion

Coupling A-10

Pressure Test: The A-10 coupling joint was visually inspected and found to have holes drilled in through the 10"IPS polyethylene pipe (see Appendix A-3a). The holes in the pipe were approximately 1.08" in diameter and located directly under the fusion zones of the 10"IPS electrofusion coupling. The ends of the pipe were capped off and air pressure was applied through a transition fitting that was inserted into one of the 10"IPS butt fusion caps (see Appendix A-3b). Leak detection fluid was applied to the areas around the coupling. Air pressure was increased and a leak was detected.

Destructive Tests: The coupling was cut in half along the area where the holes were cut into the 10"IPS polyethylene pipe (see Appendix A-3c and A-3d). As a result of the holes being drilled in the 10"IPS pipe, molten polyethylene material from the coupling was able to flow into the openings resulting in an overall decrease of interfacial joining pressure. Portions of the dissected coupling were subjected to a joint crush test and failed the test when the coupling totally disengaged from the pipe. Additional sections were cut from the joint area and subjected to broad width and thin width bend tests. In all bend tests the coupling separated from the pipe with no bonded areas detected. This was due to no scraping of the pipe surface (see Appendix A-3e).

Coupling A-6:

Pressure Test: No pressure test was performed on coupling A-6 as the pipe length on one side of the coupling was not long enough to fuse another section of pipe or a butt fusion cap.

Destructive Tests: The coupling was cut in half. One half of the joint was subjected to a crush test. The fitting failed the joint crush test with the fitting totally separating from the pipe with no bonded areas detected. The other half of the coupling joint was subjected to a broad width and a thin width bend test. In all bend tests the coupling separated from the pipe with no bonded areas detected. The fitting failed the bend test.

Coupling B-10:

Pressure Test: No pressure test was performed on coupling B-10 as the pipe length on one side of the coupling was not long enough to fuse another section of pipe or a butt fusion cap.

Destructive Tests: Coupling B-10 also had holes drilled into the 10"IPS pipe directly under the fusion areas of the coupling (see Appendix A-3f). The coupling was cut in half and subjected to both joint crush and bend tests. Portions of the dissected coupling were subjected to a joint crush test and failed the test when the coupling totally disengaged from the pipe. Additional sections were cut from the joint area and subjected to broad width and thin width bend tests. In all bend tests the coupling separated from the pipe with no bonded areas detected. This was due to no scraping of the pipe surface.

Coupling B-6:

Pressure Test: No pressure test was performed on coupling B-6 as the pipe length on one side of the coupling was not long enough to fuse another section of pipe or a butt fusion cap.

Destructive Tests: The coupling was cut in half. One half of the joint was subjected to a crush test. The fitting failed the joint crush test with the fitting totally separating from the pipe with no bonded areas detected. The other half of the coupling joint was subjected to a broad width and a thin width bend test. In all bend tests the coupling separated from the pipe with no bonded areas detected. The fitting failed the bend test.

V. Conclusion

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10"IPS Electrofusion Couplings:

On the basis of our findings, the cause for the leaking 10"IPS electrofusion couplings was due to two factors. One factor was that holes were drilled in the 10"IPS PE pipe directly under the fusion zones on the 10" couplings resulting in a drastic loss of interfacial fusion pressure. This fusion pressure is critical in order to form a good, sound electrofusion joint. There are three elements in making a polyethylene joint, Heat, Pressure, and Time. From our analysis of the 10" couplings, one of the key elements (pressure) was substantially reduced and in isolated areas was basically eliminated.

The second factor was that there was no preparation of the PE pipe. One of the most important steps in electrofusion joining is to properly prepare the polyethylene pipe by scraping off the outer surface. The outer surface / skin of polyethylene pipe acts like a barrier preventing the materials in the coupling and pipe from fusing properly, thus forming the joint. The outer surface of polyethylene pipe contains oxidation as well as die lubricants which are used in the extrusion process. Any foreign matter on the pipe's surface acts as contaminants preventing the joining of the two polyethylene components (pipe and fitting).

6"IPS Electrofusion Couplings:

The 6" couplings were not originally part of the analysis, however, since they were included in the returned sets of couplings they were evaluated by destructive testing. The 6" couplings (A-6 and B-6) were destructively tested in the same manner as the 10" couplings. The evaluations of the crush and bend/strip tests on the 6" couplings revealed that the 6"IPS polyethylene pipe was not prepared at all. Only minor surface scratches were noticeable, probably due to the pipe being dragged. The outer surface of the 6"IPS pipe had not been scraped. The main concern for these joints is the long term quality of the joints since the pipe was not scraped. Since the pipe was not scraped, there was no joining of polyethylene materials between the couplings and the pipe. Basically only a compression joint, not a fusion joint, exists between the pipe and fittings. Even though the joints passed an initial pressure test, the long term performance of the joints is questionable. Over time, with seasonal changes and changes in the ground temperature, the pipe will expand and contract. This expansion and contraction of the polyethylene pipe will cause the joints to weaken and probably leak.

Overall Conclusion:

The overall conclusion as to why the 10"IPS electrofusion couplings leaked was due to no preparation of the pipe surface and a substantial loss of joining pressure due to the holes being cut into the 10"IPS pipe directly under the fusion zones of the 10"IPS couplings.

Appendices:
- A-1. Coupling Information Chart
- A-2. Referenced standards and procedures.
- A-3. Photographs

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Appendix A-1

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Coupling Information Chart

Fitting Number	Coil Resistance (ohms)	ID Resistance (ohms)	Work Order Number	Run Date
A-10	0.816	118	M047830	9/97
A-6	0.650	454.2	M026280	6/97
B-10	0.820	118	M047830	9/97
B-6	0.652	454.8	M026280	7/97

Appendix A-2

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A-2a-1 to A-2a-2:
ASTM F1055: Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing, Section 9.4.1 *Joint Crush Test*

A-2b-1 to A-2b-3:
ASTM F1290: Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings

A-2c-1 to A-2c-3:
Central Plastics Electrofusion Operation And Training Manual: Standard Joining Procedures.

be made on unpressured pipe

ulic Burst Pressure Test:

ngs at random and prepare specimens ection 8. From the four specimens, ens each in accordance with 8.1.1 and

cimens in accordance with Test Method

the fitting or joint shall constitute spec-

of any one of the four specimens shall of the test. Failure of one of the four d is cause for retest of four additional ed at the failed specimens joining tempera- of any of these four additional specimens ailure of the test.

ed Pressure Test:

t four fittings at random and prepare specimens e with Section 8 of this specification. From the ens, condition two specimens each in accordance and 8.1.2.

st the specimens in accordance with Test Method All tests shall be conducted at 80 ± 2°C. The s are to be subjected to pipe fiber stresses of 580 psi a) for 1000 h or 670 psi (4.6 mPa) for 170 h. Joint ns shall not fail within these time periods. Any within these time periods must be of the pipe, ndent of the fitting or joint and must be of a "brittle" ipe failure, not "ductile." If ductile pipe failures occur, e the pressure of the test and repeat until 170- or -h results or pipe brittle failures are achieved.

.2.3 Failure of the fitting or joint shall constitute spec- en failure.

9.2.4 Failure of any one of the four specimens shall nstitute failure of the test. Failure of one of the four pecimens tested is cause for retest of four additional specimens, joined at the failed-specimens-joining temperature. Failure of any of these four additional specimens constitutes a failure of the test.

9.3 *Tensile Strength Test:*

9.3.1 Select four fittings at random and prepare specimens in accordance with Section 8 with the exception that it is permissible, on pipe sizes above 4 in. (102 mm) IPS, if limits of tensile machine will not allow 25 % elongation with pipe specimens of three-pipe diameters, to test with free pipe lengths of 20 in. (304-mm) minimum. From the four specimens, condition two specimens each in accordance with 8.1.1 and 8.1.2.

9.3.2 Test the specimens using the apparatus of Test Method D 638. Test at a pull rate of 0.20 in. (5.0 mm) per min. ±25 %.

9.3.3 Failure of the fitting or joint as defined in 5.3, shall constitute specimen failure.

9.3.4 Failure of any one of the four specimens shall constitute failure of the test. Failure of one of the four specimens tested is cause for retest of four additional specimens, joined at the failed specimens joining temperature. Failure of any of these four additional specimens

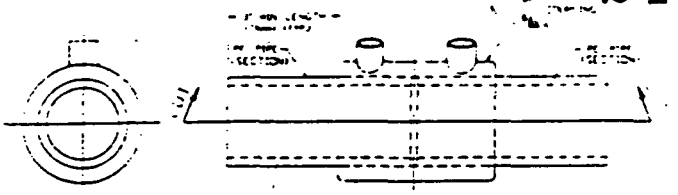

FIG. 1 Preparation of Coupling Specimen for Crush-Test

constitutes a failure of the test.

9.4 *Joint Integrity Tests*—Socket type joints and saddles illustrations of joint crush tests are offered in 9.4.1 and 9.4.2 as test methods which are useful as an evaluation of bonding strength between the pipe and fitting. Similar test evaluations as agreed upon between purchaser and seller are of equal value in performing such evaluations and may be substituted with such agreements.

9.4.1 *Joint Crush Test:*

9.4.1.1 Select four fittings at random and prepare specimens in accordance with Section 8. From the four specimens, condition two specimens each in accordance with 8.1.1 and 8.1.2 (Note 3).

NOTE 3—It is permissible to utilize in joint integrity testing, specimens from the quick-burst tests conducted in 9.1 after visually determining that neither the joint area nor the pipe segment to be crushed was a part of the failure mode in the quick-burst test.

9.4.1.2 Slit socket joints longitudinally as illustrated in

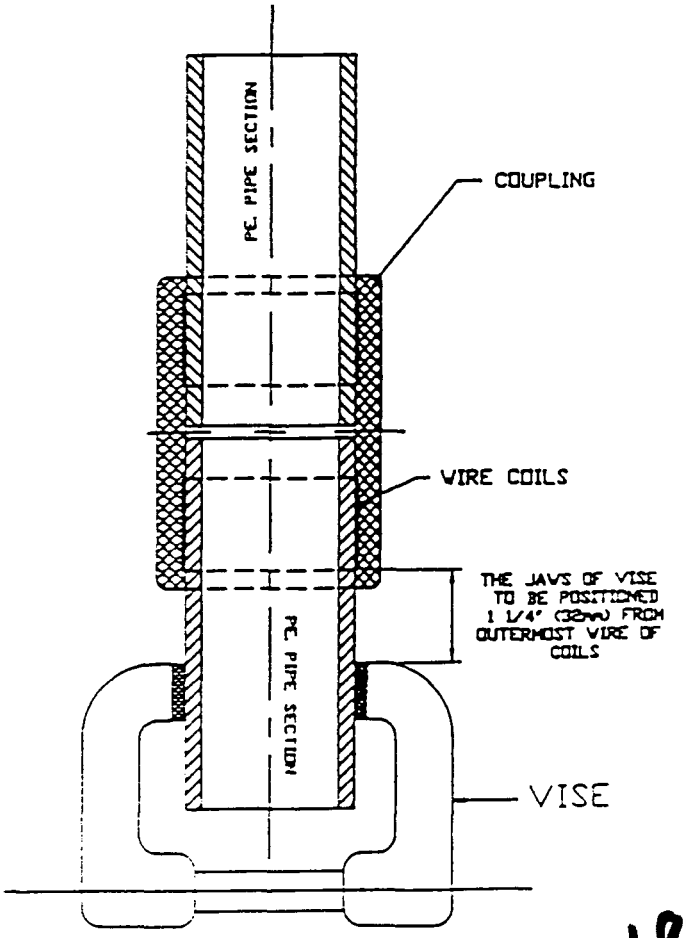

FIG. 2 Coupling Crush Test Arrangement

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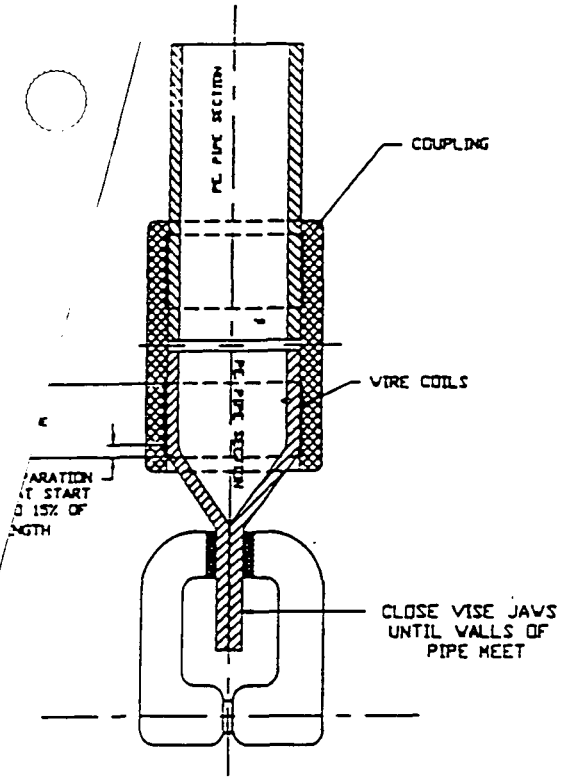

FIG. 3 Coupling Crush Test

g. 1 as near the centerline of the pipe as practical. Pipe ngths extending out of the socket may be cut back to a inimum of 3 in. (76 mm) for ease of placing in a vise.

9.4.1.3 Place each specimen half in a vise such that the outermost wire of coil is within 1.250 ± 0.125 in. (32 ± 3 mm) of vise jaws, with the jaws closing only on the pipe portion of the specimen (Fig. 2).

9.4.1.4 Tighten the jaws of the vise on the pipe until the inner walls of the pipe meet (Fig. 3). Repeat crush test on both halves and each end of specimen, at all ends, where a joint exists.

9.4.1.5 Separation of the fitting from the pipe at the fusion interface constitutes a failure of the test. Some minor separation at the outer limits of the fusion heat source up to 15 % of the fusion length may be seen. This does not constitute a failure. Ductile failure in the pipe, fitting, or the wire insulation material, is acceptable as long as the bond interface remains intact.

9.4.1.6 Failure of any one of the four specimens shall constitute failure of the test and is cause for retest of four additional fittings, joined at the same temperature as the failed specimens. Failure of any of these four additional specimens constitutes a failure of the test.

9.4.2 *Saddle Type Joints (Not Full-Wrap Design):*

9.4.2.1 Select four fittings at random and prepare specimens in accordance with Section 8. From the four specimens, condition two specimens each in accordance with 8.1.1 and 8.1.2 (see 9.4).

9.4.2.2 Pipe lengths extending from saddle joint may be cut back clear up to the outer edges of the saddle for convenience of handling, if desired, however, it is not necessary. The length of the pipe extending beyond the saddle is not important to this test (Fig. 4).

9.4.2.3 Place the specimen in vise jaws as shown in Fig. 5, such that vise jaws are within ½ in. of saddle bottom and the jaws will close only on the pipe portion of the specimen. Saddle designs incorporating a bottom half saddle will need the bottom half removed for this test. Saddle designs incorporating a full-wrap single piece saddle are to be tested as in 9.4 socket type joints (Figs. 2 and 3).

9.4.2.4 Tighten the jaws of the vise on the pipe until the inner walls of the pipe meet (Fig. 6).

9.4.2.5 Separation of the fitting from the pipe at the fusion interface constitutes a failure of the test. Some minor separation at the outer limits of the fusion heat source up to 15 % of the fusion length may be seen. This does not constitute a failure. Ductile failure in the pipe, fitting, or the wire insulation material, is acceptable as long as the bond interface remains intact.

9.4.2.6 Failure of any one of the four specimens shall constitute failure of the test and is cause for retest of four additional fittings, joined at the same temperature as the failed specimens. Failure of any of these four additional specimens constitutes a failure of the test.

9.5 *Evaluation for Voids*—When dissecting electrofusion joints for the integrity tests in 9.4, or any reason, voids at or near the fusion interface may be exposed. The voids, should they be present, are a phenomenon of the electrofusion process, due to trapped air and shrinking during the cooling

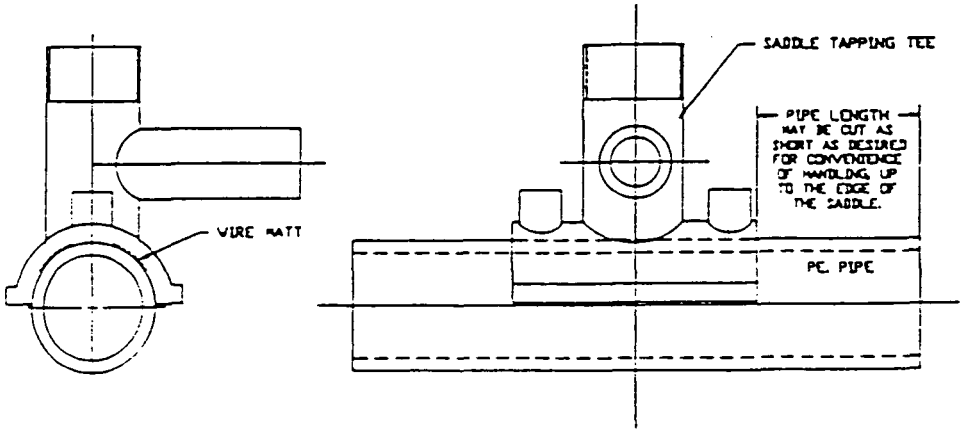

FIG. 4 Preparation of Saddle Specimen for Crush Test

ASTM Designation: F 1290 - 93

American National Standard

2195

Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings[1]

This standard is issued under the fixed designation F 1290; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice describes general procedures for making joints with polyolefin pipe and fittings by means of electrofusion joining techniques. These should be regarded as general procedures and not as a substitute for the installation procedures specified by the manufacturers. Manufacturers should be requested to supply specific recommendations for joining their products.

NOTE 1—Reference to the manufacturer in this practice is defined as the electrofusion fitting manufacturer.

1.2 The techniques covered are applicable only to joining polyolefin pipe and fittings of related polymer chemistry, for example, polyethylenes to polyethylenes using a polyethylene electrofusion fitting. Consult the manufacturer's recommendations for compatibility of the electrofusion fitting with the specific pipe or fitting material to be joined.

1.3 The electrofusion joining technique described can produce sound joints between polyolefin pipe and fittings, provided that all products involved (that is, pipe and fittings) meet the appropriate ASTM specifications.

1.4 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 1600 Terminology for Abbreviated Terms Relating to Plastics[2]

F 412 Terminology Relating to Plastic Piping Systems[3]

F 1055 Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing[3]

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology F 412, and abbreviations are in accordance with Terminology D 1600, unless otherwise specified.

3.2 *Description of Term Specific to This Standard:*

3.2.1 *control box*—the apparatus placed between the power source and the electrofusion fitting to regulate energy input to the fitting.

4. Significance and Use

4.1 Using the procedures in Sections 8 and 9, the manufacturer's instructions and equipment, pressure-tight joints can be made between manufacturer-recommended combinations of pipe that are as strong as the pipe itself.

5. Operator Experience

5.1 Skill and knowledge on the part of the operator are required to obtain a good quality joint. Each operator shall be qualified in accordance with recommended procedures and any regulatory agency or industry organization that has jurisdiction over these practices.

5.2 These procedures require the use of electrical and mechanical equipment. The person responsible for the joining of polyolefin pipe and fittings should ensure that recommended procedures developed for the electrofusion fittings involved, including the safety precaution to be followed, are issued before joining operations commence. It is especially important that the operator be aware of specific instructions regarding the use of electrical equipment in the presence of a potentially explosive environment.

6. Electrofusion Joining Processes

6.1 Electrofusion is a heat-fusion joining process where a heat source is an integral part of the fitting. When electric current is applied, heat is produced, melting and joining the components. Fusion occurs when the joint cools below the melt temperature of the material. The specified fusion cycle used requires consideration of the properties of the materials being joined, the design of the fitting being used, and the environmental conditions. See Specification F 1055 for performance requirements of polyethylene electrofusion fittings.

6.2 Adequate joint strength for field testing is attained when the fitting is not disturbed or moved until the joint material cools (Note 2). Bond strength can be affected if the joint is not allowed to cool sufficently.

NOTE 2—Polybutylene undergoes a crystalline transformation for several days after cooling below its melt temperature. Although this phenomenon has an effect on the ultimate physical properties of the material, its effect on testing of joints has not been found to be significant. If there is any question concerning the effects of crystallization, tests should be conducted on joints that have been conditioned for different periods of time in order to establish the conditioning-time relationship.

7. Classification

7.1 *Technique I: Coupling Type*—The electrofusion coupling technique involves heat fusion of pipes with a tubular fitting with pipe sections inserted in each end of the fitting

[1] This practice is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F 17.20 on Joining.

Current edition approved March 15, 1993. Published July 1993. Originally published as F 1290 - 90. Last previous edition F 1290 - 90.

[2] *Annual Book of ASTM Standards*, Vol 08.01.

[3] *Annual Book of ASTM Standards*, Vol 08.04.

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The coupling contains an internal heat source. The heat source can be: (*1*) a resistance wire coil located on the inner surface of the fitting, or (*2*) the fitting itself can be made of an electrically conductive material. When electric current is applied, heat is produced in the fitting melting the inside of the fitting and the outside of the pipe. The melted material from the two components flow together and fuse as the joint cools. A device should be used to secure the joint and hold it in axial alignment during the joining process. The device may be either an external clamp or one which is integral to the coupling.

7.2 *Technique 2: Saddle Type*—The electrofusion saddle technique involves heat fusion of a saddle fitting to the outer surface of a pipe. The heat source is located on the fusion surface of the concave base of the saddle fitting and can be either: (*1*) a resistance wire coil, or (*2*) a conductive polymer. When electric current is applied, heat is produced at the interface of the pipe and fitting, melting the surface of the two components. The fusion bond occurs when the melted materials of the two components flow together and cool below the melting temperature of the material. During the fusion process, a clamping device should be used to hold the fitting in place on the pipe. This device may be either an external clamp or one that is integral to the saddle fitting itself.

8. Apparatus

8.1 *General Recommendations:*

8.1.1 *Power Source*—An adequate source of electricity is required. Consult the manufacturer's recommendations for the type of power (ac or dc), input voltage, frequency (Hertz) and power output (KW) required for proper fusion of fittings. A transformer may be required if the source voltage differs from the voltage recommended by the manufacturer.

8.1.2 *Extension Cord*—If the power source is remote from the installation site, an extension cord may be required. Select an extension cord of sufficient conductor size to deliver the required voltage to the control box.

8.1.3 *Control Box*—A control box is required to deliver the appropriate amount of energy to the electrofusion fitting. Semi-automatic and fully automatic control boxes may incorporate either timers or sensing circuits which monitor temperatures, current, or pressures in the fittings during the fusion process. Not all control boxes are compatible with all electrofusion fittings. Consult the manufacturer to determine the compatibility of control boxes not made by the same manufacturer as the fitting.

8.1.4 *Alignment Devices*—Various types of alignment devices are available and may be required for a particular fitting. The alignment device should prevent movement of the components being joined during the fusion and cooling cycles.

8.1.5 *Surface Preparation Equipment*—The purpose of surface preparation is to remove surface contamination and oxidation from pipe or fitting spigot (Note 3).

NOTE 3—Surface preparation is very important to assure total fusion.

8.1.5.1 *Tools*—A surface cleaning tool is required for certain fitting designs to remove the outer layer or skin of material on the pipe or fitting spigot surface prior to fusion. Tools used for that purpose are commonly called scrapers. Only qualified procedures and approved tools should be used. Emery cloth or sandpaper is not recommended.

8.1.6 *Miscellaneous*—The following equipment may be useful to assist in the electrofusion joining procedure:

8.1.6.1 *Tubing Cutter*—Used to obtain square end cuts on pipe.

8.1.6.2 *Marking Pen*—Used to mark the fitting location on the pipe surface for certain fitting designs. It may be useful to mark the pipe to define the boundaries before scraping or abrading the pipe surface.

8.1.6.3 *Wiping Cloth*—A clean, dry, non-synthetic, lint-free cloth or paper towel should be used for removing surface preparation residue from the joining surfaces. Considerations of the hazards of static electricity should be applied in selection of a wiping cloth material.

9. Joining Procedure

9.1 **Precaution**—Fusion quality can be affected if extreme weather conditions exist. Therefore, the ambient temperature limits should be considered when making field joints. Observe normal precautions in the use of electrical equipment, especially in wet environments.

9.2 *Technique 1: Coupling Procedure:*

NOTE 4—When fittings are to be used to repair pipe under conditions where line pressure buildup is anticipated, pressure should be blocked off or vented to prevent excessive pressure buildup during the joining and cooling cycle.

9.2.1 Cut the pipe ends squarely and remove burrs or shavings. Clean and dry the pipe by wiping with a clean paper towel or cloth.

9.2.2 Remove the outer surface of the pipe using recommended procedure and tools. Avoid gouging or removing excessive material from the pipe surface. Care should be taken to maintain the specified minimum wall for the pipe.

NOTE 5—For certain non-pressure applications, removal of the pipe outer surface material may not be required. Consult the manufacturer for recommendations.

9.2.3 If pipe inserts are supplied with the electrofusion fitting, install these inserts into the pipe ends.

NOTE 6—Care should be taken to ensure that fitting and pipe joint surfaces are properly handled and maintained free of contamination, such as dirt, debris, or other sources of contamination such as oil from the operator's hands which could have a deleterious effect on joint quality.

9.2.4 Center the fitting on the pipe ends. The gap between the pipe ends should not exceed the recommended value.

9.2.5 Secure the fitting and pipe in place to prevent movement during the fusion and cooling cycles using the recommended alignment tool.

9.2.6 Attach leads from the control box to the fitting. Follow recommended procedures to ensure leads are connected and working properly.

9.2.7 Activate the fusion cycle in accordance with the installation instructions. When the cycle is complete, follow the recommended procedures for disconnecting the leads from the fitting.

9.2.8 Allow the assembly to cool before removing the alignment tool. Consult instructions for recommended cooling procedures.

9.2.9 *Joint Acceptance*—Assure the fusion cycle was com-

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pleted without interruption for the prescribed time for fitting type and size being joined.

9.3 *Technique 2: Saddle Procedure:*

9.3.1 Clean and dry the joining surface of the pipe by wiping with a clean paper towel or cloth.

9.3.2 Remove the outer surface of the pipe using recommended procedure and tools. Surface preparation is only required in the area where the fitting is to be installed. Avoid gouging or removing excessive material from the pipe surface. Be careful not to alter the contour of the pipe during this procedure.

9.3.3 Position the saddle fitting on the prepared surface of the pipe. Secure the fitting in place to prevent movement during the fusion and cooling cycles. Handle the fitting carefully to avoid contamination of the fusion surfaces (Note 6).

9.3.4 Attach leads from the control box to the fitting. Follow recommended procedures to ensure that the leads are connected and working properly.

9.3.5 Activate the fusion cycle in accordance with the installation instructions. When the cycle is complete, follow the recommended procedures for disconnecting the leads from the fitting.

9.3.6 Allow the assembly to stand until it is cool before removing pipe from the alignment or clamping device. Consult instructions for recommended cooling procedures.

9.3.7 *Joint Acceptance*—Assure the fusion cycle was completed without interruption for the prescribed time for fitting type and size being joined.

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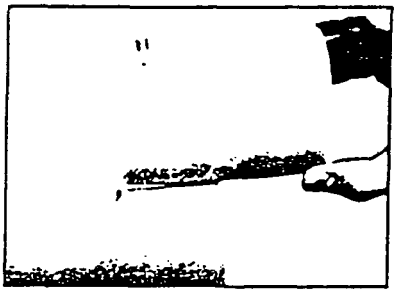
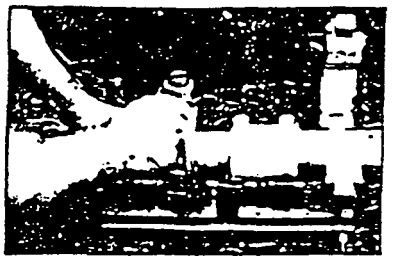
6. Continue scraping until only a virgin surface remains.

   Caution: Avoid all possible recontamination of the prepared surface. Do not touch inside of fitting or scraped pipe surfaces with your hands as perspiration and body oils could contaminate jointing areas and affect joint performance.



7. To determine stab depth, measure half the length of the coupling and mark the pipe ends an equivalent length. For ease of installation, a stab depth indicator and internal fitting stops are a molded part of Central Electrofusion couplings and reducers.

8. Slide fitting onto pipe until pipe ends meet with the stops in the I.D. of the fitting. Check measurement mark for proper stab depth.



9. Maintaining stab depth, place into the proper clamping tool to secure the pipe from movement during the fusion cycle. For best results, alignment clamps should be placed as close to the fitting as possible.

10. The sequence processor should be connected to an adequate AC power source (110 volt).

    Note: If utilizing a generator, the generator should be engaged before plugging the sequence processor in.

    Refer to the Electrical Data shown on page 12 for the precise electrical requirements of the size and type of Central Electrofusion fitting being joined.

11. The sequence processor will automatically run a quick diagnostic check of its operational functions (voltage input/output, etc.). When diagnostic check is complete "Attach Fitting" will appear on the visual display.

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Appendix A-3

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graphs:

g A-10 showing holes cut into 10"IPS polyethylene pipe and extruded material flow

ıling A-10 showing leak detection foaming due to leak.

g A-10 showing the cross sectional view of the extruded material through the holes
ylene pipe.

of the holes with extruded material.

owing no pipe preparation on the 10" pipe as well as no bonding between the fitting

ʒ B-10 showing the holes cut into the 10" pipe as well as the extruded material flow

A-3a

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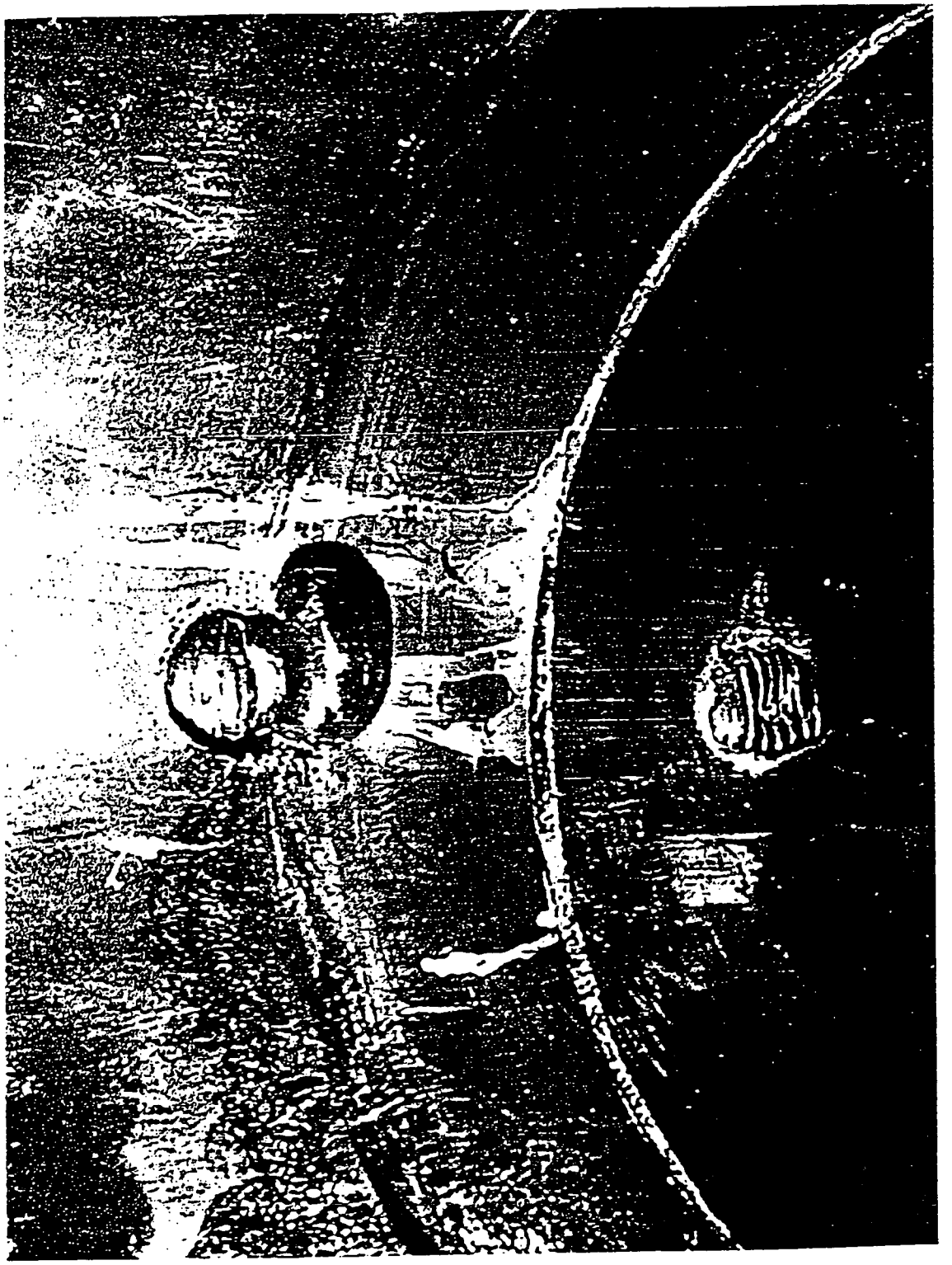

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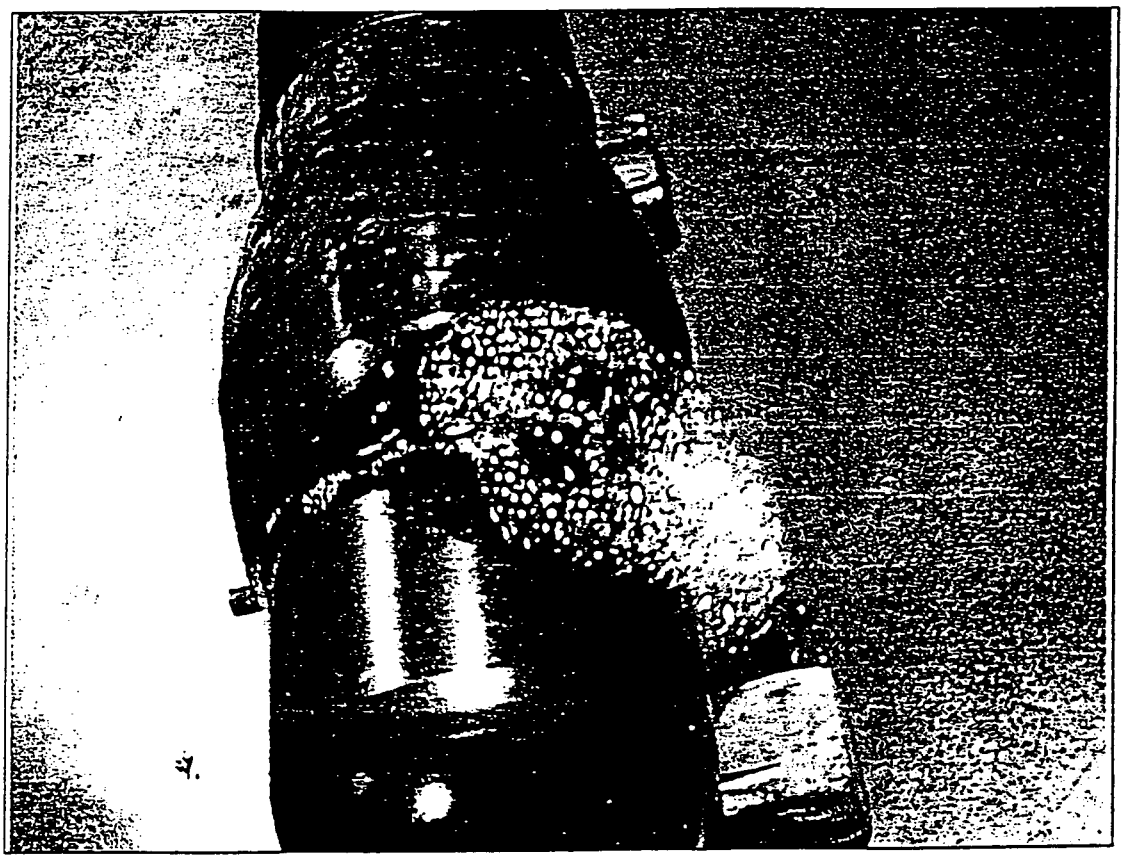

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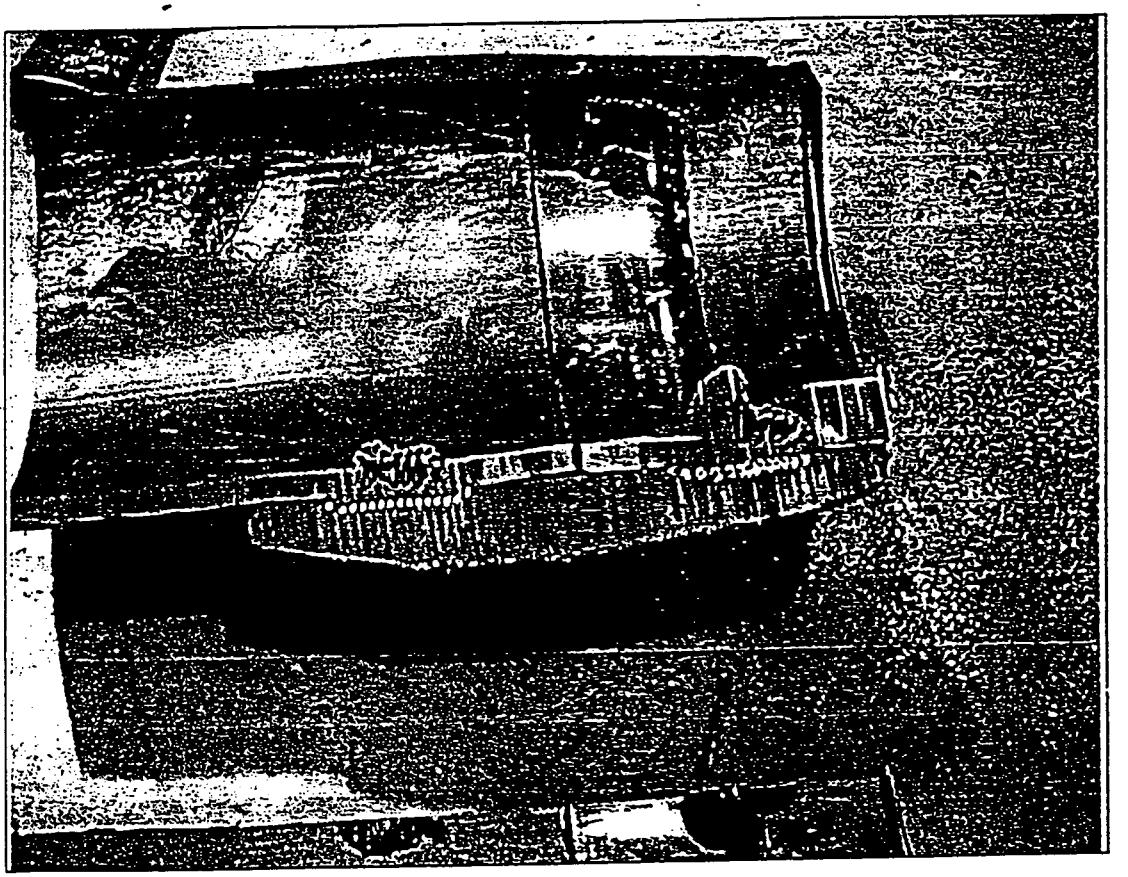

A-3d

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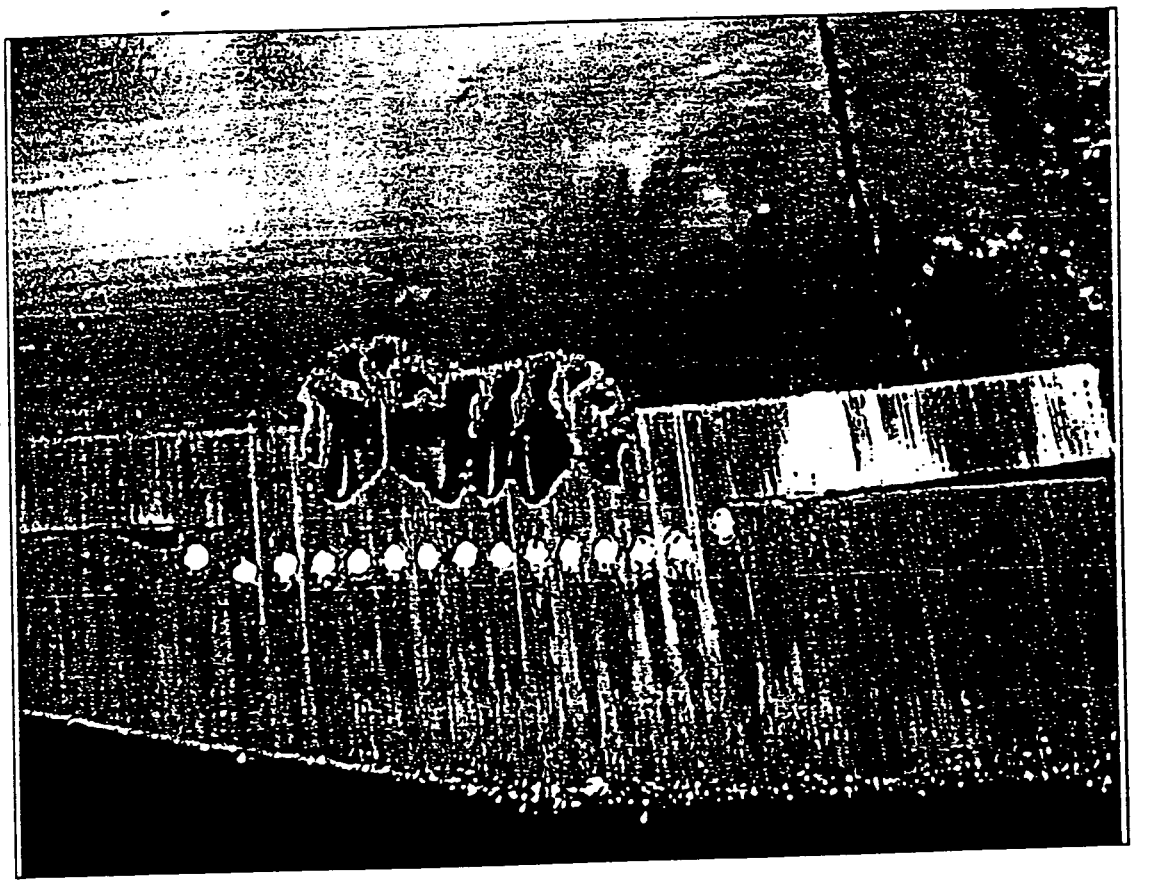

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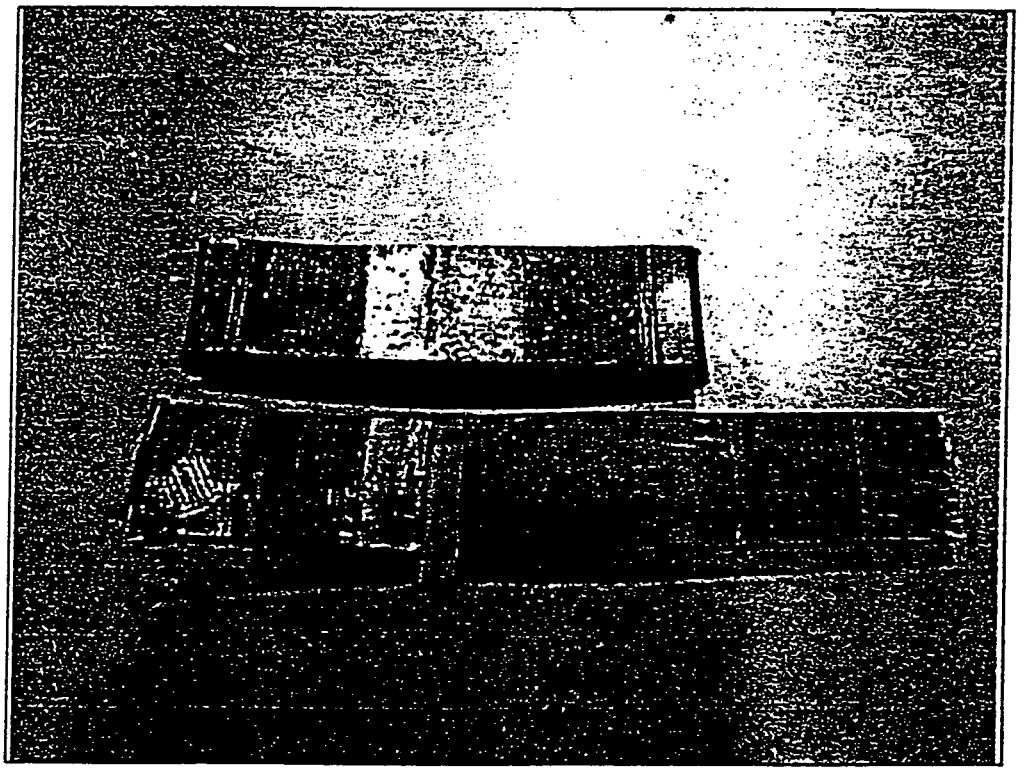

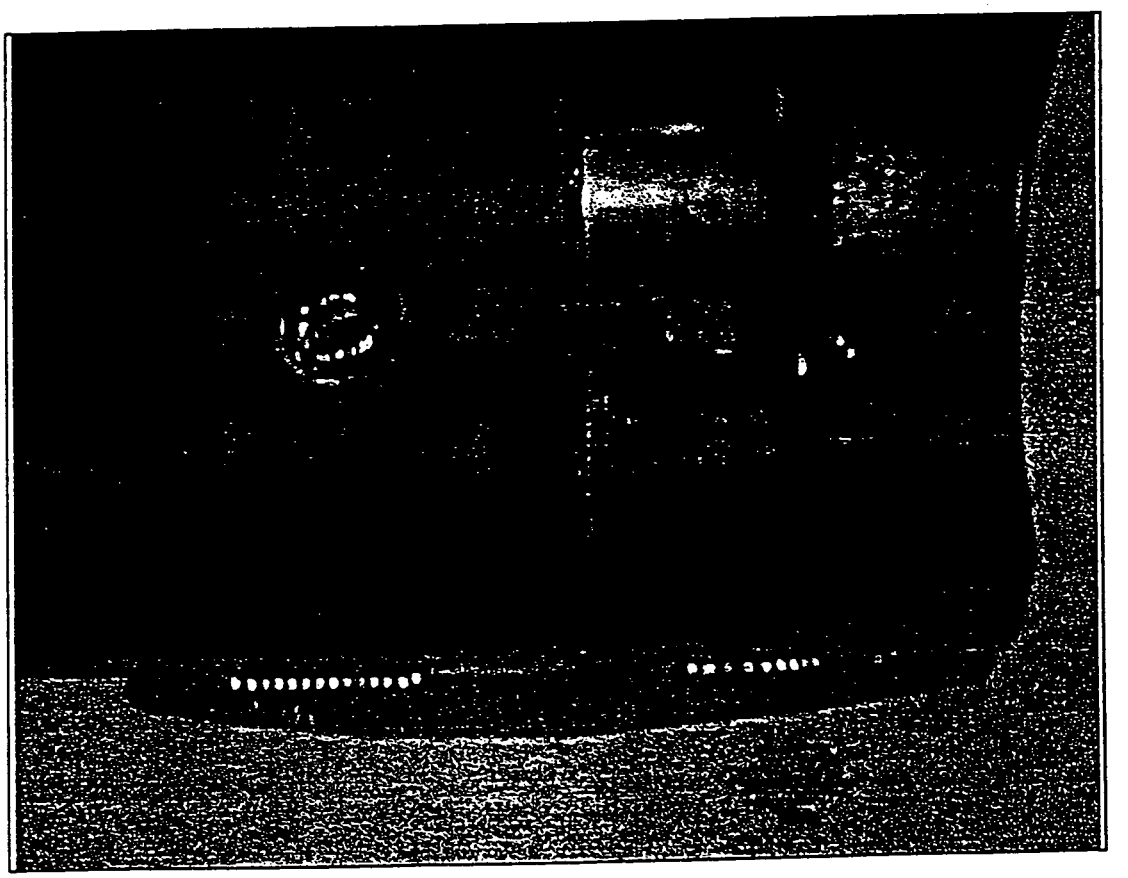

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Record Drawings

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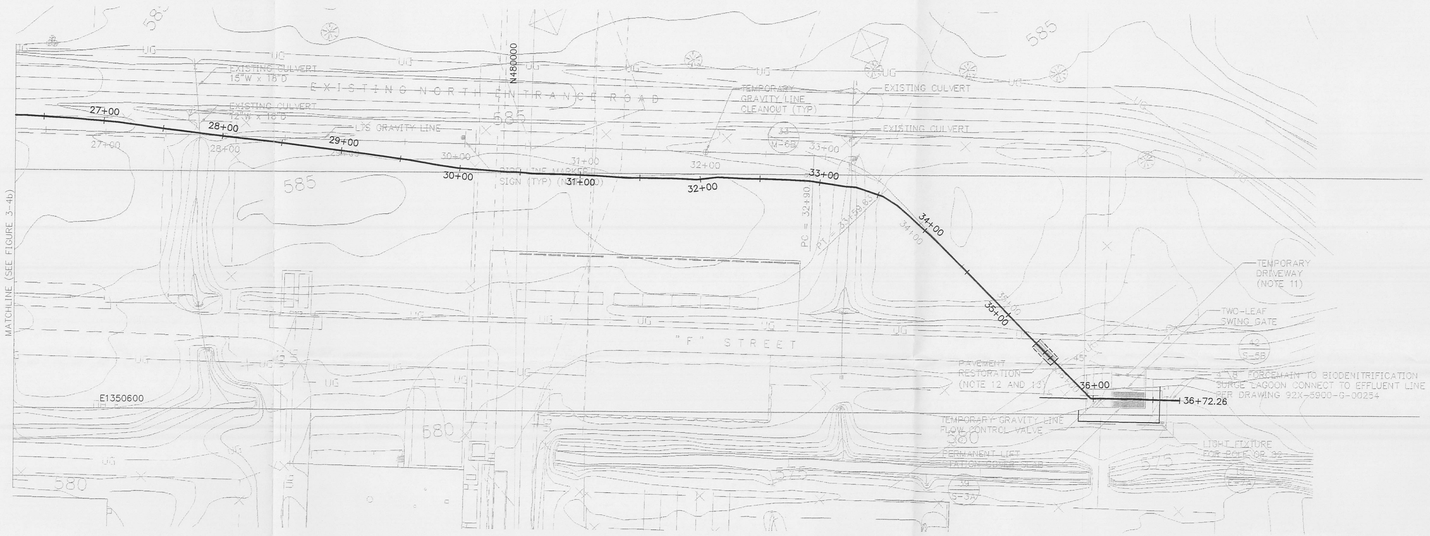
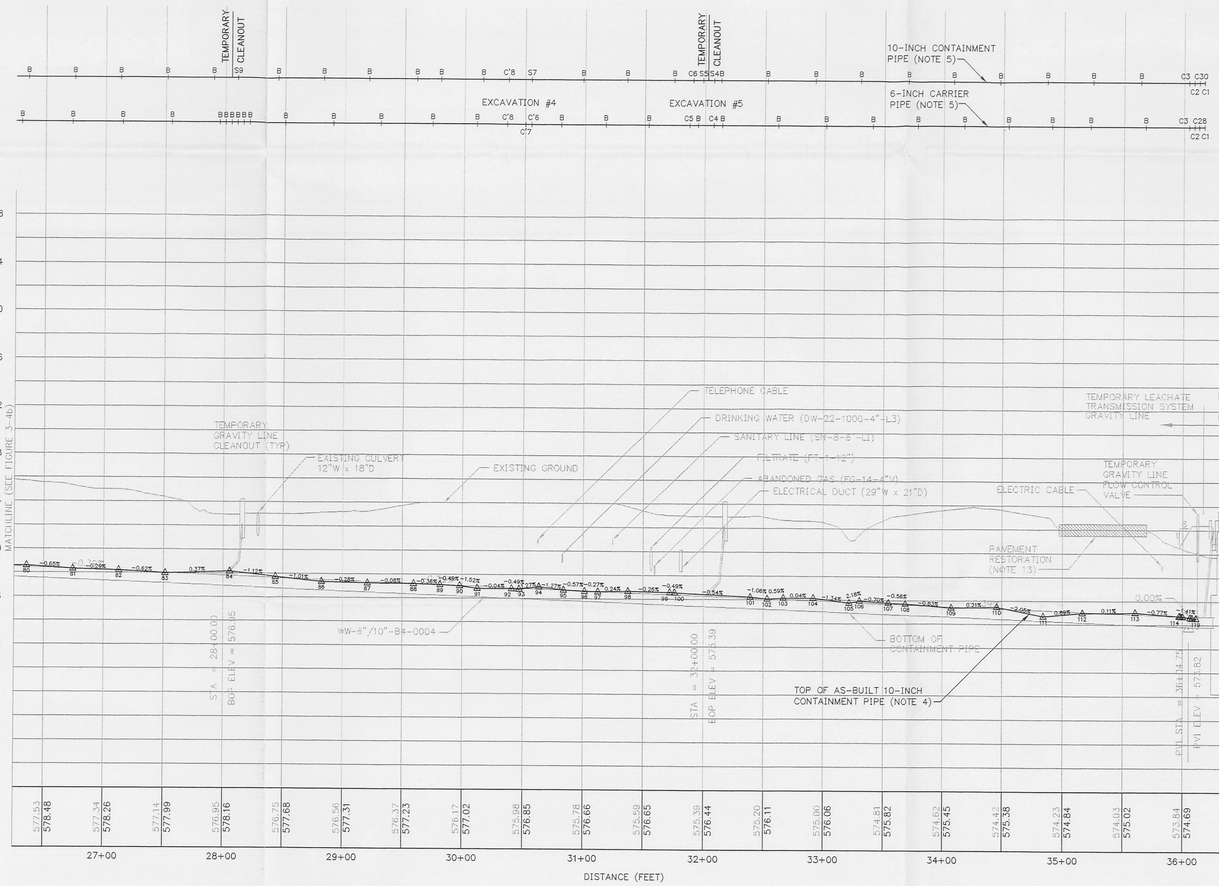


5 - PLAN
LEACHATE TRANSMISSION SYSTEM
SCALE: 1" = 50'



6 - PROFILE
LEACHATE TRANSMISSION SYSTEM
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 5'

AS-BUILT LTS GRAVITY LINE SURVEY DATA (NOTE 4)

POINT NO.	SURVEY NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION	
80	11207	480469.42	1350846.34	578.59	TOP	25+75.73
81	11206	480409.86	1350845.36	578.58	TOP	26+35.29
82	11205	480371.42	1350843.23	578.33	TOP	26+73.80
83	11204	480332.98	1350840.13	578.22	TOP	27+12.36
84	11203	480294.68	1350834.98	577.98	TOP	27+51.01
85	11202	480240.91	1350828.64	578.18	TOP	28+05.15
86	11243	480202.74	1350824.68	577.75	TOPLCSJOINT	28+43.52
87	11242	480164.59	1350819.92	577.36	TOP	28+81.97
88	11241	480126.24	1350815.1	577.25	TOP	29+20.62
89	11240	480088.14	1350809.85	577.22	TOP	29+59.09
90	11239	480066.43	1350806.07	577.14	TOP	29+81.12
91	11238	480050.12	1350803.68	577.06	TOP	29+97.60
92	11237	480035.71	1350802.65	576.84	TOP	30+12.05
93	562	480007.60	1350800.70	576.83	TOP	30+40.23
94	11223	480001.42	1350800.72	576.80	TOP	30+46.41
95	11235	479984.91	1350799.39	577.01	TOP	30+62.97
96	11234	479964.42	1350799.08	576.75	TOP	30+83.47
97	11201	479946.94	1350798.55	576.65	TOP	31+00.95
98	11233	479935.83	1350798.14	576.62	TOP	31+12.07
99	11200	479910.82	1350796.54	576.68	TOP	31+37.13
100	971	479876.38	1350795.97	576.59	T	31+71.58
101	11222	479872.25	1350796.22	576.57	TOP	31+75.70
102	11186	479809.32	1350796.33	576.23	TOP	32+38.79
103	337	479795.21	1350796.22	576.08	TOP	32+52.91
104	11184	479781.55	1350795.89	576.16	TOP	32+66.57
105	11197	479756.52	1350794.78	576.17	JOINT	32+91.62
106	11221	479727.02	1350790.42	575.77	TOP	33+21.44
107	11196	479718.33	1350789.93	575.96	JOINT	33+30.15
108	11195	479695.39	1350782.37	575.79	TOP	33+54.30
109	11194	479683.31	1350774.92	575.71	JOINT	33+68.49
110	11193	479654.34	1350749.49	575.39	JOINT	34+07.04
111	11192	479627.03	1350722.49	575.47	JOINT	34+45.45
112	11191	479600.09	1350695.49	574.69	JOINT	34+83.58
113	11190	479577.55	1350671.97	574.98	TOP	35+16.16
114	11189	479546.78	1350640.33	575.03	JOINT	35+60.29
115	20552	479520.36	1350613.72	574.72	TOP	35+97.80
116	20553	479518.59	1350613.40	574.70	TOP	35+99.60
117	20554	479512.20	1350613.63	574.61	TOP	36+06.00
118	20556	479510.60	1350613.62	574.57	TOP	36+07.60
119	11231	479507.43	1350613.62	574.54	TOPLCSJOINT	36+10.76

LEGEND

B	B-BUTT FUSION JOINT (NOTE 5)
C	C-ELECTROFUSION COUPLING (NOTE 5)
C'	C'-ELECTROFUSION COUPLING WITH BACKWELD (NOTE 5)
S	S-PIPE SLEEVE EXTRUSION WELDED (NOTE 5)
———	LTS AS-BUILT STATION LINE
△	SURVEY POINT
113	POINT NUMBER

NOTES:

1. ALL SCREENED INFORMATION REPRESENTS THE DESIGN PRESENTED IN THE REVISION 0 DRAWING SET TITLED "ON SITE DISPOSAL FACILITY PHASE I CONSTRUCTION" AND DATED 19 OCTOBER 1996 PREPARED BY GEOSYNTEC CONSULTANTS.
2. ELEVATION ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD]).
3. GRID COORDINATES SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. SURVEY DATA FOR LTS GRAVITY LINE PROVIDED BY OSDF ENGINEERING ON 19 MARCH 1999 AS PREPARED BY B.L. PAYNE SURVEYORS. NOT ALL POINTS SURVEYED AT THE TOP OF PIPE ARE SHOWN ON THE PROFILE FOR CLARITY PURPOSES.
5. JOINTS FOR THE 10-INCH CONTAINMENT PIPE WERE LOCATED BASED ON SURVEYS, CONSTRUCTION PHOTOS, AND FIELD NOTES. JOINTS FOR THE 6-INCH CARRIER PIPE WERE BASED ON CLOSED CIRCUIT TELEVIDEO OF THE PIPE DATED 16 FEBRUARY 1999 AND 2 MARCH 1999. LOCATIONS OF THE JOINTS ARE APPROXIMATE AND PROVIDED FOR INFORMATION ONLY.

REV. NO.	DATE	DESCRIPTION	DESIGN	CADD	CHECK	REVIEW	APPROVE

SCALE IN FEET (5 2.5 0 5 10) SCALE IN FEET (50 25 0 50 100)

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR DANIEL FERNALD — FLUOR DANIEL FERNALD

2195

PROJECT:
LEACHATE CONVEYANCE SYSTEM

TITLE:
LEACHATE TRANSMISSION SYSTEM
PLAN AND PROFILE DATA III

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DATE
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GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

FDF PROJECT NO.:	20100
FDF SUBCONTRACT NO.:	95PS005028
FDF DRAWING NO.:	
GEOSYNTEC PROJECT NO.:	GO0573-05.6
GEOSYNTEC DOCUMENT NO.:	F9930006
FIGURE NO.:	3-4c
GEOSYNTEC FILE NO.:	F99-A170

AS-BUILT

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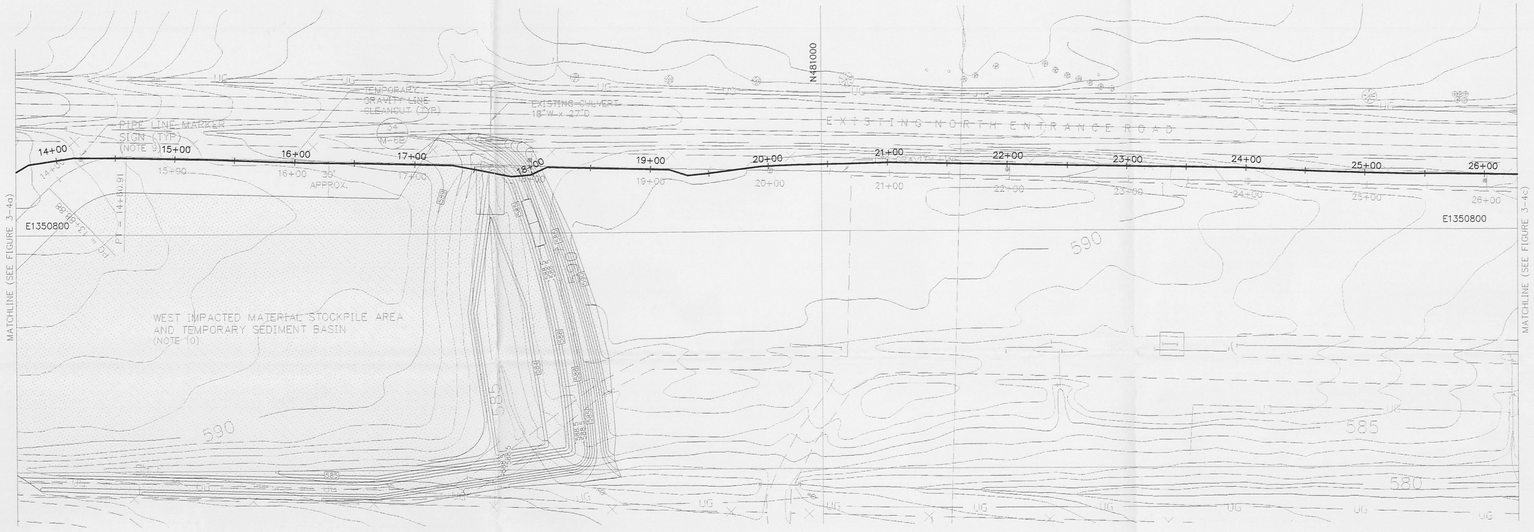
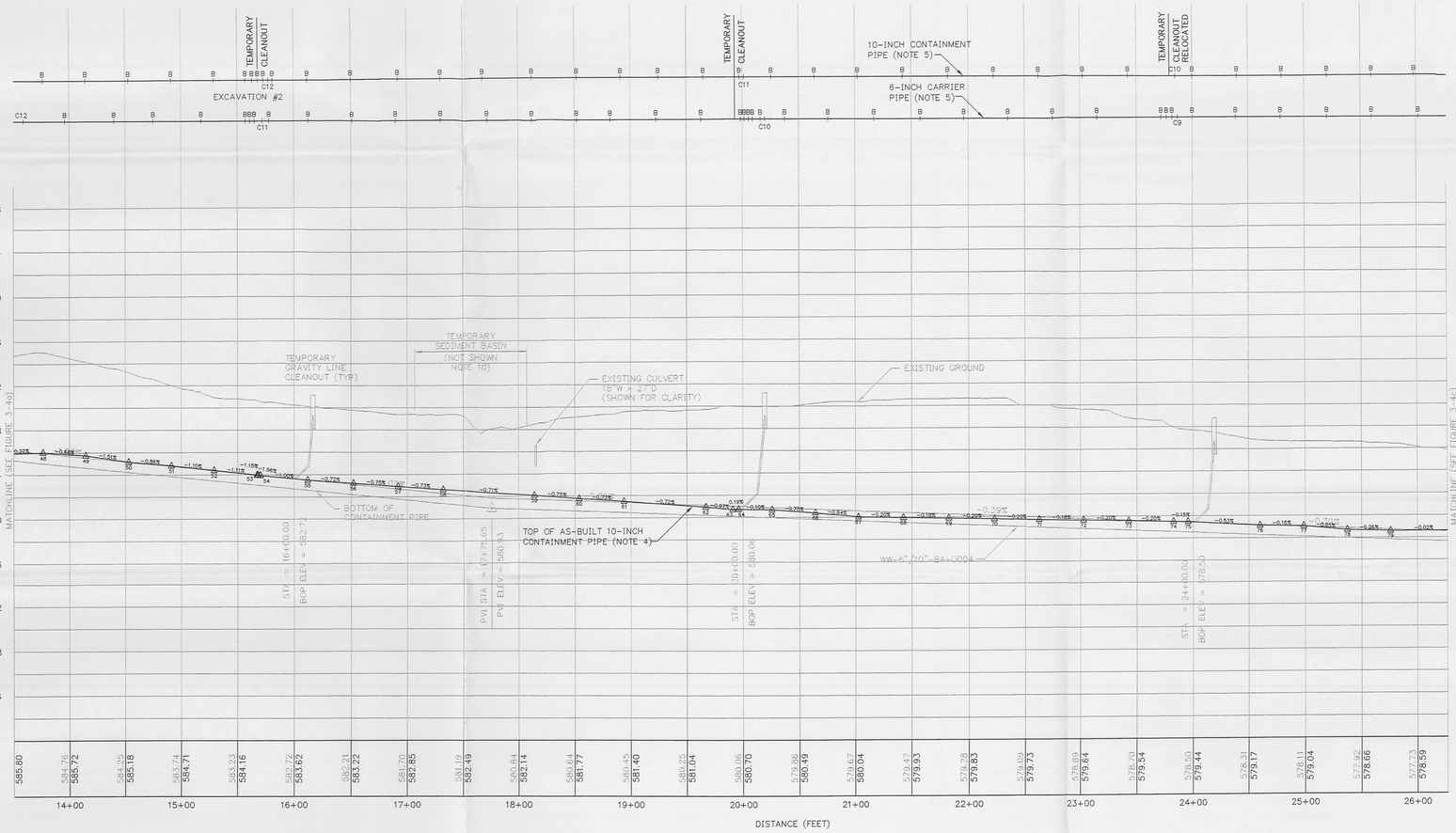


3 PLAN
LEACHATE TRANSMISSION SYSTEM
SCALE: 1" = 50'

AS-BUILT LTS GRAVITY LINE SURVEY DATA (NOTE 4)						
POINT NO.	SURVEY NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION	
48	30229	481664.59	1350859.33	585.98	TOP	13+76.23
49	30230	481626.85	1350864.92	585.72	TOP	14+14.38
50	30231	481588.41	1350864.62	585.14	TOP	14+52.82
51	30232	481550.23	1350863.71	584.81	TOP	14+91.01
52	30237	481512.06	1350862.92	584.39	TOP	15+29.18
53	236	481474.20	1350861.44	583.97	TOP	15+67.08
54	235	481473.34	1350861.39	583.96	TOP	15+67.95
55	30234	481471.62	1350861.28	583.92	TOP	15+69.66
56	30233	481429.50	1350860.29	583.50	TOP	16+11.79
57	30239	481389.51	1350859.36	583.21		16+51.79
58	30240	481349.63	1350858.32	582.91		16+91.69
59	30241	481309.74	1350857.28	582.62		17+31.59
60	11268	481229.97	1350855.19	582.04		18+13.76
61	11269	481190.08	1350854.15	581.74		18+53.66
62	20598	481150.20	1350853.11	581.45		18+93.55
63	11244	481078.02	1350851.12	580.92	TOP	19+66.73
64	571	481054.39	1350854.05	580.69	TOP	19+90.55
65	11246	481049.01	1350854.52	580.70	TOP	19+95.94
66	11247	481019.38	1350855.51	580.67	TOP	20+25.59
67	20574	480980.95	1350856.08	580.38	TOP	20+64.02
68	11249	480942.62	1350857.24	580.02	TOP	21+02.37
69	11250	480902.63	1350856.49	579.94		21+42.37
70	11251	480862.64	1350855.74	579.87		21+82.37
71	11252	480822.64	1350854.99	579.79		22+22.37
72	11253	480782.65	1350854.25	579.71		22+62.37
73	11254	480742.66	1350853.50	579.64		23+02.37
74	11255	480702.66	1350852.75	579.56		23+42.37
75	11256	480662.67	1350852.00	579.48		23+82.37
76	11211	480649.70	1350851.76	579.46	TOP	23+95.35
77	11210	480585.31	1350848.59	579.12	TOP	24+59.81
78	11209	480546.71	1350847.37	579.06	TOP	24+98.42

LEGEND

B	B-BUTT FUSION JOINT (NOTE 5)
C	C-ELECTROFUSION COUPLING (NOTE 5)
C'	C'-ELECTROFUSION COUPLING WITH BACKWELD (NOTE 5)
S	S-PIPE SLEEVE EXTRUSION WELDED (NOTE 5)
	LTS AS-BUILT STATION LINE
△	SURVEY POINT
42	POINT NUMBER



4 PROFILE
LEACHATE TRANSMISSION SYSTEM
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 5'

NOTES:

1. ALL SCREENED INFORMATION REPRESENTS THE DESIGN PRESENTED IN THE REVISION 0 DRAWING SET TITLED "ON SITE DISPOSAL FACILITY PHASE I CONSTRUCTION" AND DATED 19 OCTOBER 1996 PREPARED BY GEOSYNTEC CONSULTANTS.
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REV. NO.	DATE	DESCRIPTION	DESIGN	CADD	CHECK	REVIEW	APPROVE

SCALE IN FEET: 5 2.5 0 5 10
SCALE IN FEET: 50 25 0 50 100

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR DANIEL FERNALD
FLUOR DANIEL FERNALD

2195

PROJECT:
LEACHATE CONVEYANCE SYSTEM

TITLE:
LEACHATE TRANSMISSION SYSTEM
PLAN AND PROFILE DATA II

196

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SIGNATURE
DATE
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GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

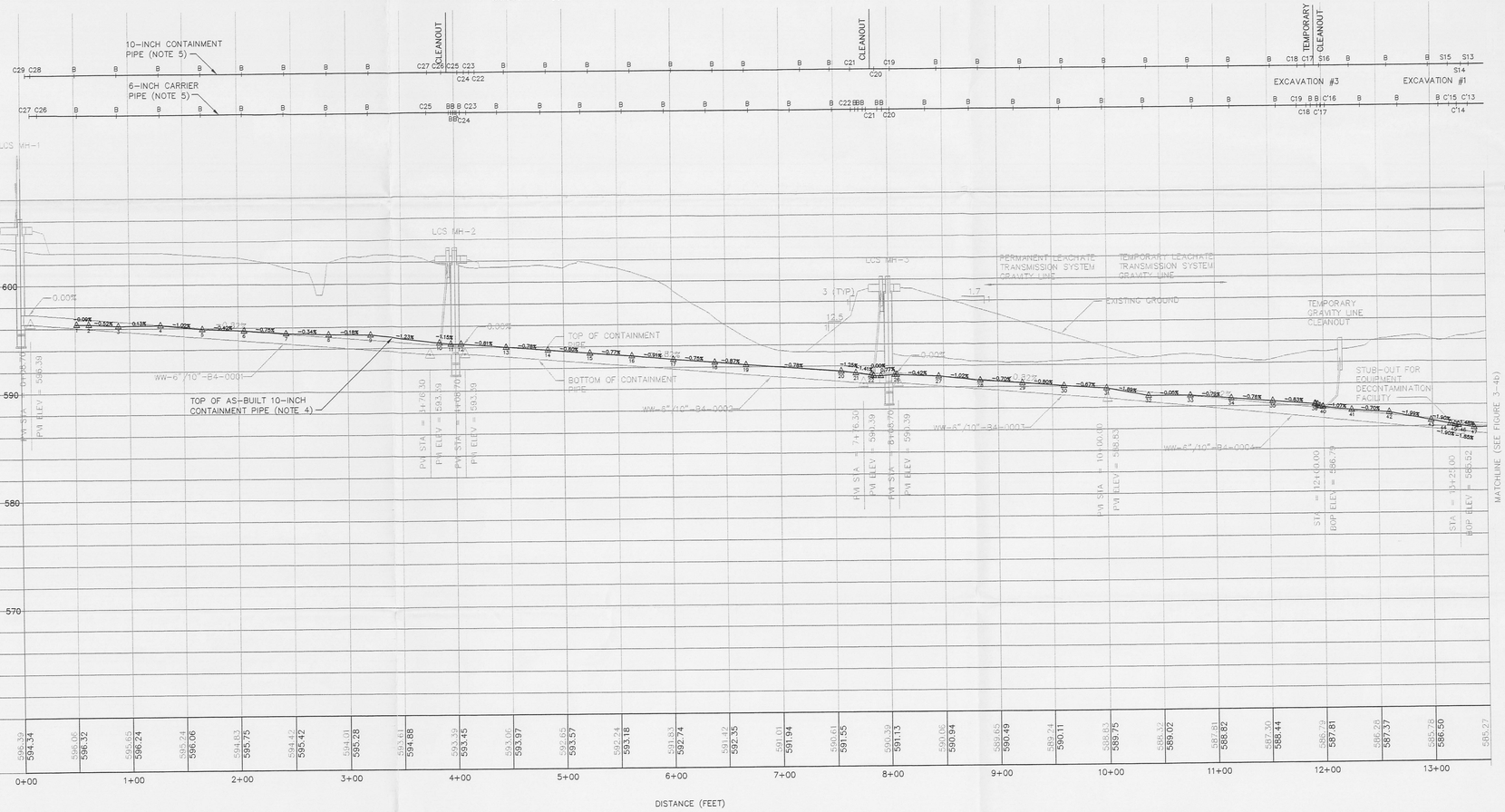
FDF PROJECT NO.:	20100
FDF SUBCONTRACT NO.:	95PS005028
FDF DRAWING NO.:	
GEOSYNTEC PROJECT NO.:	GO0573-05.6
GEOSYNTEC DOCUMENT NO.:	F9930006
FIGURE NO.:	3-4b
GEOSYNTEC FILE NO.:	F99-A169

AS-BUILT

N:\CADD\FERN-FIG\0573-5.6\F9930006\F99-A169.DWG Thu Apr 01 16:16:37 1999 John Ashe

1 PLAN
LEACHATE TRANSMISSION SYSTEM

SCALE: 1" = 50'



2 PROFILE
LEACHATE TRANSMISSION SYSTEM

HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 5'

AS-BUILT LTS GRAVITY LINE SURVEY DATA (NOTE 4)

POINT NO.	SURVEY NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION	
1	30009	482918.32	1350679.40	596.38	TOP	0+51.30
2	30008	482907.00	1350679.18	596.37	TOP	0+62.63
3	30007	482879.85	1350679.39	596.23	TOP	0+89.78
4	30006	482841.15	1350678.67	596.28	TOP	1+28.48
5	30005	482802.74	1350678.27	595.89	TOP	1+66.89
6	30004	482764.26	1350678.11	595.73	TOP	2+05.37
7	30003	482725.81	1350678.12	595.44	TOP	2+43.83
8	30002	482687.07	1350677.91	595.31	TOP	2+82.57
9	30001	482648.72	1350677.54	595.24	TOP	3+20.92
10	30203	482584.56	1350676.01	594.45	TOP	3+85.09
11	204	482574.10	1350675.61	594.33	TOP	3+95.57
12	30205	482564.64	1350675.02	594.33	TOP	4+05.05
13	30176	482522.86	1350675.17	593.99	TOP	4+46.82
14	30177	482484.43	1350674.35	593.69	TOP	4+85.27
15	30178	482445.68	1350674.04	593.38	TOP	5+24.02
16	30179	482406.93	1350673.48	593.08	TOP	5+62.77
17	30180	482368.55	1350673.19	592.73	TOP	6+01.15
18	30181	482330.09	1350672.73	592.44	TOP	6+39.61
19	30182	482301.73	1350672.24	592.19	TOP	6+68.39
20	30217	482214.48	1350670.45	591.51	TOP	7+55.66
21	30218	482200.93	1350669.87	591.34	TOP	7+69.22
22	219	482186.72	1350670.01	591.14	TOP	7+83.43
23	220	482184.47	1350670.12	591.07	TOP	7+85.69
24	221	482177.73	1350670.45	591.07	TOP	7+92.43
25	224	482165.38	1350670.13	591.17	TOP	8+05.41
26	30225	482163.23	1350670.53	591.15	TOP	8+07.22
27	30226	482125.45	1350670.16	590.99	TOP	8+45.38
28	30183	482087.22	1350669.28	590.60	TOP	8+83.62
29	30184	482048.87	1350668.82	590.33	TOP	9+22.18
30	30185	482010.04	1350668.33	590.02	TOP	9+60.80
31	30186	481971.40	1350668.33	589.76	TOP	9+99.45
32	30187	481932.82	1350667.57	589.48	TOP	10+38.03
33	30188	481894.48	1350670.30	589.01	TOP	10+76.47
34	30189	481860.21	1350686.90	588.71	TOP	11+14.55
35	30190	481830.85	1350711.59	588.42	TOP	11+52.91
36	30201	481802.89	1350738.27	588.10	TOP	11+91.55
37	200	481802.20	1350738.92	588.08	TOP	11+92.50
38	199	481800.88	1350740.16	588.03	TOP	11+94.32
39	198	481799.19	1350741.69	587.87	TOP	11+96.60
40	30197	481797.22	1350743.51	587.82	TOP	11+99.28
41	30968	481778.66	1350762.04	587.54	TOP	12+25.51
42	30195	481754.44	1350786.50	587.30	TOP	12+59.93
43	194	481726.55	1350813.25	586.53	TOP	12+98.58
44	30193	481713.24	1350825.24	586.19	TOP	13+16.48
45	192	481710.10	1350828.01	586.11	TOP	13+20.68
46	191	481707.64	1350830.11	586.05	TOP	13+23.92
47	30228	481697.42	1350839.96	585.84	TOP	13+38.11

LEGEND

B	B-BUTT FUSION JOINT (NOTE 5)
C	C-ELECTROFUSION COUPLING (NOTE 5)
C'	C'-ELECTROFUSION COUPLING WITH BACKWELD (NOTE 5)
S	S-PIPE SLEEVE EXTRUSION WELDED (NOTE 5)
	LTS AS-BUILT STATION LINE
△	SURVEY POINT
42	POINT NUMBER

NOTES:

1. ALL SCREENED INFORMATION REPRESENTS THE DESIGN PRESENTED IN THE REVISION 0 DRAWING SET TITLED "ON SITE DISPOSAL FACILITY PHASE I CONSTRUCTION" AND DATED 19 OCTOBER 1996 PREPARED BY GEOSYNTEC CONSULTANTS.
2. ELEVATION ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD]).
3. GRID COORDINATES SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. SURVEY DATA FOR LTS GRAVITY LINE PROVIDED BY OSDF ENGINEERING ON 19 MARCH 1999 AS PREPARED BY B.L. PAYNE SURVEYORS. NOT ALL POINTS SURVEYED AT THE TOP OF PIPE ARE SHOWN ON THE PROFILE FOR CLARITY PURPOSES.
5. JOINTS FOR THE 10-INCH CONTAINMENT PIPE WERE LOCATED BASED ON SURVEYS, CONSTRUCTION PHOTOS, AND FIELD NOTES. JOINTS FOR THE 6-INCH CARRIER PIPE WERE BASED ON CLOSED CIRCUIT TELEVIDEO OF THE PIPE DATED 16 FEBRUARY 1999 AND 2 MARCH 1999. LOCATIONS OF THE JOINTS ARE APPROXIMATE AND PROVIDED FOR INFORMATION ONLY.

REV. NO.	DATE	DESCRIPTION	DESIGN	CADD	CHECK	REVIEW	APPROVE

SCALE IN FEET (5 2.5 0 5 10)
SCALE IN FEET (50 25 0 50 100)

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR DANIEL FERNALD

PROJECT: LEACHATE CONVEYANCE SYSTEM

TITLE: LEACHATE TRANSMISSION SYSTEM PLAN AND PROFILE DATA I

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THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE
DATE
SEAL

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

FDF PROJECT NO.:	20100
FDF SUBCONTRACT NO.:	95PS005028
FDF DRAWING NO.:	
GEOSYNTEC PROJECT NO.:	GG0573-05.6
GEOSYNTEC DOCUMENT NO.:	F9930006
FIGURE NO.:	3-4a
GEOSYNTEC FILE NO.:	F99-A168

AS-BUILT

N:\CADD\FERN-F16\0573-5.6\F9930006\F99-A168.DWG Thu Apr 01 16:18:19 1999 John Ashe

APPENDIX D

APPENDIX D
POST CONSTRUCTION PRESSURE TEST RESULTS

2195

LTS Pressure Testing
Manhole MH-1 to PLS

200

HYDROSTATIC TEST SUMMARY FOR THE 6"/10" DUAL CONTAINMENT FORCED MAIN							
SURV#	TEST DATE	FROM	TO	PIPE SIZE	BURIED YES/NO	CONNECTED TO MANHOLES YES/NO	COMMENTS:
971244	12/02/97	MH 3	PLS	6"	YES	YES ✓	53.5 psi @ 285 hrs
971243	12/6/97	MH 1	MH 3	6"	YES	YES –	47.6 psi @ 20.6 hrs 1238 min
971241	12/11/97	MH 3	PLS	10"	YES	YES ✓	✓ 20.0 psi @ 3 hrs 180 min
971242	12/11/97	MH 2	MH 3	10"	YES	YES –	22 psi @ 3 hrs 180 min
971240	12/15/97	MH 1	MH 2	10"	YES	YES –	17.5 psi @ 3 hrs 185 min

2195

WR 42 Attachment

Table 2 - LCS Hydrostatic Pressure Summary (Cont'd)

Test Date day/mo/yr	Pipe Diameter, in	Drawing No. (s)	Station Interval	Pressure Change, psi	Pass Fail
14/10	6	M-00066	Monitoring Well No. 01	0	Pass
16/10	6	M-00066	Monitoring Well No. 02	0	Pass
16/10	6	M-00066	Monitoring Well No. 03	0	Pass
29/11	6	M-00063	LDS Pipe to Cell No. 1	0 (4)	Pass
1-2/12	6	G-00057-G-00059	LCS No. 3 to PLS	3.5/28.5 hours (5)	Pass
6/12	6	G-00057	LCS No. 1 to LCS No. 3	0.5/8.9 hours (5)	Pass
11/12	10	G-00057-G-00059	LCS No. 3 to PLS	2/3 hours (6)	Pass
11/12	10	G-00057	LCS No. 2 to LCS No. 3	0	Pass
15/12	10	G-00057	LCS No. 1 to LCS No. 2	0 (AIR TEST)	Pass

Notes

(1) Indicates ending or begining station identified approximate.

(2) Indicates tested HDPE pipe only. Test for open ended steel pipe not required.

(3) Indicates Pressure Test Log not yet submitted, awaiting signatures.

(4) Pipe was tested under reduced pressure (15 psi) because an air pressure test was being used with my approval and the air test plugs used could not safely be used at higher pressures. No leaks were present and a NCR has been written to address the test procedure change for the piping into the cell from the LDS and LCS Manholes. Due to construction damage to piping on 03 Dec. 97 test of the LDS 6/10 inch will be redone after repair.

(5) Less than or equal to 0.1 psi drop per hour. Test monitoried, reviewed and approved by RE. See test reports for more data.

(6) No pressure drop for first hour at 20 psi. Temporary fixed end seal in manhole began to leak slowly and slight pressure drop then recorded. FDF QA observed. Resident Engineer Approved.

Table 3 - Summary of Pipe Pressure Testing Between Cell and LCS/LDS Manholes
(Air Pressure Test Used with Pressure at 15 psig)

Test Date day/mo/yr	Pipe Diameter, in	Testing Interval	Pressure Change, psi	Pass Fail
29/11/97	6 (LDS, Cell 1)	Liner Box to LDS	0.2*	Not valid alone (1)
06/12/97	6 (LCS Redundant, Cell 1)	Liner Box to LCS	0	Pass (2)
07/12/97	6 (LCS, Cell 1)	Liner Box to LCS	0	Pass (2)
07/12/97	10 (LCS, Cell 3)	LCS Manhole to Plug	0	Pass
07/12/97	10 (LCS Redundant, Cell 3)	LCS Manhole to Plug	0	Pass
08/12/97	10 (LCS, Cell 1)	Liner Box to LCS	0	Pass
09/12/97	10 (LCS Redundant, Cell 1)	Liner Box to LCS	0	Pass
13/12/97	6 (LDS, Cell 1)	Inline Plug to LDS	0	Pass
13/12/97	10 (LDS, Cell 1)	Liner Box to LDS	0	Pass

Notes

(1) Pipe damaged during soil excavation after test. Pipe repaired and retested on 13 Dec. 97.

(2) Additional test to check new couplings. Pipe already tested prior to coupling.

(3) All 5 Liner Penetratio Boxes have been tested in the shop at 15 psi and in the field at minimum 10.8 psi.

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: LCS YEAR: 1997

CONTRACTOR: VBS

TEST DESCRIPTION: Hydrostatic test of 6" Gravity Line. 50 PSI test Gauge #103 Calibration 9/16/97

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒

6" HDPE Carrier Pipe

TEST LOCATION: LCS #3 Manhole to PLS

Gauge in Manhole #3

READING NO.	DATE (day/mo)	TIME	Cumm Minutes	READING	CHANGE IN READING	CA ID
1	1/12	11:37	0	53.5+		OBB
2	1/12	12 05	28	53.5-	0 to .1	
3	1/12	1316	99	53.1	.4	
4	1/12	1526	229	52.9	.2	
5	1/12	1705	328	52.7	.2	
6	2/12	0712	1175	51.2	1.5	
7	2/12	1439	1612	50.1	1.1	
8	2/12	1618	1911	50.0	0.1	

See Attached Plot. Drop in Pressure is Approximately 1 psi per 8.6 hours for approximately 2800 ft of pipe including 6 cleanouts. Every cleanout was bled and valve/fitting checked. Cleanouts are exposed at top. The very small drop in pressure (0.1 psi/hour) is considered acceptable for this length of pipe. Attached is test plot and copy of Gauge Calibration. D. Bolling

VISUAL MONITORING: [signature] 12-3-97 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 2/12/97 — GEOSYNTEC REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] 12/3/97 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 3 DEC '97 — SITE QA MANAGER day/mo/yr

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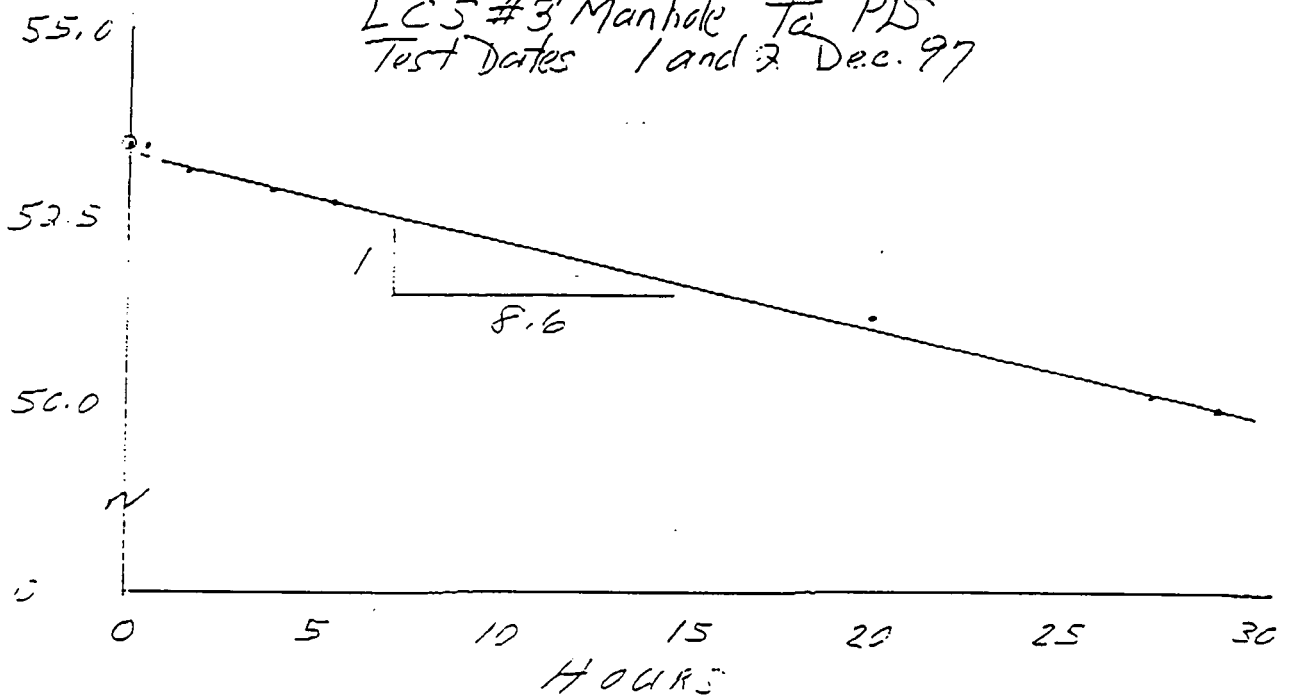
SHEET NO. 1 of 3

GEOSYNTEC CONSULTANTS 2195 Page 1 of 1

Written by: Daniel Bodine Date: / / Reviewed by: Date: 97/12/03

Client: FDF Project: Fernald-OSDF Project/~~Proposal~~ No.: 660166. Task No.: 3.1

HYDROSTATIC TEST
6" Gravity Line
LCS #3 Manhole to PLS
Test Dates 1 and 2 Dec. 97



Pressure Drop 1 psi per 8.6 Hours

Gauge No. 103 Calibration 9/16/97

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2195

PRESSURE GAUGE CERTIFICATION

RECEIVED DEC 03 1997 0845

TPF, INC.
CINCINNATI, OHIO
SINCE 1969
313 South Wayne Avenue
Cincinnati, Ohio 45215
Phone:(513) 761-9963
FAX:(513) 761-2380

Gauge Mfg. Wika

Serial # 103

Range 0/60 psi

Tolerance: ____ ±1/4% FS ____ ±1/2% FS 1.5 % FS

Actual Tolerance ± .9 psi Divisions 1 psi

Tested for: Village Building Services P.O. Number 4385

AS RECEIVED TEST

Standard Readings	Gauge Reading	Correction
1)		
2) New		
3)		

✓ In tolerance ____ Out of tolerance/needs adjustment

____ Internal damage/needs repair before certification

CERTIFICATION TEST RESULTS

STANDARD USED CM5664

Standard Readings	Gauge Reading	Correction
1) 0 psi	0 psi	
2) 10 psi	10.3 psi	-.3 psi
3) 20 psi	20.3 psi	-.3 psi
4) 30 psi	30.3 psi	-.3 psi
5) 40 psi	40.3 psi	-.3 psi
6) 50 psi	50.2 psi	-.2 psi
7) 60 psi	60.3 psi	-.3 psi
8)		
9)		
10)		
11)		
12)		
13)		
14)		
15)		

COMPLIANCE WITH MIL STD. 45662A TPF NIST # 38130A # 39496B # 39496D # 39496E # 39436C

LAB CONDITIONS - TEMP. 71 °F RH 59 %

T.P.F. Standards Due 1-14-98

DATE TESTED Sept 16, 1997 TEST ENGINEER Shawn Perry

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3 of 3

2195

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04

DESCRIPTION: LCS YEAR: 1992

CONTRACTOR: VBS

TEST DESCRIPTION: LCS Gravity Line Hydrostatic Test
Gauge No. ~~97-0#13~~ 103 Calibration 9/16/97 (Sept)

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒
6" LCS line Manhole #1 to Manhole #3

TEST LOCATION: Manhole #1 to Manhole #3 Gauge in #1
Note: Air temp above Manhole (outside) @ 21°F

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	CA ID
1	5/12	1705	53.2	0	overnight stabilization
2	6/12	0807	47.6	5.6	DGB
3	6/12	0837	47.5	0.1	DGB
4	6/12	0907	47.5	0	DGB
5	6/12	0937	47.4	0.1 *	DGB
6	6/12	1007	47.4	0	DGB
7	6/12	1037	47.4	0	DGB
8	6/12	1107	47.4	0	DGB
9	6/12	1137	47.3	.1 *	DGB
10	6/12	1343	47.1	.2	DGB

1238 min

* Vibration Taken place at top of concrete slab where hammer breaking up concrete.
Pressure loss estimated at approx. 0.1 psi/hour.
Test approved by Resident Engineer DGB
Due to Gelid Temps GE did not request increasing pressure at start of test (3 AM) to over 50 psi

VISUAL MONITORING: [signature] CONTRACTOR'S REPRESENTATIVE day/mo/yr — David Bodine 6/12/97 GEOSYNTEC REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] CONTRACTOR'S REPRESENTATIVE day/mo/yr — [signature] 8 DEC '97 SITE CQA MANAGER day/mo/yr

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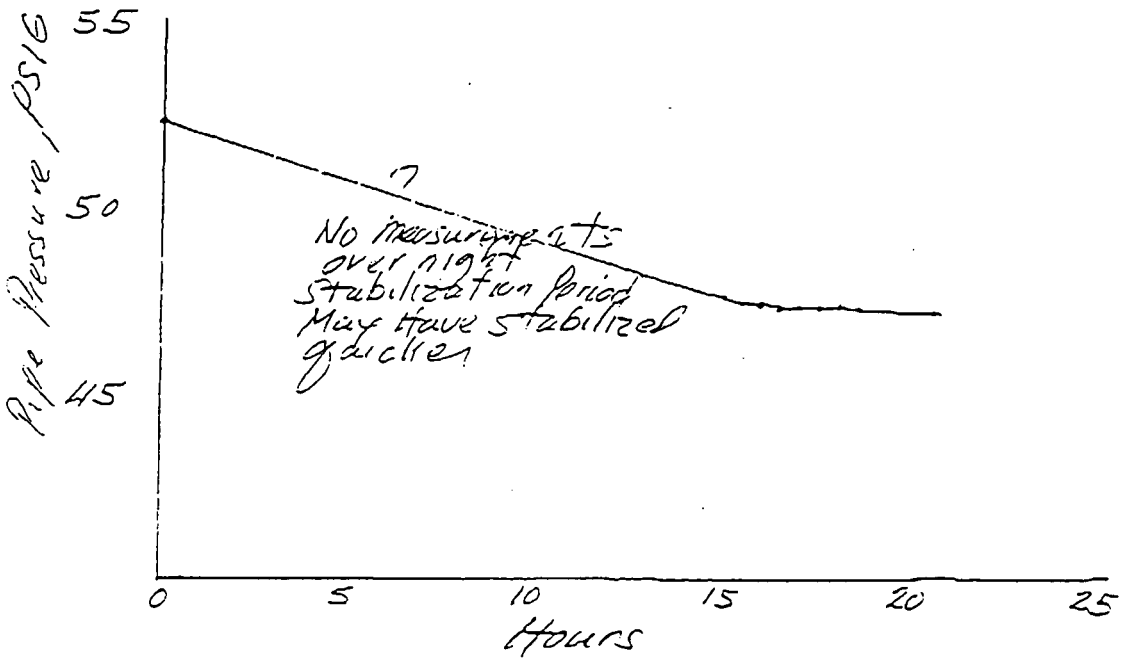
SHEET NO. 1 OF 7

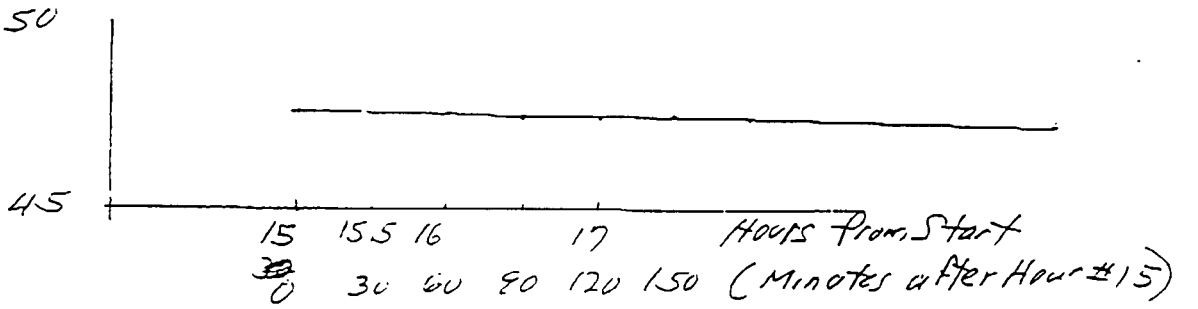
GEOSYNTEC CONSULTANTS 2195 Page 1 of 1

Written by: Daniel Bodine Date: 97/12/06 (YY MM DD) Reviewed by: _____ Date: __/__/__ (YY MM DD)

Client: FDF Project: Fernald OSDF Project/Proposal No.: GQ0166 Task No.: 3.1

HYDROSTATIC TEST
6" Gravity Line
LCS/LDS Manhole No 1. to No. 3





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GeoSyntec Consultants

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04

DESCRIPTION: LCS YEAR: 1997

CONTRACTOR: VBS

TEST DESCRIPTION: 10" LCS Manhole 2 to Manhole 3 Hydrostatic Test @ 15 psi min

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☑ MANHOLE: ☐ OTHER: ☐

Gauge No. 201 Calibration

TEST LOCATION: Manhole 2 to Manhole 3

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	CA ID
1	11/12	1330	22.7 psi		CLB
2	11/12	1400	22.7	0	[illegible]
3	11/12	1430	22.0	0	[illegible]
4	11/12	1500	22.0	0	[illegible]
5	11/12	1530	22.0	0	[illegible]
6	11/12	1600	22.0	0	[illegible]
7	11/12	1630	22.0	0	[illegible]

VISUAL MONITORING: [signature] CONTRACTOR'S REPRESENTATIVE day/mo/yr — [signature] 11/16/97 GEOSYNTEC REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] CONTRACTOR'S REPRESENTATIVE day/mo/yr — [signature] 11/12/97 SITE CQA MANAGER day/mo/yr

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*GeoSyntec Consultants file no. 1-18-2TL

SHEET NO. 1 OF

2195

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04

DESCRIPTION: LCS' YEAR: 1997

CONTRACTOR: VBS

TEST DESCRIPTION: Hydrostatic @ 15psi min 10"

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☐

Calibration 9/16/97 Gauge TFP # 103

TEST LOCATION: Manhole No. 3 TP PLS

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	CA ID
1	11/12	1420	20.0		DYB
2	11/12	1450	20.0	0	DYB
3	11/12	1520	20.0	0	DYB
4	11/12	1550	19.0 *	1.0	DYB
5	11/12	1620	18.9 **	.1 (.6)	DYB
6	11/12	1655	18.2	.7	DYB
7	11/12	1720	18.0 ***	.2	DYB
				2psi Total	

* Slight leak observed in fixed end seal at 12 o'clock and 6 o'clock

** Slight leak around fixed end seal still present. Tapped gauge and dropped to 18.5

*** Slight leak still present. Reading 17.8 after tapping gauge. Mike Goalbey observed

VISUAL MONITORING: [signature] CONTRACTOR'S REPRESENTATIVE day/mo/yr — [signature] 11/12/97 GEOSYNTEC REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] CONTRACTOR'S REPRESENTATIVE day/mo/yr — [signature] 11/12/97 SITE CQA MANAGER day/mo/yr

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SHEET NO. ____ OF ____

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

2195

PRESSURE TEST RECORD

TEST RECORD NO._____ DATE 12/1/97

Rev. C 4/11/94

LINE SERVICE/ NO.: LCS	LINE MEDIUM: Leachate
MAX. OPERATING PRESSURE:	TEST PRESSURE: 50 psi
SPEC./CODE:	TEST MEDIUM: Water

REFERENCE DRAWINGS/TEST BOUNDARIES: PLS to LCS-3

ORIGINAL

PIPE SIZE: 6" TYPE: HDPE

PIPE IN TRENCH ☒ YES ☐ NO

BACKFILL CONDITIONS:

ALL REQUIRED GAUGES/INST. ISOLATED: CONFIRMATION: Y-W DATE: 12/1/97

CQC NOTIFIED Yahaya Willingham DATE/TIME 12/1 - 11:00am

TEST GAUGE IDENT. 103	CALIBRATION DUE DATE: 9-16-98
TEST START TIME: 11:37am 12/1	TEST GAUGE READING: 53.5 psi
TEST FINISH TIME: 4:18pm 12/2	TEST GAUGE READING: 50 psi

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR:	✓		
CLIENT/QC:	X		12/16/97
CLIENT/QA:			

REMARKS/COMMENTS:

Time	Date	PSI *
11:37*	12/1	53.5+
12:05p	12/1	53.5-
1:06p	12/1	53.1
3:26p	12/1	52.9
5:00p	12/1	52.7
7:15p	12/2	51.2
2:40p	12/2	50.1
4:15p	12/2	50.0

* Slight loss in pressure (approximately 1psi/8.6 hrs.) is acceptable for length (2800 ft.) of pipe

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TESTED BY: DATE: 12/2/97

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

2195

PRESSURE TEST RECORD

TEST RECORD NO._____ DATE 12/6/97

LINE SERVICE/ NO.: LCS	LINE MEDIUM: Leachate
MAX. OPERATING PRESSURE:	TEST PRESSURE: 50 psi
SPEC./CODE:	TEST MEDIUM: water

REFERENCE DRAWINGS/TEST BOUNDARIES: LCS-1 to LCS-3

PIPE SIZE: 6" TYPE: HDPE

PIPE IN TRENCH ☑ YES ☐ NO

BACKFILL CONDITIONS:

ORIGINAL

ALL REQUIRED GAUGES/INST. ISOLATED: CONFIRMATION: [illegible] DATE: 12/5/97

CQC NOTIFIED Yahaya Willingham DATE/TIME 12/5 - 5:00 am

TEST GAUGE IDENT. 103	CALIBRATION DUE DATE: 9-16-98
TEST START TIME: 8:07 am	TEST GAUGE READING: 47.6 psi
TEST FINISH TIME: 1:43 pm	TEST GAUGE READING: 47.1 psi

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: [illegible]	✓		
CLIENT/QC: [illegible]	X		12/16/97
CLIENT/QA:			

REMARKS/COMMENTS:

Time	PSI
8:07	47.6 *
9:07	47.5
10:07	47.4
11:07	47.4
13:43	47.1

* slight drop in pressure due to vibration of hammer on concrete cover slab. Due to cold temp. (21°F) RE did not request line be pumped to 50 psi.

211

TESTED BY: [illegible] DATE: 12/6/97

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

ORIGINAL

PRESSURE TEST RECORD

2195

TEST RECORD NO._____ DATE 12/11/97

LINE SERVICE/ NO.: CCS	LINE MEDIUM: Leachate
MAX. OPERATING PRESSURE:	TEST PRESSURE: 15 psi
SPEC./CODE:	TEST MEDIUM: Water

REFERENCE DRAWINGS/TEST BOUNDARIES: PLS to CCS-3

PIPE SIZE: 10" TYPE: HDPE

PIPE IN TRENCH ☑ YES ☐ NO

BACKFILL CONDITIONS:

ALL REQUIRED GAUGES/INST. ISOLATED: CONFIRMATION: [illegible] DATE: 12/11/97

CQC NOTIFIED Yahaya Williams DATE/TIME 12/11 - 2:00pm

TEST GAUGE IDENT. 103	CALIBRATION DUE DATE: 9-16-98
TEST START TIME: 2:20pm	TEST GAUGE READING: 20 psi
TEST FINISH TIME: 5:20	TEST GAUGE READING: 18 psi

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: [illegible]	✓		
CLIENT/QC: [illegible]	X		12/18/97
CLIENT/QA:			

REMARKS/COMMENTS:

Time	PSI
2:20	20 psi
3:20	20 psi
3:50	19 psi *
4:50	18.2 psi *
5:20	18 psi *

* Slight leak in end seal was observed. Pressure lost occured after topping gauge.

212

TESTED BY: [illegible] DATE: 12/11/97

REV. 0 12/11/97

FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

2195

PRESSURE TEST RECORD

TEST RECORD NO._____ DATE 12/11/97

LINE SERVICE/ NO.: LCS	LINE MEDIUM: Leachate
MAX. OPERATING PRESSURE:	TEST PRESSURE: 15 psi
SPEC./CODE:	TEST MEDIUM: Water

REFERENCE DRAWINGS/TEST BOUNDARIES: LCS-2 to LCS-3

PIPE SIZE: 10" TYPE: HDPE containment

PIPE IN TRENCH ☒ YES ☐ NO

BACKFILL CONDITIONS:

ORIGINAL

ALL REQUIRED GAUGES/INST. ISOLATED: CONFIRMATION: YES DATE: 12/11/97

CQC NOTIFIED Gabriel Willingham DATE/TIME 12/11 - 1:00 pm

TEST GAUGE IDENT. 201	CALIBRATION DUE DATE: 6-10-98
TEST START TIME: 1:30 pm	TEST GAUGE READING: 22 psi
TEST FINISH TIME: 4:30 pm	TEST GAUGE READING: 22 psi

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR:			
CLIENT/QC:	X		12/16/97
CLIENT/QA:			

REMARKS/COMMENTS:

Time	PSI
1:30	22 psi
2:30	22 psi
3:30	22 psi
4:30	22 psi

ORIGINAL

213

TESTED BY: DATE: 12/11/97

VILLAGE BUILDING SERVICES, INC.
FDF PROJECT NO. 20110/1700
FDF SUBCONTRACT NO. 589

OPERABLE UNIT 2
ON-SITE DISPOSAL FACILITY
LEACHATE CONVEYANCE SYSTEM

2195

PRESSURE TEST RECORD

TEST RECORD NO._____ DATE 12/15/97

LINE SERVICE/ NO.: LCS	LINE MEDIUM: Leachate
MAX. OPERATING PRESSURE:	TEST PRESSURE: 15 psi
SPEC./CODE:	TEST MEDIUM: ~~Water~~ Air

REFERENCE DRAWINGS/TEST BOUNDARIES: LCS-1 to LCS-2

PIPE SIZE: 10" TYPE: HDPE

PIPE IN TRENCH ☑ YES ☐ NO

BACKFILL CONDITIONS:

ALL REQUIRED GAUGES/INST. ISOLATED: CONFIRMATION: YLW DATE: 12/15/97

CQC NOTIFIED Yahaya Williams DATE/TIME 8:00am 12/15/97

TEST GAUGE IDENT. 103	CALIBRATION DUE DATE: 9-16-98
TEST START TIME: 8:15 am	TEST GAUGE READING: 17.5 psi
TEST FINISH TIME: 11:20 am	TEST GAUGE READING: 17.5 psi

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR:	✓		
CLIENT/QC:	X		12/18/97
CLIENT/QA:			

REMARKS/COMMENTS:

Time	psi
8:15	17.5
9:15	17.5
10:15	17.5
11:20	17.5

Gauge was observed @ 11:30 during drainage.

3 of 4

214

TESTED BY: _____ DATE: 12/15/97

ORIGINAL

2195

Pressure Testing Manholes to Cells

215

Table 3 - Summary of Pipe Pressure Testing Between Cell and LCS/LDS Manholes

Final Cell 1 Tests

(Air Pressure Test Used with Pressure at 15 psig)

Test Date day/mo/yr	Pipe Diameter, in	Testing Interval	Pressure Change, psi	Pass Fail
29/11/97	6 (LDS, Cell 1)	Liner Box to LDS	0.2*	Not valid alone (1)
06/12/97	6 (LCS Redundant, Cell 1)	Liner Box to LCS	0	Pass (2)
07/12/97	6 (LCS, Cell 1)	Liner Box to LCS	0	Pass (2)
07/12/97	10 (LCS, Cell 3)	LCS Manhole to Plug	0	Pass
07/12/97	10 (LCS Redundant, Cell 3)	LCS Manhole to Plug	0	Pass
08/12/97	10 (LCS, Cell 1)	Liner Box to LCS	0	Pass
09/12/97	10 (LCS Redundant, Cell 1)	Liner Box to LCS	0	Pass
13/12/97	6 (LDS, Cell 1)	Inline Plug to LDS	0	Pass
14/12/97	10 (LDS, Cell 1)	Liner Box to LDS	0	Pass

Notes

(1) Pipe damaged during soil excavation after test. Pipe repaired and retested on 13 Dec. 97.
(2) Additional test to check new couplings. Pipe already tested prior to coupling.
(3) All 5 Liner Penetratio Boxes have been tested in the shop at 15 psi and in the field at minimum 10.8 psi.

All tests in table above reported in Phase 1 Cell 1 Final C&A Report

2195

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04

DESCRIPTION: LCS YEAR: 1997

CONTRACTOR: VBS-Wise

TEST DESCRIPTION: 6" LCS line calibration
Air Test Gauge RE12-11/6/97

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒
carrier pipe

TEST LOCATION: LDS Cell #1 to LDS Manhole

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	29/11	1420	15.1		
2	Test Plug Blew				
	Restart				
1	29/11	1547	15.0 *		DGB
2	29/11	1602	14.8	.2 *	DGB
3	29/11	1617	14.8	0	DGB
4	29/11	1633	14.8	0	DGB
5	29/11	1647	14.8	0	DGB

* Vibration due to compactor at top of berm
Not a loss in test pressure due to leak D. Bodine

VISUAL MONITORING: [signature] for Dan Roth 29/11/97 — Daniel Bodine 29/11/97
CONTRACTOR'S REPRESENTATIVE day/mo/yr — GEOSYNTEC REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] 29/11/97 — [signature] 3 DEC '97
CONTRACTOR'S REPRESENTATIVE day/mo/yr — SITE QOA MANAGER day/mo/yr

COPY TO: [illegible]

2195

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GO0166 TASK NO.: 04

DESCRIPTION: Phase 1 YEAR: 1997

CONTRACTOR: Petro

TEST DESCRIPTION: Air Test @ 15 psi (10.8 min required)
Gauge No. 97-0813 Calibration 8/12/97 (Aug)

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒
LCS Redundant Liner Penetration Box - Primary

TEST LOCATION: Cell #1 LCS Redun Box for Primary
30 min Test Required

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	6/12	1020	12.5	N/A	SK.
2	6/12	1035	12.5	.1	SK.
3	6/12	1050	12.5	0	SK.
4	6/12	1105	12.5	0	SK.

VISUAL MONITORING: N. Lee Kinser — CONTRACTOR'S REPRESENTATIVE day/mo/yr
Scott Cameron 6/12/1997 — GEOSYNTEC REPRESENTATIVE day/mo/yr

FINAL APPROVAL: David D. Wilson 6/12/97 — CONTRACTOR'S REPRESENTATIVE day/mo/yr
H.E. Mueller 218 6 DEC 97 — SITE CQA MANAGER day/mo/yr

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04

DESCRIPTION: LCS / Phase 1 YEAR: 1997

CONTRACTOR: VBS / Petro

TEST DESCRIPTION: Air Test @ 15psi Test to check couplings (2 VBS & 1 Petro) Pipe already Tested.

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒

6" LCS Recirculant

TEST LOCATION: Cell #1 To LCS Manhole #1

Gauge No 97-0513 Calib. 8/12/97

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	6/12	1512	15.3	Initial Stabilization	RBB
2	6/12	1520	15.2	0 (Test Start)	RBB
3	6/12	1535	15.2	0	RBB
4	6/12	1550	15.2	0	RBB

Soap solution used to check couplings

VISUAL MONITORING: J. R. Schaintaum — CONTRACTOR'S REPRESENTATIVE day/mo/yr

Ronald Bodine 6/12/97 — GEOSYNTEC REPRESENTATIVE day/mo/yr

FINAL APPROVAL: J. R. Schaintaum — CONTRACTOR'S REPRESENTATIVE day/mo/yr

219 8 DEC 97 — SITE CQA MANAGER day/mo/yr

COPY TO:

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04

DESCRIPTION: LCS CONSTRUCTION YEAR: 1997

CONTRACTOR: UGS/WISE

TEST DESCRIPTION: AIR PRESSURE TEST, 30 MINUTES AT 15 PSI MINIMUM
Purpose OF TEST TO CHECK 6" COUPLINGS IN EXCAVATION PIT

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒
6" HDPE SDR 11 AND 26 CARRIER LINE (GRAVITY) LCS Gauge #97-0813 Calib. 8/12/97

TEST LOCATION: INSTALLED SECTION FROM INSIDE LCS 01 MANHOLE THROUGH AND INCLUDING THE PRIMARY LINER PENETRATION BOX

READING NO.	DATE (day/mo)	TIME	READING PSIG	CHANGE IN READING	QA ID
1	7 DEC	09:00	15.4	N/A	SQ
2	↓	09:15	15.4	0	SG
3		09:30	15.4	0	SG

VISUAL MONITORING: [signature] CONTRACTOR'S REPRESENTATIVE day/mo/yr — [signature] 7/DEC/97 GEOSYNTEC REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] CONTRACTOR'S REPRESENTATIVE day/mo/yr — [signature] 220 8 DEC 97 SITE COA MANAGER day/mo/yr

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04

DESCRIPTION: LCS CONSTRUCTION YEAR: 1997

CONTRACTOR: UBS / WISE

TEST DESCRIPTION: AIR PRESSURE TEST, 15 PSI FOR 1 HR MINIMUM

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☐

Gauge No RE 12 Calib. 11/6/97 BY.

TEST LOCATION: 10" LCS CONTAINMENT PIPE FROM LCS 03 MANHOLE EAST APPROX. 15 ft. TO STUB END TO BE CONNECTED DURING CELL 3 CONSTRUCTION.

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	7 DEC	09:20	18.0	N/A	SG
2		09:35	18.0	0	SG
3		09:50	18.0	0	SG
4		10:05	18.0	0	SG
5		10:20	18.0	0	SG

VISUAL MONITORING: [signature] 7/12/97 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 7 DEC/97 — GEOSYNTEC REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] 7/12/97 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 221 8 DEC 97 — SITE QOA MANAGER day/mo/yr

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2195

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04

DESCRIPTION: LCS CONSTRUCTION YEAR: 1997

CONTRACTOR: UBS / WISE

TEST DESCRIPTION: AIR PRESSURE TEST, 15 PSI FOR 1 HR MINIMUM
Gauge No RE 12 Calibration 11/6/97

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☐

TEST LOCATION: 10" REDUNDANT LCS CONTAINMENT LINE FROM LCS-03 MANHOLE EAST APPROX. 15' TO STUB END TO BE CONNECTED DURING CELL 3 CONSTRUCTION

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	7 DEC	11:10	16.1	N/A	SG
2	↓	11:25	16.1	0	SG
3		11:40	16.1	0	SG
4		11:55	16.1	0	SG
5		12:10	16.1	0	SG

VISUAL MONITORING: George F. Schneider 12/7/97 — CONTRACTOR'S REPRESENTATIVE day/mo/yr
[signature] 7/DEC/97 — GEOSYNTEC REPRESENTATIVE day/mo/yr

FINAL APPROVAL: George F. Schneider 12/7/97 — CONTRACTOR'S REPRESENTATIVE day/mo/yr
[signature] 222 8 DEC 97 — SITE COA MANAGER day/mo/yr

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2195

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: LCS CONSTRUCTION YEAR: 1997

CONTRACTOR: VBS/WISE

TEST DESCRIPTION: AIR PRESSURE TEST, 15 PSI FOR 1HR MINIMUM

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☐

TEST LOCATION: 10" CONTAINMENT SECTION OF LCS LINE FROM LCS 01 MANHOLE TO LINER PENETRATION BOX IN CELL 1

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	8 DEC	16:20	16.8	N/A	SG
2	↓	16:35	16.8	0	SG
3		16:50	16.8	0	SG
4		17:05	16.8	0	SG
5		17:20	16.8	0	SG

VISUAL MONITORING:

CONTRACTOR'S REPRESENTATIVE day/mo/yr — GEOSYNTEC REPRESENTATIVE 8/DEC/1997 day/mo/yr

FINAL APPROVAL:

CONTRACTOR'S REPRESENTATIVE 8/12/97 day/mo/yr — SITE CQA MANAGER 11/12/97 day/mo/yr

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04

DESCRIPTION: LCS YEAR: 1997

CONTRACTOR: VBS

TEST DESCRIPTION: 10" Containment - Air Test @ 15 PSI. max.

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☐

TEST LOCATION: LCS Redundant from LCS Manhole to Cell
Repair pt 3 couplings by backwelding
add sleeve in excavation pit.

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	8/12	14 15	17.3 psi	N/A	SQ
2	9/12	14 30	17.3	0	SQ
3	9/12	14 45	17.3	0	SQ
4	9/12	15 00	17.3	0	SQ
5	9/12	15 15	17.3	0	SQ

VISUAL MONITORING: CONTRACTOR'S REPRESENTATIVE day/mo/yr — GEOSYNTEC REPRESENTATIVE 9 DEC 1997 day/mo/yr

FINAL APPROVAL: CONTRACTOR'S REPRESENTATIVE 9/12/97 day/mo/yr — SITE CQA MANAGER 224 11/12/97 day/mo/yr

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04.1

DESCRIPTION: LDS CONSTRUCTION YEAR: 1997

CONTRACTOR: UBS / WISE

TEST DESCRIPTION: AIR PRESSURE TEST (of REPAIR AREA), 15 PSI, 30 MINUTE MINIMUM

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒

GUAGE 97-0813 Calibration 8/12/97

TEST LOCATION: 6" HDPE GRAVITY CARRIER PIPING FROM LDS 01 MANHOLE EAST APPROX 20 FT. INCLUDING MITERED LATERAL, (ENDED WITH EXPANSION PLUG IN LINE)

READING NO.	DATE (day/mo)	TIME	READING PSIG	CHANGE IN READING	QA ID
1	13/DEC	13:30	16.0	N/A	SQ
2	13 DEC	13:40	16.0	0	SQ
3	13 DEC	13:50	15.8	-0.2 *	SQ
4	13 DEC	13:55	15.8	0	SQ
5	13 DEC	14:00	15.8	0	SQ
6	13 DEC	14:10	15.8	0	SQ
7	13 DEC	14:15	15.8	0	SQ

* → PRESSURE, AFTER STABILIZATION HELD STEADY, AT APPROX 13:48 THE PIPE BEING TESTED WAS KICKED DURING OTHER ONGOING WORK IN THE AREA VIBRATING THE GUAGE TO THE NEW READING WHERE IT HELD STEADY.

VISUAL MONITORING: [signature] 12-14-97 CONTRACTOR'S REPRESENTATIVE day/mo/yr — [signature] 13/DEC/1997 ~~SITE CQA MANAGER~~ GEOSYNTEC REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] 12-14-97 CONTRACTOR'S REPRESENTATIVE day/mo/yr — [signature] 225 15/Dec/97 SITE CQA MANAGER day/mo/yr

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: LCS CONSTRUCTION YEAR: 1997

CONTRACTOR: UBS / WISE

TEST DESCRIPTION: AIR PRESSURE TEST, 15 PSI, 30 MINUTE MINIMUM

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☐

GUAGE # REIR Calibration 11/6/97

TEST LOCATION: 10" CONTAINMENT, LDS PIPING FROM LDS01 MANHOLE TO CELL 1

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	14 DEC	1400	16.0	N/A	SG
2	14 DEC	14:10	16.0	0	SG
3	14 DEC	14:20	16.0	0	SG
4	14 DEC	14:30	16.0	0	SG

VISUAL MONITORING: [signature] 12-14-97 CONTRACTOR'S REPRESENTATIVE day/mo/yr — [signature] 14 DEC 1997 GEOSYNTEC REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] 12-14-97 CONTRACTOR'S REPRESENTATIVE day/mo/yr — [signature] 226 15 Dec 97 SITE QA MANAGER day/mo/yr

COPY TO: FILE

WR 42 Attachment

Cell 1 Above Ground Tests

Table 4 - Phase 1 Hydrostatic Pressure Test Summary

Test Date day/mo/yr	Pipe Diameter, in	Drawing No. (s)	Test Segment Name/Description	Pressure Change, psi	Pass Fail
12/09/97 ✓	6	G-00076	SG-01-06 (LDS 01 to Liner Box)	0.8*	Pass
13/09/97	6	G-00076	Solid pipe used with HMW 01	0**	Pass
17/09/97	6	Cell 2	Solid pipe used with HMW 02	0	Pass
16/09/97 ✓	10	G-00076	SG-01-10 (LDS 01 to Liner Box)	0	Pass
16/09/97 ✓	6	G-00076	SG-02-06 (LCS 01 RD to Liner Box)	0	Pass
16/09/97 ✓	6	G-00076	SG-03-06 (LCS 01 to Liner Box)	0	Pass
17/09/97 ✓	10	G-00076	SG-02-10 (LCS 01 RD to Liner Box)	0	Pass
17/09/97 ✓	10	G-00076	SC-03-10 (LCS 01 to Liner Box)	0	Pass

Notes for Phase 1 Hydrostatic Pressure Table

All tests performed on Phase 1 Pipe Segments prior to installation. All pipes will be connected to VBS piping and to Liner Penetration Boxes (except HMW) and may require additional pressure testing. The final pressure test between the Liner Penetration Boxes and the Manholes will be summarized in Table 3

* The 0.8 psi decrease in pressure occurred near the end of the test when a test pipe was bumped and a small leak was noted at the pipe thread connection. This Resident Engineer reviewed the data, talked to both QC and QA personnel observing the full test and approved or passed the test.

** This pipe was tested uncovered and in direct sunshine and pressure decreased and increased depending on change in temperature and expansion of the pipe. Pressure was kept on the pipe for a very long time and no leaks were noted. Between 11:35 AM and 17:10 PM the pressure decreased and increased with no net change in pressure (Pressure 104 psi). This RE passed the test and recommended that for all future tests, the pipe be covered, tested away from direct sunlight, or tested at a time when sunlight and temperature would not affect the test. Contractor, CQC and QA agreed to test early in the morning and away from direct sunlight.

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04.1

DESCRIPTION: Phase I Construction YEAR: 1997

CONTRACTOR: Petro Environmental

TEST DESCRIPTION: Hydro test of 6" Gravity Line intended to be used between LDS and Liner Box. (Tie in with LDS) LDS 01

MATERIAL DESCRIPTION: FORCEMAIN: ☒ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☐

SG-01-06 (Segment #1 6" Diameter)

TEST LOCATION: West of Cell #1, outside of Trench

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	12 SEPT	0715	121	—	BN
2	↓	0730	121	0	BN
3		0745	121	0	BN
4		0800	120.5 *	0.5	BN
		0815	120.2 *	0.3	BN
	* SMALL LEAK WAS DETECTED AT PIPE THREAD ON NIPPLE INTERFACE WITH BLANK FLANGE AT GAUGE END OF PIPE, RESULTING IN PRESSURE DROP. (INITIATED/OBSERVED ~0800 HOURS)				PASS RGB
Gauge # (CERT #) (SERIAL NO. 097360)		97-0812 JAY INSTRUMENT & SPECIALTY CO. TEL: 1-800-543-8200	DATED 8/12/97		
SEE	SUBMITTAL NO.	59			

VISUAL MONITORING: J. Richard Schaistown 9/12/97 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 12 SEPT 97 — SITE QA ~~MANAGER TECHNICAL~~ day/mo/yr

FINAL APPROVAL: J. Richard Schaistown 9/12/97 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 12 SEPT 97 — SITE QA MANAGER TECHNICAL MANAGER 12/05/97 day/mo/yr

COPY TO: FDF, D. BODINE (GEOSYNTEC), FILE

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PRESSURE TEST RECORD

2195

ST RECORD NO. SG-01-6 DATE September 12, 1997

LINE SERVICE/NO.: LDS 6-in. Carrier Pipe	LINE MEDIUM: HDPE 6-in. Dual Containment
MAX. OPERATING PRESSURE: Gravity Line	TEST PRESSURE: 120 PSI
SPEC./CODE: Tech. Spec. Section 02605	TEST MEDIUM: Water

REFERENCE DRAWINGS/TEST BOUNDARIES:

Tested segment 1, 139.6-ft. long, from Village Building Services' tie-in point #1 to Petro Environmental's perforated pipe LDS tie-in point.

PIPE IN TRENCH: [ ] YES [X] NO

CKFILL CONDITIONS: Tested prior to installation, will be backfilled with embedment fill material.

LL REQUIRED GAUGES/INST. ISOLATED: CONFIRMATION: Yes DATE: 09/12/97

CQC NOTIFIED: Yes - GeoSyntec	DATE/TIME: 09/10/97 — 3:00 PM
TEST GAUGE IDENT.: Cert. No.: 97-0812	CALIBRATION DUE DATE: 08/12/97
TEST START TIME: 7:15 AM	TEST GAUGE READING: 121 PSI
TEST FINISH TIME: 8:15 AM	TEST GAUGE READING: 120.2 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		09/12/97
CLIENT/QC:	X		09/12/97
CODE INSPECTOR: Michael W. Godley	X		09/12/97

REMARKS/COMMENTS:

Weather: Morning fog, partly cloudy, AM temperature of about 54°F.
There was a slight pressure drop due to an observed water leak around the nipple threads on the gauge assembly entering the blind flange. This occurred at approximately 8:00 am and there was no noted pressure drop prior to this leak occurring. Based upon these observations, FDF, GeoSyntec and Petro Environmental were all confident that this was the source of the pressure drop and in agreement that this pipe section passed the hydrostatic

TESTED BY: J. Richard Schairbaum DATE: 09/12/97
J. Richard Schairbaum, Quality Control Manager

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PETRO environmental

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04.1

DESCRIPTION: PHASE I CONSTRUCTION YEAR: 1997

CONTRACTOR: PETRO

TEST DESCRIPTION: HYDROSTATIC PRESSURE TEST OF 6" GRAVITY LINE 132.6 FT. LONG SEGMENT. TO BE INSTALLED FROM VBS TIE-IN POINT TO PETRO'S CONTROL POINT NO. 1009 (LCS PIPE).

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒ CARRIER

6" DIAMETER DRII SG-03-06

TEST LOCATION: WEST OF CELL I IN THE TREE AREA

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	16 SEPT	0600	120.5		RL
2	16 SEPT	0615	120.1	.4	RL
3	16 SEPT	0630	120.0	.5	RL
4	16 SEPT	0645	120.0	.5	RL
5	16 SEPT	0700	120.0	.5	RL
6	16 SEPT	0715	120.0	.5	RL

NO LEAKAGE WAS OBSERVED FROM THE FLANGES, VALVES, GAUGE OR WELDS. HOWEVER, OBSERVATION FOR MOST OF THE PIPE WAS LIMITED DUE TO IT BEING COVERED WITH 10" DIAMETER PIPE.

GAUGE - ROYAL # RE4, CALIBRATED BY RF/CL 11-8-96.

VISUAL MONITORING: J. Richard Schaubum 9/16/97 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

Randy Livingston 16/09/97 — SITE COA ~~MANAGER~~ GEOTECHNICAL TECH. day/mo/yr

FINAL APPROVAL: J. Richard Schaubum 9/16/97 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

J.T. McNeil 16/09/97 — SITE COA MANAGER day/mo/yr

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PRESSURE TEST RECORD

2195

.ST RECORD NO. SG-03-06 DATE September 16. 1997

LINE SERVICE/NO.: 6-in. Carrier Pipe	LINE MEDIUM: HDPE 6-in. Dual Containment
MAX. OPERATING PRESSURE: Gravity Line	TEST PRESSURE: 120 PSI
SPEC./CODE: Tech. Spec. Section 02605	TEST MEDIUM: Water

REFERENCE DRAWINGS/TEST BOUNDARIES:

Tested 6-in. dia. segment, 132.6-ft. long (10-in. section). To be installed from Village Building Services' tie-in point to Petro Environmental's Control Point No. 1009 (LCS Pipe).

PIPE IN TRENCH: [ ] YES [X] NO

CKFILL CONDITIONS: Tested prior to installation, will be backfilled with embedment fill material.

.L REQUIRED GAUGES/INST. ISOLATED: CONFIRMATION: Yes DATE: 09/12/97

CQC NOTIFIED: Yes - GeoSyntec DATE/TIME: 09/15/97 — 2:00 PM

TEST GAUGE IDENT.: Cert. No.: RE-4	CALIBRATION DUE DATE: 11/08/96
TEST START TIME: 6:15 AM	TEST GAUGE READING: 120.1 PSI
TEST FINISH TIME: 7:15 AM	TEST GAUGE READING: 120.0 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		09/16/97
CQC CONSULT.: Randy Livingston	X		09/16/97
FDF QA/QC: Michael W. Fodder	X		09/16/97

REMARKS/COMMENTS:

Weather: Morning fog, AM temperature of about 64° F.

.ESTED BY: J. Richard Schairbaum DATE: 09/16/97

J. Richard Schairbaum, Quality Control Manager

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PETRO environmental

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04.1

DESCRIPTION: PHASE I CONSTRUCTION YEAR: 1997

CONTRACTOR: PETRO

TEST DESCRIPTION: HYDROSTATIC PRESSURE TEST OF 6" GRAVITY LINE, 136.3FT. LONG SEGMENT. TO BE INSTALLED FROM VBS'S TIE-IN POINT TO PETRO'S CONTROL POINT NO. 1008 (LCS REDUNDANT PIPE).

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☑

6" DIAMETER DR11 SG-02-06

TEST LOCATION: WEST OF CELL I IN TREE AREA.

READING NO.	DATE (day/mo)	TIME	READING	TEMP. °F	CHANGE IN READING	QA ID
1	16 SEPT	0600	120.0	64		RL
2	16 SEPT	0615	120.0	62	0	RL
3	16 SEPT	0630	120.0	62	0	RL
4	16 SEPT	0645	120.0	64	0	RL
5	16 SEPT	0700	120.0	64	0	RL

NO LEAKAGE WAS OBSERVED FROM THE FLANGES, VALVES, GAUGE OR WELDS. HOWEVER, OBSERVATION FOR MOST OF THE PIPE WAS LIMITED DUE TO IT BEING COVERED WITH 10" DIAMETER PIPE.

GAUGE - ASHCROFT DURAGAUGE - CERTIFICATION 8-12-97, CERT # 97-0812

VISUAL MONITORING: J. Richard Schaubroeck 9/16/97 CONTRACTOR'S REPRESENTATIVE day/mo/yr — Randy Livingston 16/09/97 SITE COA ~~MANAGER~~ ENGINEERING REP. day/mo/yr

FINAL APPROVAL: J. Richard Schaubroeck 9/16/97 CONTRACTOR'S REPRESENTATIVE day/mo/yr — J. Smith 16/09/97 SITE COA MANAGER day/mo/yr

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PRESSURE TEST RECORD

2195

TEST RECORD NO. SG-02-06 DATE September 16, 1997

LINE SERVICE/NO.: 6-in. Carrier Pipe	LINE MEDIUM: HDPE 6-in. Dual Containment
MAX. OPERATING PRESSURE: Gravity Line	TEST PRESSURE: 120 PSI
SPEC./CODE: Tech. Spec. Section 02605	TEST MEDIUM: Water

REFERENCE DRAWINGS/TEST BOUNDARIES:

Tested 6-in. dia. segment, 136.3-ft. long (10-in. section). To be installed from Village Building Services' tie-in point to Petro Environmental's Control Point No. 1008 (LCS Redundant Pipe).

PIPE IN TRENCH: [ ] YES [X] NO

BACKFILL CONDITIONS: Tested prior to installation, will be backfilled with embedment fill material.

ALL REQUIRED GAUGES/INST. ISOLATED: CONFIRMATION: Yes DATE: 09/12/97

CQC NOTIFIED: Yes - GeoSyntec DATE/TIME: 09/15/97 — 2:00 PM

TEST GAUGE IDENT.: Cert. No.: 97-0812	CALIBRATION DUE DATE: 08/12/97
TEST START TIME: 6:00 AM	TEST GAUGE READING: 120.0 PSI
TEST FINISH TIME: 7:00 AM	TEST GAUGE READING: 120.0 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		09/16/97
CQC CONSULT.: Randy Summitt	X		09/16/97
FDF QA/QC: Michael Moller	X		09/16/97

REMARKS/COMMENTS:

Weather: Morning fog, AM temperature of about 64° F.

TESTED BY: J. Richard Schairbaum DATE: 09/16/97

J. Richard Schairbaum, Quality Control Manager

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PETRO environmental

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04.1

DESCRIPTION: PHASE I CONSTRUCTION YEAR: 1997

CONTRACTOR: PETRO

TEST DESCRIPTION: HYDROSTATIC PRESSURE TEST OF 10" GRAVITY LINE, 139.6 FT. LONG SEGMENT. TO BE INSTALLED FROM VBS'S TIE-IN POINT TO PETRO CONTROL POINT No. 1007 (2DS PIPE).

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☑ MANHOLE: ☐ OTHER: ☐

10" DIAMETER DRII SG-01-10

TEST LOCATION: WEST OF CELL I IN TREE AREA.

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	16 SEPT	0600	15.05		RL
2	16 SEPT	0615	15.05	0	RL
3	16 SEPT	0630	15.05	0	RL
4	16 SEPT	0645	15.05	0	RL
5	16 SEPT	0700	15.05	0	RL

NO LEAKAGE WAS OBSERVED AT THE FLANGES, VALVES, GAUGE, BUTT FUSION WELDS OR FROM THE PIPE.

GAUGE - ASHCROFT DURAGAUGE - CERTIFICATION 8-12-97, CERT. # 97-0812.
JAY INSTRUMENT & SPECIALTY CO.

VISUAL MONITORING: J. Richard Schlaiberer 9/16/97 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

Randy Livingston 16/09/97 — SITE COA ~~MANAGER~~ ENGINEERING TECH day/mo/yr

FINAL APPROVAL: J. Richard Schlaiberer 9/16/97 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[illegible] 16/09/97 — SITE COA MANAGER day/mo/yr

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PRESSURE TEST RECORD

2195

EST RECORD NO. SG-01-10 DATE September 16, 1997

LINE SERVICE/NO.: 10-in. Secondary Contain.	LINE MEDIUM: HDPE 6/10 -in. Dual Contain.
MAX. OPERATING PRESSURE: Gravity Line	TEST PRESSURE: 15 PSI
SPEC./CODE: Tech. Spec. Section 02605	TEST MEDIUM: Water

REFERENCE DRAWINGS/TEST BOUNDARIES:

Tested 10-in. dia., 139.6-ft. long segment. To be installed from Village Building Services' tie-in point to Petro Environmental's Control Point No. 1007 (LDS Pipe).

PIPE IN TRENCH: [ ] YES [X] NO

ACKFILL CONDITIONS: Tested prior to installation, will be backfilled with embedment fill material.

LL REQUIRED GAUGES/INST. ISOLATED: CONFIRMATION: Yes DATE: 09/12/97

CQC NOTIFIED: Yes - GeoSyntec	DATE/TIME: 09/15/97 — 2:00 PM
TEST GAUGE IDENT.: Cert. No.: 97-0813	CALIBRATION DUE DATE: 08/12/97
TEST START TIME: 6:00 AM	TEST GAUGE READING: 15.05 PSI
TEST FINISH TIME: 7:00 AM	TEST GAUGE READING: 15.05 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		09/16/97
CQC CONSULT.: Pamela Simpson	X		09/16/97
FDF QA/QC: Michael W. Fuller	X		09/16/97

REMARKS/COMMENTS:

Weather: Morning fog, AM temperature of about 64° F.

TESTED BY: J. Richard Schairbaum DATE: 09/16/97

J. Richard Schairbaum, Quality Control Manager

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PETRO environmental

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04.1

DESCRIPTION: PHASE I CONSTRUCTION YEAR: 1997

CONTRACTOR: PETRO

TEST DESCRIPTION: HYDROSTATIC PRESSURE TEST OF 10" SECONDARY CONTAIN. GRAVITY LINE, 132.6 FT. LONG SEGMENT. TO BE INSTALLED FROM YBS TIE-IN POINT TO PETRO'S CONTROL POINT NO. 1009 (LCS PIPE).

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☑ MANHOLE: ☐ OTHER: ☐

10" DIAMETER SG-03-10

TEST LOCATION: WEST OF CELL I IN THE TREE AREA.

READING NO.	DATE (day/mo)	TIME	READING	TEMP. °F	CHANGE IN READING	QA ID
1	17 SEPT	0600	16.3			RL
2	17 SEPT	0615	16.3	75	0	RL
3	17 SEPT	0630	16.3	75	0	RL
4	17 SEPT	0645	16.3	75	0	RL
5	17 SEPT	0700	16.3	75	0	RL

NO LEAKAGE WAS OBSERVED AT THE FLANGES, VALVES, GAUGE, BUTT FUSION WELDS OR FROM THE PIPE.

GAUGE - ASHCROFT DURAGAUGE - CERTIFICATION 8-12-97, CERT. # 97-0813

VISUAL MONITORING: J. Richard Schaubroeck 9/17/97 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

Randy Livingston 17/09/97 — SITE COA ~~MANAGER~~ ENGINEERING TECH. day/mo/yr

FINAL APPROVAL: J. Richard Schaubroeck 9/17/97 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

J. M. Simon 18/09/97 — SITE COA MANAGER day/mo/yr

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PRESSURE TEST RECORD

EST RECORD NO. SG-03-10 DATE September 17, 1997

LINE SERVICE/NO.: 10-in. Secondary Contain.	LINE MEDIUM: HDPE 6/10 -in. Dual Contain.
MAX. OPERATING PRESSURE: Gravity Line	TEST PRESSURE: 15 PSI
SPEC./CODE: Tech. Spec. Section 02605	TEST MEDIUM: Water

REFERENCE DRAWINGS/TEST BOUNDARIES:

Tested 10-in. dia., 132.6-ft. long segment. To be installed from Village Building Services' tie-in point to Petro Environmental's Control Point No. 1009 (LCS Pipe).

PIPE IN TRENCH: [ ] YES [X] NO

ACKFILL CONDITIONS: Tested prior to installation, will be backfilled with embedment fill material.

ALL REQUIRED GAUGES/INST. ISOLATED: CONFIRMATION: Yes DATE: 09/17/97

CQC NOTIFIED: Yes - GeoSyntec DATE/TIME: 09/16/97 — 4:00 PM

TEST GAUGE IDENT.: Cert. No.: 97-0813	CALIBRATION DUE DATE: 08/12/97
TEST START TIME: 6:00 AM	TEST GAUGE READING: 16.3 PSI
TEST FINISH TIME: 7:00 AM	TEST GAUGE READING: 16.3 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		09/17/97
CQC CONSULT.: Randy Livingston	X		09/17/97
FDF QA/QC: Michael A. Geller	X		09/17/97

REMARKS/COMMENTS:

Weather: Cool, AM temperature of about 67° F.

TESTED BY: J. Richard Schairbaum DATE: 09/17/97

J. Richard Schairbaum, Quality Control Manager

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PETRO

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04.1

DESCRIPTION: PHASE I CONSTRUCTION YEAR: 1997

CONTRACTOR: PETRO

TEST DESCRIPTION: HYDROSTATIC PRESSURE TEST OF 10" SECONDARY CONTAIN., GRAVITY LINE 136.3 FT. LONG SEGMENT. TO BE INSTALLED FROM VBSS TIE-IN POINT TO PETRO'S CONTROL POINT NO. 1008 (LCS REDUNDANT PIPE).

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☑ MANHOLE: ☐ OTHER: ☐

10" DIAMETER SG-02-10

TEST LOCATION: WEST OF CELL 2 IN THE TREE AREA.

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	17 SEPT	1410	15.9		RL
2	17 SEPT	1425	15.9	0	RL
3	17 SEPT	1440	15.9	0	RL
4	17 SEPT	1455	15.9	0	RL
5	17 SEPT	1510	15.9	0	RL

NO LEAKAGE WAS OBSERVED AT THE FLANGES, VALVES, GAUGE, BUTT FUSION WELDS OR FROM THE PIPE.

GAUGE - ASHCROFT DURAGAUGE - CERTIFICATION 8-12-97, CERT # 97-0813.

VISUAL MONITORING: J. Richard Schaubauer 9/17/97 CONTRACTOR'S REPRESENTATIVE day/mo/yr — Randy Livingston 17/09/97 SITE COA ~~MANAGER~~ ENGINEERING TECH day/mo/yr

FINAL APPROVAL: J. Richard Schaubauer 9/17/97 CONTRACTOR'S REPRESENTATIVE day/mo/yr — J. McMillin 18/09/97 SITE COA MANAGER day/mo/yr

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PRESSURE TEST RECORD

2195

EST RECORD NO. SG-02-10 DATE September 17, 1997

LINE SERVICE/NO.: 10-in. Secondary Contain.	LINE MEDIUM: HDPE 6/10-in. Dual Contain.
MAX. OPERATING PRESSURE: Gravity Line	TEST PRESSURE: 15 PSI
SPEC./CODE: Tech. Spec. Section 02605	TEST MEDIUM: Water

REFERENCE DRAWINGS/TEST BOUNDARIES:

Tested 10-in. dia., 136.3-ft. long segment. To be installed from Village Building Services' tie-in point to Petro Environmental's Control Point No. 1008 (LCS Redundant Pipe).

E IN TRENCH: [ ] YES [X] NO

CKFILL CONDITIONS: Tested prior to installation, will be backfilled with embedment fill material.

LL REQUIRED GAUGES/INST. ISOLATED: CONFIRMATION: Yes DATE: 09/17/97

CQC NOTIFIED: Yes - GeoSyntec	DATE/TIME: 09/17/97 --- 2:00 PM
TEST GAUGE IDENT.: Cert. No.: 97-0813	CALIBRATION DUE DATE: 08/12/97
TEST START TIME: 2:10 PM	TEST GAUGE READING: 15.9 PSI
TEST FINISH TIME: 3:10 PM	TEST GAUGE READING: 15.9 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		09/17/97
CQC CONSULT.: Randy Livingston	X		09/17/97
FDF QA/QC: Michael M. Joller	X		09/17/97

REMARKS/COMMENTS:

Weather: Cool, rainy, cloudy.

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TESTED BY: J. Richard Schairbaum DATE: 09/17/97

J. Richard Schairbaum, Quality Control Manager

PETRO

MH-2 Cell 2				MH 3 Cell 3			
Test Date	Pipe & Size	Tested Interval	Test Pressure	Test Date	Pipe & Size	Tested Interval	Test Pressure
1 May 98 V	LCS-R 10-in	MH/Tie-in	16.0				
4 May 98 V	LCS 10-in	MH/Tie-in	15.2				
5 May 98 V	LDS 10-in	MH/Tie-in	15.5	8 May 98 V	LDS 10-in	MH/Cell	16.0
14 May 98 V	LCS-R 6-in	MH/Tie-in	17.0				
4 May 98 V	LCS 6-in	MH/Tie-in	15.5				
8 May 98 V	LDS 6-in	MH/Cell	16.0	13 May 98 V	LDS 6-in	MH/Tie in	15.5
Final Tests Cell 2							
16 Sept 98 P V	LCS-R 10-in	MH/Cell LPB	15.3				
16 Sept 98 - P V	LCS 10-in	MH/Cell LPB	15.4				
15 Sept 98 - P V	LDS 10-in	MH/Cell LPB	15.1				
16 Sept 98 - P V	LCS-R 6-in	MH/Cell LPB	15.2				
16 Sept 98 - P V	LCS 6 in	MH/Cell LPB	15.2				
18 Sept 98 - P V	LDS 6-in	MH/Cell LPB	15.2				
4 June 98 - P	10 in Containment	Above Grd	17 psi	513 ft (≈83 ft added)			Cell 3
5 June 98 - P	6 in Carrier	Above Grd	122 psi	513 ft (≈83 ft added)			Cell 3
14 May 98 P	6 in Carrier	Above Grd.	120 psi	438 ft length			Cell 2
15 May 98 P	6 in Carrier	Above Grd.	122 psi	430 ft length			Cell 3
20 May 98 P	10 in Containment	Above Grd	16 psi	430 ft length			Cell 3
21 May 98 P	10 in Containment	Above Grd.	16 psi	438 ft length			Cell 2

Above Ground Cell 2 and 3 Tests

V = VBS test, P = Petro Test

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Note: Tests of Horizontal Monitoring Well and Liner Penetration Boxes are not summarized above but are included in the Appendix

All tests reported in Phase II Cell 2 Final CQA Report

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00409 TASK NO.: 04.1

DESCRIPTION: Phase one YEAR: 1998

CONTRACTOR: Village Builders Service (VBS)

TEST DESCRIPTION: 10" HDPE LCS Redundant Containment pipe LCS/02 15 psi min. 1 hour

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☐

TEST LOCATION:

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	1/5	0945	16.0 psi	—	BE
2		1000	16.0	0	BE
3		1015	16.0	0	BE
4		1030	16.0	0	BE
5		1045	16.0	0	BE
6		1100	16.0	0	BE

VISUAL MONITORING: Marvin Brooks 4/5/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 1/5/98 — SITE QA ~~MANAGER~~ REPRESENTATIVE day/mo/yr

FINAL APPROVAL: Marvin Brooks 4/5/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 04 may 98 — SITE QA MANAGER day/mo/yr

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: ~~GQ0166~~ 680409 TASK NO.: 04.1

DESCRIPTION: Phase I Constr. YEAR: 1998

CONTRACTOR: VBS

TEST DESCRIPTION: VBS, air pressure test. 15 psi minimum pressure. 10" containment line (LCS) running into LCS-02 tank

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☐

TEST LOCATION: LCS containment running into LCS-02 tank. Approx. 20' long segment on East side of tank

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	04 May	09:30	15.25 lbs	N/A	RP
2	↓	09:45	↓	Ø	RP
3	↓	10:00	↓	↓	RP
4	↓	10:15	↓	↓	RP
5	↓	10:30	↓	↓	RP
6	↓	10:45	↓	↓	RP

Gauge #102. Kevin Marcum VBS pipefitter.
Weather: Cloudy, Mild. Temp approx 60°F - 65°F

VISUAL MONITORING: Marvin Brooks 4-5 ~~5-4~~-98 — CONTRACTOR'S REPRESENTATIVE — day/mo/yr

Rob Reddick 04 May 1998 — SITE COQA ~~MANAGER~~ REP representative — day/mo/yr

FINAL APPROVAL: Marvin Brooks 4-5 ~~5-4~~-98 — CONTRACTOR'S REPRESENTATIVE — day/mo/yr

04 may '98 — SITE COQA MANAGER — day/mo/yr

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: ~~C00166~~ C00409 4/6/98 TASK NO.: 04.1

DESCRIPTION: Phase I Constr. YEAR: 1998

CONTRACTOR: VBS

TEST DESCRIPTION: air pressure test of 6" HDPE pipe running into LCS tank. 15 psi minimum pressure, 1 hr period

MATERIAL DESCRIPTION: FORCEMAIN: ☒ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☐

TEST LOCATION: 6" LCS line from Cell-2 into LCS-02 tank, 20' segment attached to tank

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	04 May	12:30	15.5 psi	N/A	RP
2	↓	13:00	↓	Ø	RP
3		13:30		Ø	RP

Gauge #102
Weather: cloudy, mild 65°F

VISUAL MONITORING: Marvin Brooks 4 5 98 — CONTRACTOR'S REPRESENTATIVE — day/mo/yr

Rob Pedicord 04 May 98 — SITE CQA ~~MANAGER~~ 4 May 98 RP representative — day/mo/yr

FINAL APPROVAL: Marvin Brooks 4 5 98 — CONTRACTOR'S REPRESENTATIVE — day/mo/yr

[signature] 4 may '98 — SITE CQA MANAGER — day/mo/yr

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04.1

DESCRIPTION: Phase one YEAR: 1998

CONTRACTOR: VBS

TEST DESCRIPTION: 15 psi FOR MIN. 1 hour 10"

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☐

TEST LOCATION: LDS 02 M.H to 25' towards cell #2

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	05/05	16:00	15.5	—	BG
2	↓	16:15	15.5	0	BG
3		16:30	15.5	0	BG
4		16:45	15.5	0	BG
5		17:00	15.5	0	BG
6		17:10	15.5	0	BG

VISUAL MONITORING: [signature] 6 5 98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; [signature] 5/5/98 — SITE CQA ~~MANAGER~~ REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] 6-5-98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; [signature] 6/5/98 — SITE CQA MANAGER day/mo/yr

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00409 TASK NO.: 04.1

DESCRIPTION: OSDF - Phase I YEAR: 1998

CONTRACTOR: VBS

TEST DESCRIPTION: 6" HDPE LDS Transmission pipe

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒

gravity Carrier

TEST LOCATION: LDS-02 Manhole into Cell Group #103

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	8 May 98	1315	16 psi	0	CS
2	"	1330	16 psi	0	CS
3	"	1345	16 psi	0	CS
4	"	1400	16 psi	0	CS
5	"	1415	16 psi	0	CS

VISUAL MONITORING: Martin Brooks 8-5-98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; Collin Shrew 8 May 98 — SITE CQA ~~MANAGER~~ Representative day/mo/yr

FINAL APPROVAL: Martin Brooks 8-5-98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; [signature] 8 May 98 — SITE CQA MANAGER day/mo/yr

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04.1

DESCRIPTION: Phase I YEAR: 1998

CONTRACTOR: VRS

TEST DESCRIPTION: 10" HDPE LDS containment pipe
15 psi minimum / 1 hr

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☐

TEST LOCATION: LDS-03 Manhole into cell Gauge #103

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	8 May 98	1535	16 psi	–	CS
2	"	1550	16 psi	Ø	CS
3	"	1605	16 psi	Ø	CS
4	"	1620	16 psi	Ø	CS
5	"	1635	16 psi	Ø	CS

VISUAL MONITORING: [signature] 8 5 98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; [signature] 8 May 98 — SITE CQA ~~MANAGER~~ Representative day/mo/yr

FINAL APPROVAL: [signature] 8 5 98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; [signature] 8 May 98 — SITE CQA MANAGER day/mo/yr

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04.1

DESCRIPTION: Phase one YEAR: 1998

CONTRACTOR: Village Building Services

TEST DESCRIPTION: 1 hour pneumatic pressure 15 psi min, 0 allowed pressure loss

MATERIAL DESCRIPTION: FORCEMAIN: ☒ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☐

TEST LOCATION: 6" HDPE LDS-03 (0-20')

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	CA ID
1	13/05	13:30	15.5 psi	—	BE
2	↓	13:45	↓	0	↓
3		14:00		0	
4		14:15		0	
5		14:30		0	

VISUAL MONITORING: [signature] 13-5-98 CONTRACTOR'S REPRESENTATIVE day/mo/yr — B. [signature] 13/05/98 SITE CQA ~~MANAGER~~ REP. day/mo/yr

FINAL APPROVAL: [signature] 13-5-98 CONTRACTOR'S REPRESENTATIVE day/mo/yr — [signature] 14 may '98 SITE CQA MANAGER day/mo/yr

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04.1

DESCRIPTION: Phase one YEAR: 1998

CONTRACTOR: Village Building Services (VBS)

TEST DESCRIPTION: 3 hour pneumatic pressure test 15psi min. no allowable loss

MATERIAL DESCRIPTION: FORCEMAIN: ☒ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☐

6" HDPE, LCS Redundant manhole #2

TEST LOCATION: 0' - 20'

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	14/05	1445	17.0 psi	—	BL
2	↓	1500	↓	0 psi	↓
3		1515		↓	
4		1530			
5		1545			
6		1600			
7		1615			
8		1630			
9		1645			
10		1700			
11		1715			
12		1730			
13		1745			

VISUAL MONITORING: Marvin Brooks 15-5-98 — CONTRACTOR'S REPRESENTATIVE, day/mo/yr
B. Evans 14/May/98 — SITE CQA ~~MANAGER~~ REP., day/mo/yr

FINAL APPROVAL: Marvin Brooks 15-5-98 — CONTRACTOR'S REPRESENTATIVE, day/mo/yr
[signature] 15 May 98 — SITE CQA MANAGER, day/mo/yr

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- Phase II

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04.1

DESCRIPTION: Phase II YEAR: 1998

CONTRACTOR: PETRO

TEST DESCRIPTION: Air Pressure Test, 15 psi minimum, 1 hour w/no loss

MATERIAL DESCRIPTION: FORCEMAIN: ☒ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☐

TEST LOCATION: Cell-2, LCS Redundant 6" line between LCS tank and penetration box

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	16 Sept	1735	15.2 psi	—	RP
2	16 Sept	1840	15.2 psi	Ø	RP

VISUAL MONITORING: J. Richard Schlaubaum 9/17/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

Rob Peddicord 16/4/98 — SITE CQA ~~MANAGER~~ representative day/mo/yr

FINAL APPROVAL: J. R. Schlaubaum — CONTRACTOR'S REPRESENTATIVE day/mo/yr

Collin P. Gibson 17 Sept 1998 — SITE CQA MANAGER day/mo/yr

COPY TO: PETRO

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00409 TASK NO.: 04.1

DESCRIPTION: Phase II YEAR: 1998

CONTRACTOR: PETRO

TEST DESCRIPTION: Air pressure test. 15 psi minimum, 1 hour w/ no loss

MATERIAL DESCRIPTION: FORCEMAIN: ☒ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☐

TEST LOCATION: Cell 2, LCS 6" line, between LCS tank and penetration box

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	16 Sept	1610	15.2 psi	—	RP
2	" "	1710	15.2 psi	Ø	RP

VISUAL MONITORING: J. Richard Jakubowski 9/17/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

Rob Reddicord 16/9/98 — SITE CQA ~~MANAGER~~ representative day/mo/yr

FINAL APPROVAL: J. R. Jakubowski — CONTRACTOR'S REPRESENTATIVE day/mo/yr

Collin P. Wilder 17 Sept 98 — SITE CQA MANAGER day/mo/yr

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00409 TASK NO.: 04

DESCRIPTION: Phase II YEAR: 1998

CONTRACTOR: PETRO

TEST DESCRIPTION: Air Pressure Test, 15 psi for one hour

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☐

TEST LOCATION: 10" LCS between Manhole #2 and penetration box

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	16 Sept.	1317	15.4	Ø	CS
2	↓	1332	15.4	Ø	CS
3		1347	15.4	Ø	CS
4		1402	15.4	Ø	CS
5		1417	15.4	Ø	CS

VISUAL MONITORING: J. Richard Schaubroeck 9/17/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

Collin P. Sykes 16 Sept 1998 — SITE CQA MANAGER day/mo/yr

FINAL APPROVAL: J. R. Schaubroeck — CONTRACTOR'S REPRESENTATIVE day/mo/yr

Collin P. Sykes 17 Sept 1998 — SITE CQA MANAGER day/mo/yr

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04

DESCRIPTION: Phase II YEAR: 1998

CONTRACTOR: PETRO

TEST DESCRIPTION: Air pressure test, 15 ~~atm~~ psi for one hour

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☐

TEST LOCATION: 10" LCS Redundant between Manhole #2 and penetration box

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
Initial	16 Sept.	1015	15.3	Ø	CS
1	↓	1030	15.3	Ø	CS
2		1045	15.3	Ø	CS
3		1100	15.3	Ø	CS
4		1115	15.3	Ø	CS
5		1130	15.3	Ø	CS

VISUAL MONITORING: J. Richard Hakinson 9/17/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

Collin P. Nelson 16 Sept 98 — SITE CQA MANAGER day/mo/yr

FINAL APPROVAL: J. R. Hakinson — CONTRACTOR'S REPRESENTATIVE day/mo/yr

Collin P. Nelson 17 Sept 1998 — SITE CQA MANAGER day/mo/yr

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04

DESCRIPTION: Phase II YEAR: 1998

CONTRACTOR: PETRO

TEST DESCRIPTION: Air Pressure test, 10 psi minimum, 0% loss over 30 min

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒

Penetration Box

TEST LOCATION: Cell #2 LDS penetration Box

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	17 Sept 1998	1325	11.9	0	CA
2	17 Sept	1340	11.9	0	CA
3	17 Sept	1356	11.9	0	CA
			~~11~~ CA	~~0~~ CA	~~CA~~

VISUAL MONITORING: [signature] 18 Sept 98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 17 Sept 1998 — SITE CQA MANAGER day/mo/yr

FINAL APPROVAL: [signature] 9/18/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 18 Sept 98 — SITE CQA MANAGER day/mo/yr

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04

DESCRIPTION: Phase II YEAR: 1998

CONTRACTOR: PETRO

TEST DESCRIPTION: Air Pressure test, 10.8 psi minimum, w/o loss over 30 min.

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒

Penetration Box

TEST LOCATION: Cell #2, LCS redundant LCS penetration Box

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	17 Sept 1998	1255	11.6	Ø	CS
2	17 Sept 1998	1310	11.6	Ø	CS
3	17 Sept 1998	1325	11.6	Ø	CS

VISUAL MONITORING: [signature] 18 Sept 98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 17 Sept 1998 — SITE CQA MANAGER day/mo/yr

FINAL APPROVAL: [signature] 9/18/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 18/Sept 1998 — SITE CQA MANAGER day/mo/yr

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04

DESCRIPTION: Phase II YEAR: 1998

CONTRACTOR: PETRO

TEST DESCRIPTION: Air pressure test, 10.8 psi minimum W/Ø loss over 30 minutes

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒

Penetration Box

TEST LOCATION: Cell #2 LCS penetration Box

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	17 Sept 1998	1120	11.0	Ø	CL
2	17 Sept 1998	1135	11.0	Ø	CL
3	17 Sept 1998	1150	11.0	Ø	CL

VISUAL MONITORING: [signature] 18 Sept 98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 17 Sept 1998 — SITE QA MANAGER day/mo/yr

FINAL APPROVAL: [signature] 18 Sept 98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 18 Sept 98 — SITE QA MANAGER day/mo/yr

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04

DESCRIPTION: PHASE II CONSTRUCTION YEAR: 1998

CONTRACTOR: PETRO ENVIRONMENTAL

TEST DESCRIPTION: AIR PRESSURE TEST ON 10" LDS PIPE FOR CELL-2 / 15psi minimum for 1 hr Ø psi loss

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☑ MANHOLE: ☐ OTHER: ☐

TEST LOCATION: CELL-2 10" LDS PIPE from penetration box to Manhole #2

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
#1	15 SEPT. 98	1545	15.1	—	RDH
#2	15 SEPT 98	1600	15.1	Ø	RDH
#3	15 SEPT 98	1615	15.1	Ø	RDH
#4	15 SEPT 98	1630	15.1	Ø	RDH
#5	15 SEPT 98	1645	15.1	Ø	RDH

VISUAL MONITORING: J. Richard Schaubs 9/18/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; Rodney [illegible] 18 SEPT. 1998 — SITE CQA ~~MANAGER~~ Representative day/mo/yr

FINAL APPROVAL: J. Richard Schaubs 9/18/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; Collins P. Sykes 18 Sept 1998 — SITE CQA MANAGER day/mo/yr

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04

DESCRIPTION: Phase II YEAR: 1998

CONTRACTOR: PETRO

TEST DESCRIPTION: One hour, air pressure test. Minimum 15 psi for one hour with Ø psi loss.

MATERIAL DESCRIPTION: FORCEMAIN: ☑ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☐

6" LDS gravity force main.

TEST LOCATION: From the LDS manhole #2 to the Cell #2 penetration boxes

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	18 Sept 98	1315	15.2 psi	Ø	CS
2	↓	1330	15.2	Ø	CS
3		1345	15.2	Ø	CS
4		~~1415~~ 1400	15.2	Ø	CS
5		1415	15.2	Ø	CS

VISUAL MONITORING: J. R. Schaubaum 9/22/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; Collin P. Nelson 22 Sept 1998 — SITE CQA MANAGER day/mo/yr

FINAL APPROVAL: J. R. Schaubaum 9/22/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; Collin P. Nelson 22 Sept 1998 — SITE CQA MANAGER day/mo/yr

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04

DESCRIPTION: PHASE II YEAR: 1998

CONTRACTOR: PETRO ENVIRONMENTAL

TEST DESCRIPTION: PRESSURIZE PENETRATION BOX FOR (1/2) HALF HOUR, NO CHANGE
PRESSURIZE PIPE FOR (1) ONE HOUR, NO CHANGE

MATERIAL DESCRIPTION: FORCEMAIN: ☒ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒
PRIMARY PENETRATION BOX LCS REDUNDANT / Gravity Forcemain

TEST LOCATION: Cell #2 Catchment Basin. From Cell #2 to Manhole #2

READING NO.	DATE (day/mo)	TIME	READING PSI	CHANGE IN READING	QA ID
1	20 OCT	1518 - 1548	15.0 TO 15.0	0 (Box)	MH
2	20 OCT	1555 - 1655	15.8 TO 15.8	0 (PIPE)	MH

VISUAL MONITORING: John Stury 21 10 98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr
Mike Hampton 20/10/98 — SITE CQA ~~MANAGER~~ REPRESENTATIVE day/mo/yr

FINAL APPROVAL: J. Richard Schenkenberg 28/11/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr
Carl M. Gulas 26 Oct 1998 — SITE CQA ~~MANAGER~~ day/mo/yr

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04

DESCRIPTION: PHASE II YEAR: 1998

CONTRACTOR: PETRO ENVIROUMENTAL

TEST DESCRIPTION: PRESSURIZE PENETRATION BOX FOR (1/2) HALF HOUR, NO CHANGE
PRESSURIZE PIPE FOR (1) ONE HOUR, NO CHANGE

MATERIAL DESCRIPTION: FORCEMAIN: ☒ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒
PRIMARY PENETRATION BOX LCS/ Gravity Forcemain

TEST LOCATION: CELL TWO CATCHMENT BASIN. From cell #2 To manhole #2.

READING NO.	DATE (day/mo)	TIME	READING PSI	CHANGE IN READING	QA ID
1	20 OCT	1400 - 1430	11.0 TO 11.0	0 BOX	DLE
2	20 OCT	1718 - 18-18	15.2 TO 15.2	0 PIPE	MH

VISUAL MONITORING: [signature] 21 10 98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr
[signature] 20/10/98 — SITE CQA ~~MANAGER~~ REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] 28/11/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr
[signature] 26 Oct 1998 — SITE CQA MANAGER day/mo/yr

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04

DESCRIPTION: OSDA - option year 1 YEAR: 1998

CONTRACTOR: Petro

TEST DESCRIPTION: 6" hydrostatic pressure test of horizontal monitoring well cell #3

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒

horizontal monitoring well

TEST LOCATION: Tested above ground prior to final placement for cell #3

Guage 97-0812 ~~@ 438' length~~ 140' length

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	13 May	0530	145 psi	—	CS
2	"	0545	145 psi	Ø	CS
3	"	0600	145 psi	Ø	CS
4	"	~~60~~ 0615	145 psi	Ø	CS
5	"	0630	145 psi	Ø	CS

VISUAL MONITORING: [signature] 14 5 98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 13/May 98 — SITE CQA ~~MANAGER~~ Representative day/mo/yr

FINAL APPROVAL: [signature] 5/14/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 13 May 98 — SITE CQA MANAGER day/mo/yr

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HDPE PIPING - HYDROSTATIC PRESSURE TEST RECORD

TEST RECORD NO.: HMW-03-006 DATE: May 13, 1998

LINE SERVICE NO.: Horizontal Monitoring Well - Cell #3	LINE MEDIUM: HDPE 6-in. dia. Carrier Pipe
MAX. OPERATING PRESSURE: Gravity	TEST PRESSURE: 120.0 PSI
SPECIFICATION CODE: Tech. Spec. Section 02605	TEST MEDIUM: Water

REFERENCE DRAWINGS/TEST BOUNDARIES:

Tested 6-in. dia., 140-lin. ft. long segment. To be installed from Village Building Service's tie-in point at Control Point No. 9303 (Horizontal Monitoring Well - Cell 3) to the perforated horizontal monitoring well assembly.

HDPE PIPE INSTALLED: No

BACKFILL CONDITIONS: Tested prior to installation; will be backfilled with embedment fill material.

ALL REQUIRED GAUGES INSTALLED/ISOLATED: Yes CONFIRMATION: Yes DATE: 05/05/98

CQC NOTIFIED: Yes --- GeoSyntec	DATE/TIME: 05/05/98 --- 2:00 PM
TEST GAUGE IDENT.: Certification Number: 97-0812	CALIBRATION DUE DATE: 08/12/98
TEST START TIME: 5:30 AM	TEST GAUGE READING: 145 PSI
TEST FINISH TIME: 6:30 AM	TEST GAUGE READING: 145 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		05/13/98
CQC CONSULT: [illegible]	X		05/13/98
FDF QA/QC: Michael [illegible]	X		05/13/98

REMARKS/COMMENTS:

None.

REVIEWED/TESTED BY: J. Richard Schairbaum DATE: 05/21/98

J. Richard Schairbaum, Quality Control Manager

PETRO environmental technologies

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GO0409 TASK NO.: 04.1

DESCRIPTION: Phase one YEAR: 1998

CONTRACTOR: Petro

TEST DESCRIPTION: ~~hydraulic~~ hydrostatic pressure test, 6" HDPE carrier pipe CELL #2 438' length

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☒

TEST LOCATION: Carrier pipe for LDS, LCS, and LCS redundant CELL #2 Guage # 97-0812 ~~[illegible]~~ TO BE CUT TO APPROPRIATE LENGTHS PRIOR TO INSTALLATION

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	14 May	0530	120psi	—	CS
2	"	~~0600~~ 0545	120psi	Ø	CS
3	"	0600	120psi	Ø	CS
4	"	0615	120psi	Ø	CS
5	"	0630	120psi	Ø	CS

VISUAL MONITORING: [signature] 14 5 98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; [signature] 14 MAY 98 — SITE CQA ~~MANAGER~~ Representative day/mo/yr

FINAL APPROVAL: [signature] 5/14/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; [signature] 14 may 98 — SITE CQA MANAGER day/mo/yr

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HDPE PIPING - HYDROSTATIC PRESSURE TEST RECORD

TEST RECORD NO.: LDS/LCS/R. LCS Pipe DATE: May 14, 1998

LINE SERVICE NO.: LDS/LCS/R. LCS for Cell #2	LINE MEDIUM: HDPE 6-in. dia. Carrier Pipe
MAX. OPERATING PRESSURE: Gravity	TEST PRESSURE: 120.0 PSI
SPECIFICATION CODE: Tech. Spec. Section 02605	TEST MEDIUM: Water

REFERENCE DRAWINGS/TEST BOUNDARIES:

Tested 6-in. dia., 438-lin. ft. long pipe for the LDS/LCS/R. LCS pipe sections to be installed accordingly into Cell #2. This pipe will be cut to the appropriate lengths prior to actual installation.

HDPE PIPE INSTALLED: No

BACKFILL CONDITIONS: Tested prior to installation; will be backfilled with embedment fill material.

ALL REQUIRED GAUGES INSTALLED/ISOLATED: Yes CONFIRMATION: Yes DATE: 05/13/98

CQC NOTIFIED: Yes --- GeoSyntec	DATE/TIME: 05/13/98 — 4:00 PM
TEST GAUGE IDENT.: Certification Number: 97-0812	CALIBRATION DUE DATE: 08/12/98
TEST START TIME: 5:30 AM	TEST GAUGE READING: 120 PSI
TEST FINISH TIME: 6:30 AM	TEST GAUGE READING: 120 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		05/14/98
CQC CONSULT.:	X		05/14/98
FDF QA/QC: Michael W. Geller	X		05/14/98

REMARKS/COMMENTS:

None.

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REVIEWED/TESTED BY: J. Richard Schairbaum DATE: 05/21/98

J. Richard Schairbaum, Quality Control Manager

PETRO environmental technologies

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00409 TASK NO.: 04.1

DESCRIPTION: Phase one YEAR: 1998

CONTRACTOR: Petro Environmental Technologies (PET)

TEST DESCRIPTION: 1 hour hydro pressure test 120 psi min with no allowable loss

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☐

TEST LOCATION: 6" HDPE ~~containment~~ CAPPED PIPE FOR CELL #3 4/30' OF PIPE TESTED

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	15/05	0545	122 psi	—	BL
2	↓	0600	↓	0 psi	↓
3		0615			
4		0630			
5		0645			

VISUAL MONITORING: S.B. Brandetto 5/15/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; B. Brown 15/05/98 — SITE QA ~~MANAGER~~ REP. day/mo/yr

FINAL APPROVAL: S.B. Brandetto 5/15/98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; J.E. Smith 15 May '98 — SITE QA MANAGER day/mo/yr

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HDPE PIPING - HYDROSTATIC PRESSURE TEST RECORD

TEST RECORD NO.: LDS/LCS/R. LCS Pipe DATE: May 15, 1998

LINE SERVICE NO.: LDS/LCS/R. LCS for Cell #3	LINE MEDIUM: HDPE 6-in. dia. Carrier Pipe
MAX. OPERATING PRESSURE: Gravity	TEST PRESSURE: 120.0 PSI
SPECIFICATION CODE: Tech. Spec. Section 02605	TEST MEDIUM: Water

REFERENCE DRAWINGS/TEST BOUNDARIES:

Tested 6-in. dia., 430-lin. ft. long pipe for the LDS/LCS/R. LCS pipe sections to be installed accordingly into Cell #3. This pipe will be cut to the appropriate lengths prior to actual installation.

HDPE PIPE INSTALLED: No

BACKFILL CONDITIONS: Tested prior to installation; will be backfilled with embedment fill material.

ALL REQUIRED GAUGES INSTALLED/ISOLATED: Yes CONFIRMATION: Yes DATE: 05/13/98

CQC NOTIFIED: Yes --- GeoSyntec	DATE/TIME: 05/14/98 --- 4:00 PM
TEST GAUGE IDENT.: Certification Number: 97-0812	CALIBRATION DUE DATE: 08/12/98
TEST START TIME: 5:45 AM	TEST GAUGE READING: 122 PSI
TEST FINISH TIME: 6:45 AM	TEST GAUGE READING: 122 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		05/15/98
CQC CONSULT:	X		05/15/98
FDF QA/QC:	X		05/15/98

REMARKS/COMMENTS:

None.

REVIEWED/TESTED BY: J. Richard Schairbaum DATE: 05/21/98

J. Richard Schairbaum, Quality Control Manager

PETRO environmental technologies

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04.1

DESCRIPTION: Phase I Construction YEAR: 1998

CONTRACTOR: Petro Env. (w/ Debra)

TEST DESCRIPTION: 1-hour air pressure test, 15 psi minimum.

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒

Horizontal Monitoring well 6"

TEST LOCATION: LCS/LDS-02 horizontal monitoring well

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	18 May	16:00	18 psi	—	RP
2	↓	16:15	18 psi	Ø	RP
3		16:30	18 psi	Ø	RP
4		16:45	18 psi	Ø	RP
5		17:00	18 psi	Ø	RP

Gauge certification # 970813

VISUAL MONITORING: [signature] 18 5 98 — CONTRACTOR'S REPRESENTATIVE, day/mo/yr — Rob Reddicord 18-05-98 RP — SITE CQA ~~MANAGER~~ Technician, day/mo/yr 18 May 98

FINAL APPROVAL: [signature] 18 5 98 — CONTRACTOR'S REPRESENTATIVE, day/mo/yr — [signature] — SITE CQA MANAGER, day/mo/yr 19 May 98

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HDPE PIPING - HYDROSTATIC PRESSURE TEST RECORD

TEST RECORD NO.: Horizontal Monitoring Well - Cell 2 DATE: May 18, 1998

LINE SERVICE NO.: Horizontal Monitoring Well	LINE MEDIUM: HDPE 6-in. dia. pipe
MAX. OPERATING PRESSURE: Gravity	TEST PRESSURE: 15.0 PSI
SPECIFICATION CODE: Tech. Spec. Section 02605	TEST MEDIUM: Air

REFERENCE DRAWINGS/TEST BOUNDARIES:

This test was conducted on the horizontal monitoring well after fusion welding the solid portion to VBS' tie-in location at Cell #2.

HDPE PIPE INSTALLED: No

BACKFILL CONDITIONS: Tested prior to installation; will be backfilled with embedment fill material.

ALL REQUIRED GAUGES INSTALLED/ISOLATED: Yes CONFIRMATION: Yes DATE: 05/18/98

CQC NOTIFIED: Yes — GeoSyntec	DATE/TIME: 05/18/98 — 9:00 AM
TEST GAUGE IDENT.: Certification Number: 97-0813	CALIBRATION DUE DATE: 08/12/98
TEST START TIME: 4:00 PM	TEST GAUGE READING: 18 PSI
TEST FINISH TIME: 5:00 PM	TEST GAUGE READING: 18 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		05/18/98
CQC CONSULT.:	X		05/18/98
FDF QA/QC:	X		05/18/98

REMARKS/COMMENTS:

None.

REVIEWED/TESTED BY: J. Richard Schairbaum DATE: 05/22/98

J. Richard Schairbaum, Quality Control Manager

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04

DESCRIPTION: Phase one / option year #1 YEAR: 1998

CONTRACTOR:

TEST DESCRIPTION: 1 hour air pressure test @ 15 psi (min) with no loss

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒

TEST LOCATION: Horizontal monitoring well @ cell # 2 (retest due to added 7' solid wall pipe)

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	19/5	1445	17.5 psi	—	BE
2	↓	1500	↓	0 psi	↓
3		1515		↓	
4		1530			
5		1545			

VISUAL MONITORING: [signature] CONTRACTOR'S REPRESENTATIVE day/mo/yr — [signature] 19/5/98 SITE CQA ~~MANAGER~~ REP day/mo/yr

FINAL APPROVAL: [signature] CONTRACTOR'S REPRESENTATIVE day/mo/yr — [signature] 20 May 98 SITE CQA MANAGER day/mo/yr

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HDPE PIPING - HYDROSTATIC PRESSURE TEST RECORD

TEST RECORD NO.: HMW-02-006 DATE: May 19, 1998

LINE SERVICE NO.: Horizontal Monitoring Well - Cell #2	LINE MEDIUM: HDPE 6-in. dia. Carrier Pipe
MAX. OPERATING PRESSURE: Gravity	TEST PRESSURE: 15.0 PSI
SPECIFICATION CODE: Tech. Spec. Section 02605	TEST MEDIUM: ~~Water~~ air

REFERENCE DRAWINGS/TEST BOUNDARIES:

Re-tested the 6-in. dia. horizontal monitoring well installed at Cell 2 because of an additional 7-lin. ft. of solid wall pipe added to the previously tested and passed pipe. Was tested from the end of the pipe back to Manhole No. 2.

HDPE PIPE INSTALLED: No

BACKFILL CONDITIONS: Tested prior to installation; will be backfilled with embedment fill material.

ALL REQUIRED GAUGES INSTALLED/ISOLATED: Yes CONFIRMATION: Yes DATE: 05/19/98

CQC NOTIFIED: Yes — GeoSyntec	DATE/TIME: 05/19/98 — 2:00 PM
TEST GAUGE IDENT.: Certification Number: 97-0812	CALIBRATION DUE DATE: 08/12/98
TEST START TIME: 2:45 PM	TEST GAUGE READING: 17.8 PSI
TEST FINISH TIME: 3:45 PM	TEST GAUGE READING: 17.8 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		05/19/98
CQC CONSULT:	X		05/19/98
FDF QA/QC:	X		05/19/98

REMARKS/COMMENTS:

None.

RECEIVED MAY 26 1998 R. Grisman

REVIEWED/TESTED BY: J. Richard Schairbaum DATE: 05/21/98

Richard Schairbaum, Quality Control Manager

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04

DESCRIPTION: Phase I Constr. YEAR: 1998

CONTRACTOR: Retro Env.

TEST DESCRIPTION: 1 hour pressure test w/air. 15 psi minimum

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☐

430' segement of LCS pipe for Cell-3, 10" diam.

TEST LOCATION: Pipe laying above ground, To be cut into appropriate lengths to be placed where needed in Cell-3 system (LCS, LDS, LCS redundant)

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	20 May	10:15	16 psi	—	RP
2	↓	10:30	16 psi	Ø	RP
3		10:45	16 psi	Ø	RP
4		11:00	16 psi	Ø	RP
5		11:15	16 psi	Ø	

Gauge certification # 970813

VISUAL MONITORING: [signature] 20 5 98 [signature] 20 May 1998
CONTRACTOR'S REPRESENTATIVE day/mo/yr SITE CQA ~~MANAGER~~ TECHNICIAN 20 May 1998 RP day/mo/yr

FINAL APPROVAL: [signature] 20 5 98 [signature] 20 May '98
CONTRACTOR'S REPRESENTATIVE day/mo/yr SITE CQA MANAGER day/mo/yr

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HDPE PIPING - HYDROSTATIC PRESSURE TEST RECORD

TEST RECORD NO.: LDS/LCS/R. LCS Pipe DATE: May 20, 1998

LINE SERVICE NO.: LDS/LCS/R. LCS for Cell #3	LINE MEDIUM: HDPE 10-in. dia. Containment Pipe
MAX. OPERATING PRESSURE: Gravity	TEST PRESSURE: 15.0 PSI
SPECIFICATION CODE: Tech. Spec. Section 02605	TEST MEDIUM: ~~Water~~ Air

REFERENCE DRAWINGS/TEST BOUNDARIES:

Tested 10-in. dia., 430-lin. ft. long pipe for the LDS/LCS/R. LCS pipe sections to be installed accordingly into Cell #3. This pipe will be cut to the appropriate lengths prior to actual installation.

HDPE PIPE INSTALLED: No

BACKFILL CONDITIONS: Tested prior to installation; will be backfilled with embedment fill material.

ALL REQUIRED GAUGES INSTALLED/ISOLATED: Yes CONFIRMATION: Yes DATE: 05/20/98

CQC NOTIFIED: Yes — GeoSyntec	DATE/TIME: 05/19/98 — 4:00 PM
TEST GAUGE IDENT.: Certification Number: 97-0813	CALIBRATION DUE DATE: 08/12/98
TEST START TIME: 10:15 AM	TEST GAUGE READING: 16 PSI
TEST FINISH TIME: 11:15 AM	TEST GAUGE READING: 16 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		05/20/98
CQC CONSULT.:	X		05/20/98
FDF QA/QC:	X		05/20/98

REMARKS/COMMENTS:

None.

RECEIVED MAY 26 1998 R. Dusman

REVIEWED/TESTED BY: J. Richard Schairbaum DATE: 05/21/98

J. Richard Schairbaum, Quality Control Manager

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04.1

DESCRIPTION: Phase I Constr. YEAR: 1998

CONTRACTOR: Retro Env.

TEST DESCRIPTION: 1-hour air pressure test, 15 psi minimum

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ MANHOLE: ☐ OTHER: ☐

10" containment pipe

TEST LOCATION: 438' long pipe segment laying above ground. Pipe to be cut into appropriate lengths as needed for Cell-2 LCS, LCS redundant, & LDS

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	21 May	08:10	16 psi	—	RP
2	↓	08:45	16 psi	Ø	RP
3		09:15	16 psi	Ø	RP

Gauge certification # 970813

VISUAL MONITORING: [signature] 21 MAY 98 — CONTRACTOR'S REPRESENTATIVE, day/mo/yr; [signature] 21 May 98 — SITE CQA ~~MANAGER~~ RP, day/mo/yr

FINAL APPROVAL: [signature] 21 MAY 98 — CONTRACTOR'S REPRESENTATIVE, day/mo/yr; [signature] 21 May 98 — SITE CQA MANAGER, day/mo/yr

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HDPE PIPING - HYDROSTATIC PRESSURE TEST RECORD

TEST RECORD NO.: LDS/LCS/R. LCS Pipe DATE: May 21, 1998

LINE SERVICE NO.: LDS/LCS/R. LCS for Cell #2	LINE MEDIUM: HDPE 10-in. dia. Containment Pipe
MAX. OPERATING PRESSURE: Gravity	TEST PRESSURE: 15.0 PSI
SPECIFICATION CODE: Tech. Spec. Section 02605	TEST MEDIUM: Air

REFERENCE DRAWINGS/TEST BOUNDARIES:

Tested 10-in. dia., 438-lin. ft. long pipe for the LDS/LCS/R. LCS pipe sections to be installed accordingly into Cell #2. This pipe will be cut to the appropriate lengths prior to actual installation.

HDPE PIPE INSTALLED: No

BACKFILL CONDITIONS: Tested prior to installation; will be backfilled with embedment fill material.

ALL REQUIRED GAUGES INSTALLED/ISOLATED: Yes CONFIRMATION: Yes DATE: 05/20/98

CQC NOTIFIED: Yes — GeoSyntec	DATE/TIME: 05/20/98 — 1:00 PM
TEST GAUGE IDENT.: Certification Number: 97-0813	CALIBRATION DUE DATE: 08/12/98
TEST START TIME: 8:10 AM	TEST GAUGE READING: 16 PSI
TEST FINISH TIME: 9:15 AM	TEST GAUGE READING: 16 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		05/21/98
CQC CONSULT.:	X		05/21/98
FDF QA/QC:	X		05/21/98

REMARKS/COMMENTS:

None.

REVIEWED/TESTED BY: J. Richard Schairbaum DATE: 05/26/98

J. Richard Schairbaum, Quality Control Manager

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00409 TASK NO.: 04

DESCRIPTION: PHASE 1 CONSTRUCTION YEAR: 98

CONTRACTOR: PETRO ENVIRONMENTAL

TEST DESCRIPTION: AIR PRESSURE TEST ON 6" HORIZONTAL MONITORING WELL. (10 MIN. MINIMUM)

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☑

6" GRAVITY LINE

TEST LOCATION: CELL-3 HORIZONTAL MONITORING WELL 6" PIPE (PETRO HALF)

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
#1	3 JUNE 98	10:17 A.M.	17 PSI	—	RDH
#2	3 JUNE 98	10:32 A.M.	17 PSI	Ø	RDH
#3	3 JUNE 98	10:47 A.M.	17 PSI	Ø	RDH
#4	3 JUNE 98	11:02 A.M.	17 PSI	Ø	RDH
#5	3 JUNE 98	11:17 A.M.	17 PSI	Ø	RDH
	* ASHCROFT DURAGUAGE # 97-0813				

VISUAL MONITORING: John Storey 3 6 98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; Rodney P. Hummel 3 JUNE 98 — SITE CQA ~~MANAGER~~ TECH. day/mo/yr

FINAL APPROVAL: John Storey 3 6 98 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; [signature] 4 June '98 — SITE CQA MANAGER day/mo/yr

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HDPE PIPING - HYDROSTATIC PRESSURE TEST RECORD

TEST RECORD NO.: Cell 3 - Horizontal Monitoring Well DATE: June 3, 1998

LINE SERVICE NO.: Cell 3 Horiz. Mon. Well (6" Pipe)	LINE MEDIUM: HDPE 6-in. dia. Gravity Pipe
MAX. OPERATING PRESSURE: Gravity	TEST PRESSURE: 15.0 PSI
SPECIFICATION CODE: Tech. Spec. Section 02605	TEST MEDIUM: Air

REFERENCE DRAWINGS/TEST BOUNDARIES:

Tested the 6-in., dia. horizontal montoring well (Petro's half) from the tie-in location at the West Berm following installation.

HDPE PIPE INSTALLED: Yes, but not buried.

BACKFILL CONDITIONS: Tested prior to backfilling with embedment fill material.

ALL REQUIRED GAUGES INSTALLED/ISOLATED: Yes CONFIRMATION: Yes DATE: 06/01/98

CQC NOTIFIED: Yes — GeoSyntec	DATE/TIME: 06/03/98 — 8:00 AM
TEST GAUGE IDENT.: Certification Number: 97-0813	CALIBRATION DUE DATE: 08/12/98
TEST START TIME: 10:17 AM	TEST GAUGE READING: 17 PSI
TEST FINISH TIME: 11:17 AM	TEST GAUGE READING: 17 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		06/03/98
CQC CONSULT:	X		06/03/98
FDF QA/QC:	X		06/03/98

REMARKS/COMMENTS:

None.

REVIEWED/TESTED BY: J. Richard Schairbaum DATE: 06/24/98

J. Richard Schairbaum, Quality Control Manager

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04

DESCRIPTION: PHASE 1 CONSTRUCTION YEAR: 98

CONTRACTOR: PETRO ENVIRONMENTAL

TEST DESCRIPTION: ABOVE GROUND AIR PRESSURE TEST OF 10" HIGH DENSITY POLYEUROTHANE CONTAINMENT PIPE TO BE DIVIDED INTO 3 SEGMENTS INTENDED FOR CELL-3 LDS, LCS, LCS REDUNDANT.

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☑

10" HIGH DENSITY POLYEUROTHANE CONTAINMENT PIPE (GRAVITY)

TEST LOCATION: REFER TO TEST DESCRIPTION ABOVE

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
#1	4 JUNE 98	0807 A.M.	17 PSI	—	RDH
#2	4 JUNE 98	0822 A.M.	17 PSI	Ø	RDH
#3	4 JUNE 98	0837 A.M.	17 PSI	Ø	RDH
#4	4 JUNE 98	0852 A.M.	17 PSI	Ø	RDH
#5	4 JUNE 98	0907 A.M.	17 PSI	Ø	RDH
	*	97-0813 GAUGE			

VISUAL MONITORING: [signature] 4 6 98 — CONTRACTOR'S REPRESENTATIVE, day/mo/yr; [signature] 4 JUNE 98 — SITE CQA ~~MANAGER~~ TECH., day/mo/yr

FINAL APPROVAL: [signature] 4 6 98 — CONTRACTOR'S REPRESENTATIVE, day/mo/yr; [signature] 5 June 98 — SITE CQA MANAGER, day/mo/yr

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HDPE PIPING - HYDROSTATIC PRESSURE TEST RECORD

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TEST RECORD NO.: LDS/LCS/R. LCS Pipe DATE: June 4, 1998

LINE SERVICE NO.: LDS/LCS/R. LCS for Cell #3	LINE MEDIUM: HDPE 10-in. dia. Containment Pipe
MAX. OPERATING PRESSURE: Gravity	TEST PRESSURE: 15.0 PSI
SPECIFICATION CODE: Tech. Spec. Section 02605	TEST MEDIUM: Air

REFERENCE DRAWINGS/TEST BOUNDARIES:

Tested 10-in. dia., 513-lin. ft. long pipe for the LDS/LCS/R. LCS pipe sections to be installed accordingly into Cell #3. This pipe will be cut to the appropriate lengths prior to actual installation.

This test was conducted after an additional +/- 80-lin. ft. was added to the pre-tested length of pipe.

HDPE PIPE INSTALLED: No

BACKFILL CONDITIONS: Tested prior to installation; will be backfilled with embedment fill material.

ALL REQUIRED GAUGES INSTALLED/ISOLATED: Yes CONFIRMATION: Yes DATE: 06/01/98

CQC NOTIFIED: Yes — GeoSyntec	DATE/TIME: 06/03/98 — 4:00 PM
TEST GAUGE IDENT.: Certification Number: 97-0813	CALIBRATION DUE DATE: 08/12/98
TEST START TIME: 8:07 AM	TEST GAUGE READING: 17 PSI
TEST FINISH TIME: 9:07 AM	TEST GAUGE READING: 17 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		06/04/98
CQC CONSULT.:	X		06/04/98
FDF QA/QC:	X		06/04/98

REMARKS/COMMENTS:

None.

REVIEWED/TESTED BY: J. Richard Schairbaum DATE: 06/24/98

J. Richard Schairbaum, Quality Control Manager

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FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04

DESCRIPTION: PHASE 1 CONSTRUCTION YEAR: 98

CONTRACTOR: PETRO ENVIRONMENTAL

TEST DESCRIPTION: WATER PRESSURE TEST OF 513' LONG 6" HIGH DENSITY POLYURETHANE PIPE. (ABOVE GROUND)

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: ☒

CARRIER (6") to be used for LCS, LCS Redundant, LDS - Cell 3

TEST LOCATION: ABOVE GROUND TEST.

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
#1	5 JUNE 98	0530 A.M.	122 PSI	—	RDH
#2	5 JUNE 98	0545 A.M.	122 PSI	Ø	RDH
#3	5 JUNE 98	0600 A.M.	122 PSI	Ø	RDH
#4	5 JUNE 98	0615 A.M.	122 PSI	Ø	RDH
#5	5 JUNE 98	0630 A.M.	122 PSI	Ø	RDH
	* 97 -	0812 GAUGE			

VISUAL MONITORING: John Stacy — CONTRACTOR'S REPRESENTATIVE — 5-6-98 day/mo/yr — Robert P. Durnal — SITE CQA ~~MANAGER~~ TECH. — 5 JUNE 98 day/mo/yr

FINAL APPROVAL: John Stacy — CONTRACTOR'S REPRESENTATIVE — 5-6-98 day/mo/yr — SITE CQA MANAGER — 8 June '98 day/mo/yr

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HDPE PIPING - HYDROSTATIC PRESSURE TEST RECORD

TEST RECORD NO.: LDS/LCS/R. LCS Pipe DATE: June 5, 1998

LINE SERVICE NO.: LDS/LCS/R. LCS for Cell #3	LINE MEDIUM: HDPE 6-in. dia. Carrier Pipe
MAX. OPERATING PRESSURE: Gravity	TEST PRESSURE: 120.0 PSI
SPECIFICATION CODE: Tech. Spec. Section 02605	TEST MEDIUM: Water

REFERENCE DRAWINGS/TEST BOUNDARIES:

Tested 6-in. dia., 513-lin. ft. long pipe for the LDS/LCS/R. LCS pipe sections to be installed accordingly into Cell #3. This pipe will be cut to the appropriate lengths prior to actual installation.

This test was conducted after an additional +/- 80-lin. ft. was added to the pre-tested length of pipe.

HDPE PIPE INSTALLED: No

BACKFILL CONDITIONS: Tested prior to installation; will be backfilled with embedment fill material.

ALL REQUIRED GAUGES INSTALLED/ISOLATED: Yes CONFIRMATION: Yes DATE: 06/01/98

CQC NOTIFIED: Yes --- GeoSyntec	DATE/TIME: 06/04/98 — 4:00 PM
TEST GAUGE IDENT.: Certification Number: 97-0812	CALIBRATION DUE DATE: 08/12/98
TEST START TIME: 5:30 AM	TEST GAUGE READING: 122 PSI
TEST FINISH TIME: 6:30 AM	TEST GAUGE READING: 122 PSI

TEST VERIFICATION	ACCEPT	REJECT	DATE
CONTRACTOR: J. Richard Schairbaum	X		06/05/98
CQC CONSULT:	X		06/05/98
FDF QA/QC:	X		06/05/98

REMARKS/COMMENTS:

None.

REVIEWED/TESTED BY: J. Richard Schairbaum DATE: 06/24/98

J. Richard Schairbaum, Quality Control Manager

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APPENDIX E

APPENDIX E
LTS OPERATIONAL DATA

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Inspection and Maintenance Requirements

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TABLE 3-1

LEACHATE COLLECTION AND LEAK DETECTION SYSTEMS INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections		Conditions to Check	Remedy
	Active Period	Closure Period		
LDS	Weekly	Weekly for the first three months after cell closure, then monthly for the remainder of the first year	• condition of submersible level transmitter and appurtenances	• check level transmitter operations (e.g., operating temperature range, accuracy, etc.), electrical connections, and alarm light.
			• leakage from primary containment vessel	• check for source of leak; if source identified then take appropriate corrective measures (i.e., spot-seal vessel, replace vessel, etc.)
			• liquid in LDS containment pipe	• keep monitoring port drained; perform video inspection of pipe and attempt to identify source of leakage; develop plan to mitigate effects
LCS	Weekly	Weekly for the first three months after cell closure, then monthly for the remainder of the first year	• condition of submersible level transmitter and appurtenances	• check level transmitter operations (e.g., operating temperature range, accuracy, etc.), electrical connections, strobe light, and radio transmission
			• condition of shutoff valve	• check valve operability; correct any deficiencies
			• liquid in LCS containment pipe	• keep monitoring port drained; perform video inspection of pipe and attempt to identify source of leakage; develop plan to mitigate effects
			• liquid in redundant LCS carrier pipe	• drain pipe into LTS gravity line
LDS & LCS Pipes	prior to the start of active operations, then annually	Annually	Video inspect for: • crushing of pipe • clogging of pipe	• flush clogged pipe with water or mechanically clean • insert small diameter pipe in crushed pipe, if possible • replace crushed pipe if crushed portion is outside of the cell • utilize redundant LCS pipe

Notes: (1) Frequencies of inspection and maintenance activities are preliminary.
(2) Leachate collection and leak detection systems shall be inspected after the occurrence of major earthquakes.

TABLE 3-2

LDS/LCS MANHOLES AND LTS GRAVITY LINE INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections		Conditions to Check	Remedy
	Active Period	Closure Period		
LDS Manholes	Weekly	Weekly for the first three months after cell closure, then monthly	• confirm all required signage is visible	• repair and/or replace as necessary
			• cracked, broken manhole cover	• replace manhole cover
			• leaking seal on manhole cover	• replace seal
			• general structural condition of containment vessel	• check for structural integrity; if problems are found, take appropriate measures (i.e., spot seal vessel, replace vessel, etc.) and implement permanent solution
			• odors, bacterial growth (containment vessel)	• flush and/or spray sodium hypochlorite into containment vessel
LCS Gravity Line	Weekly	Monthly	• liquid in LCS gravity line containment pipe	• keep containment pipe drained; performed video inspection of pipe and attempt to identify source of leakage; if leakage is minor, continue to operate; if leakage is significant, evaluate repair options with CCM
			• inspection of pipe for clogging or crushing (annual only)	• flush clogged pipe with water or mechanically clean; repair as necessary
			• butterfly valve in proper position	• adjust valve to limit flow to permanent lift station to 200 gpm
LDS Gravity Line	Weekly	Monthly	• liquid in LDS gravity line containment pipe	• keep containment pipe drained; performed video inspection of pipe and attempt to identify source of leakage; if leakage is minor, continue to operate; if leakage is significant, evaluate repair options with CCM
			• inspection of pipe for clogging or crushing (annual only)	• flush clogged pipe with water or mechanically clean; repair as necessary
LTS Gravity Line	Weekly	Monthly	• liquid in LTS gravity line containment pipe	• keep containment pipe drained; performed video inspection of pipe and attempt to identify source of leakage; if leakage is minor, continue to operate; if leakage is significant, evaluate repair options with CCM
			• inspection of pipe for clogging or crushing (annual only)	• flush clogged pipe with water or mechanically clean; repair as necessary
LCS Manholes	Weekly	Weekly for the first three months after cell closure, then monthly	• confirm all required signage is visible	• repair and/or replace as necessary
			• cracked, broken manhole cover	• replace manhole cover
			• leaking seal on manhole cover	• replace seal
			• completion of OSDF construction	• remove designed valves and replace with pipe spool piece
			• general structural condition of manhole	• check for structural integrity; if damage is observed, assess extent and make repair recommendations

Notes: (1) Frequencies of inspection and maintenance activities are preliminary.
(2) LDS/LCS manholes and LTS gravity line shall by inspected after the occurrence of major earthquakes.

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TABLE 3-3

GRAVITY LINE INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections		Conditions to Check	Remedy
	Active Period	Closure Period		
Temporary Gravity Line	Weekly	N/A	• record accumulated flow at disc flow meter; check that flow meter is operation (3) • leakage from temporary gravity line and plumbing • condition of liquid transmitter for temporary gravity secondary containment system • frost protection soil cover • liquid in temporary gravity line containment pipe	• repair and/or replace as necessary • investigate source of leakage, repair as necessary • check sensor operations, electrical connections, and alarm light • increase soil cover if inadequate cover exists • keep containment pipe drained; perform video inspection of pipe and attempt to identify source of leakage; if leakage is minor, continue to operate; if leakage is significant, evaluate repair options with CCM

Notes: (1) Frequencies of inspection and maintenance activities are preliminary.
(2) LDS/LCS manholes and LTS gravity line shall by inspected after the occurrence of major earthquakes.

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OSDF PHASE I

Petro Environmental Technologies Inc.

Weekly Inspection Record-LDS Manhole #1

Inspection Date	Deficiencies Noted	Action Taken
12/23/97	Liquid in primary & secondary containment vessel	Approx. 300-gal of stormwater was discharged to FEMP stormwater drain
12/26/97	Liquid in primary containment vessel	Pumped approx. 165-ga to LCS 2-inch riser
12/30/97	Liquid in primary containment vessel	Pumped approx. 165-ga to LCS 2-inch riser
1/5/98	Liquid in primary containment vessel	Pumped approx. 165-ga to LCS 2-inch riser
1/6/98	Liquid in primary containment vessel	Pumped approx. 165-ga to LCS 2-inch riser
1/7/98	Liquid in primary containment vessel	Pumped approx. 165-ga to LCS 2-inch riser
1/13/98	Liquid in primary & secondary containment vessel	Pumped approx 200-gal. to LCS 2-inch riser
1/20/98	None	
1/27/98	None	
2/2/98	None	
2/10/98	Liquid in primary containment vessel	Pumped approx. 165-ga to LCS 2-inch riser
2/17/98	None	
2/23/98	Liquid in primary & secondary containment vessel	Pumped approx 200-gal. to LCS 2-inch riser
3/2/98	None	
3/9/98	None	
3/16/98	Liquid in primary & secondary containment vessel	Pumped approx 200-gal. to LCS 2-inch riser
4/3/98	Liquid in primary & secondary containment vessel	Pumped approx 255-gal. to LCS 2-inch riser
4/10/98	None	
4/14/98	Liquid in primary & secondary containment vessel	Pumped approx 205-gal. to LCS 2-inch riser
4/20/98	None	
4/27/98	None	
5/4/98	Liquid in primary & secondary containment vessel	Pumped approx 347-gal. to LCS 2-inch riser
5/15/98	Liquid in primary & secondary containment vessel	Pumped approx 260-gal. to LCS 2-inch riser
5/29/98	Liquid in primary & secondary containment vessel	Pumped approx 305-gal. to LCS 2-inch riser
6/5/98	Liquid in primary & secondary containment vessel	Pumped approx 225-gal. to LCS 2-inch riser
6/11/98	None	
6/18/98	Liquid in primary & secondary containment vessel	Pumped approx 225-gal. to LCS 2-inch riser
6/24/98	Liquid in primary & secondary containment vessel	Pumped approx 265 gal toLCS 2-inch riser
7/6/98	Liquid in primary & secondary containment vessel	Pumped approx 325 gal to LCS 2-inch riser
7/13/98	Liquid in primary containment vessel	Pumped approx165 gal to LCS 2-inch riser

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7/20/98	Liquid in primary & secondary containment vessel	Pumped approx. 245 gal to LCS 2-inch riser
7/27/98	Liquid in primary & secondary containment vessel	Pumped approx. 1,765 gal to LCS 2-inch riser
7/29/98	Liquid in primary containment vessel	Pumped approx165 gal to LCS 2-inch riser
8/6/98	Liquid in primary containment vessel	Pumped approx165 gal to LCS 2-inch riser
8/24/98	Liquid in primary & secondary containment vessel	Pumped approx 405 gal to LCS 2-inch riser
8/27/98	Liquid in primary & secondary containment vessel	Pumped approx 465 gal to LCS 2-inch riser

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
November 20, 1998	121	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 50° F MIN.: 32° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.39
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Work Area:

No.	Trade	Hours	Location/Description of Work
3	Operators	10.0	Cell 3 – fine graded Protective Layer on Intercell Berm; Manhole Nos. 1-3 – pumped out water/inspected manholes; Site – general housekeeping.
	Laborers	26.0	Same as above.
	Mechanic	10.0	Sitewide – performed general equipment maintenance.
3	Televac Environmental	12.0	Manholes 1 & 2 – performed video inspection of LDS/LCS piping.
2	Hirsch & Associates	11.0	Cell 3 – collected Protective Layer certification shots.

Cell 1/Cell 2 Rad. Work Area:

No.	Trade	Hours	Location/Description of Work
6	Operators	12.0	OSDF Decon. Pad – decontaminated equipment.
1	Laborers	10.0	Same as above.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
2	Operators	12.0	SWU – assisted Schebor Bros. with hydroseeding, cleaned out the trenches at the Wheel Wash Facility, decontaminated equipment, constructed water line crossings, re-worked 4-in. dia. water line, and freeze-protected the water line system.
3	Laborers	28.0	Same as above.
1	Schebor Bros.	7.0	SWU – completed hydroseeding the IFP and surrounding areas, and seeded SP-7.

PETRO environmental technologies

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Hubbard Trucking H-1	06/26/98		06/29/98	0.0	10.0	0.0
Hubbard Trucking H-2	06/26/98		06/29/98	0.0	10.0	0.0
Hubbard Trucking H-3	06/26/98		06/29/98	0.0	10.0	0.0
Hubbard Trucking H-4	06/26/98		06/29/98	0.0	10.0	0.0
Hubbard Trucking H-5	06/26/98		06/29/98	0.0	10.0	0.0
Hubbard Trucking H-6	06/26/98		06/29/98	0.0	10.0	0.0
Hubbard Trucking H-7	06/26/98		06/29/98	0.0	10.0	0.0
Hubbard Trucking H-8	07/28/98		07/29/98	0.0	10.0	0.0
Hubbard Trucking H-9	07/28/98		07/29/98	0.0	10.0	0.0
Hubbard Trucking H-10	08/03/98		08/04/98	0.0	10.0	0.0
Hubbard Trucking H-11	08/10/98		08/11/98	0.0	10.0	0.0
Hubbard Trucking H-12	09/02/98		09/02/98	0.0	10.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or subcontractors):**

- **OSDF Work Area:**

Petro Environmental performed the following work today: ***Cell 3*** – completed fine grading of the Intercell Berm Protective Layer to meet certification points and to meet FDF's POC; ***Manhole Nos. 1-3*** – inspected the manholes and pumped out water as follows: Manhole No. 1 – pumped about 211 gallons from the Primary Containment Vessel (water was generated during flushing of LDS line to remove silt blockage and permit video inspection); Manhole No. 2 – pumped approximately 140 gallons of water from the Primary Containment Vessel. Manhole No. 3 was also pumped to remove rainwater that had collected prior to sealing of the risers and manhole appurtenances. Attached are copies of the Manhole Weekly Inspection Checklist; ***Site*** – performed general housekeeping.

Televac Environmental performed a video inspection of the LDS/LCS piping system at ***Manhole Nos. 1 and 2***. The inspection at Manhole No. 1 was an annual inspection of the piping, while the inspection conducted at Manhole No. 2 was to verify piping integrity following Cell 2 construction activities. Hirsch & Associates performed survey work in ***Cell 3*** today by collecting Protective Layer certification shots.

- **Cell 1/2 Rad. Work Area:**

Within this work area, Petro Environmental performed the following work: ***Cells 1 & 2*** – due to rain, no impacted materials were placed into the cells today; ***OSDF Decon. Pad*** – decontaminated the Cat 963 track loader and the Mack Roll-Off truck (for cable repair work).

- **SWU Work Area:**

The following work was completed in this work area today by Petro Environmental: Assisted Schebor Bros. with hydroseeding, cleaned out the trenches at the Wheel Wash Facility, decontaminated a pick-up truck, Volvo L120C loader, and D5C Dozer, constructed water line crossings at SP-4 and SP-1 (as requested by Dave Weber), re-worked the 4-in. dia. water line to replace a check valve to allow backfeed of SWU from construction water well, and drained water from the water line to protect against freezing over the weekend. Schebor Bros. completed hydroseeding (interim seed mix) the IFP and surrounding areas, and also seeded the SP-7 stockpile. Attached is a Follow-Up Phase Report detailing the geomembrane start-up test results for the liner installation activties performed along Interceptor Ditch #2.

WEEKLY INSPECTION CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 1

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Alarm Light	
	Leakage from Primary Containment Vessel	~~No~~ / Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ / Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Strobe Light	
	Position of Butterfly Valve	~~Acceptable~~ / Unacceptable	Adjust Valve Flow to 200 gpm	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
Inspected By: H. LEE OLIVER		Signature: H. Lee Oliver		Date: 11-17-98

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WEEKLY INSPECTION CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 2

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Alarm Light	
	Leakage from Primary Containment Vessel	~~No~~ / Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ / Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Strobe Light	
	Position of Butterfly Valve	~~Acceptable~~ / Unacceptable	Adjust Valve Flow to 200 gpm	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
Inspected By: H. LEE OLIVER		Signature: H. Lee Oliver		Date: 11-17-98

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PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
November 23, 1998	122	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 62° F MIN.: 47° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.00
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Work Area:

No.	Trade	Hours	Location/Description of Work
1	Operators	4.0	Cells 3/4 – graded Stockpile No. 10 to prepare for hydroseeding and graded general surrounding areas; Manhole No. 2 – pumped out water/inspected.
[illegible]	Mechanic	11.0	Sitewide – performed general equipment maintenance.
[illegible]	Schebor Bros.	2.0	Cells 3/4 – hydroseeded the Stockpile No. 10.

Cell 1/Cell 2 Rad. Work Area:

No.	Trade	Hours	Location/Description of Work
6	Operators	60.0	Cell 1 – continued to place impacted materials, placed material along haul road; Cell 2 – continued to place Select Layer; OSDF Decon. Pad – performed general housekeeping.
6	Laborers	60.0	Same as above.
2	Teamsters	20.0	Same as above.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
3	Operators	30.0	SWU – continued to haul AFP material into Cell 2, removed old fencing/trees and placed into Category 4 stockpile, pulled down edges of pile, & completed decontamination of equipment.
5	Laborers	43.0	Same as above.
12	Teamsters	115.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
[illegible] A25C Articulating Truck (#1)	03/23/98		03/23/98	0.0	10.0	0.0
V[illegible] A25C Articulating Truck (#2)	03/23/98		03/24/98	0.0	10.0	0.0

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Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Hubbard Trucking H-9	07/28/98		07/29/98	10.0	0.0	0.0
Hubbard Trucking H-10	08/03/98		08/04/98	10.0	0.0	0.0
Hubbard Trucking H-11	08/10/98		08/11/98	10.0	0.0	0.0
Hubbard Trucking H-12	09/02/98		09/02/98	10.0	0.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or sub-contractors):**

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- **OSDF Work Area:**

Petro Environmental performed the following work today: ***Cells 3/4*** – graded the general area and fine graded Stockpile No. 10 in preparation for hydroseeding; ***Manhole No. 2*** – inspected the manholes and pumped out water as follows: Manhole No. 2 – pumped about 211 gallons from the LDS primary containment vessel, approximately 792 gallons from the LDS manhole, and approximately 50 gallons from the LCS manhole (see attached Weekly Inspection Checklist).

- **Cell 1/2 Rad. Work Area:**

Within this work area, Petro Environmental performed the following work: ***Cell 1*** – impacted material was placed into the cell as follows: 14 ROBs (from OMTA) of Category 2 material were placed into Grid Locations 5H/6H; 94 loads of Category 1 material (from WIMS) which was used to cover Category 2 material, construct perimeter berms, and fill in Grid Location 6I; placed 1 lift of Category 1 material in Grid Location 5G and on the Haul Road along the Grid 5/4 line in Grids G & H; ***Cell 2*** – continued to place Category 1 flyash material (from AFP) during construction of the Select Layer (179 loads); ***Decon. Pad*** – performed general housekeeping and manifested Category 2 debris for placement into Cell 1.

SWU Work Area:

The following work was completed in this work area today by Petro Environmental: continued hauling flyash Category 1 material to the OSDF Cell 2 for construction of the Select Layer, removed old fencing/small trees from the AFP and placed into a Category 4 stockpile, pulled down the edges of the AFP toward the center of the stockpile, and completed decontamination/release of the Cat D5C dozer.

4. **Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):**

Petro Environmental's QC Inspector provided quality control oversight for today's work activities. Attached are the Follow-Up Phase Inspection reports for the definable features of work that were performed today.

5. **Tests Required by Plans and/or Specifications Performed and Results of Tests:**

None.

6. **Materials Received (Note inspection results and storage provided):**

None.

WEEKLY INSPECTION CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 1

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Alarm Light	
	Leakage from Primary Containment Vessel	~~No~~ / Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ / Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Strobe Light	
	Position of Butterfly Valve	~~Acceptable~~ / Unacceptable	Adjust Valve Flow to 200 gpm	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
Inspected By: H. LEE OLIVER		Signature: H. Lee Oliver		Date: 11-23-98

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WEEKLY INSPECTION CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 2

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Alarm Light	
	Leakage from Primary Containment Vessel	~~No~~ / Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	No / ~~Yes~~	Keep Monitoring Port Drained and Attempt to Identify Leak Source	Pumped out See attachment {(see Daily QC Report)
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ / Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Strobe Light	
	Position of Butterfly Valve	~~Acceptable~~ / Unacceptable	Adjust Valve Flow to 200 gpm	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	No / ~~Yes~~	Keep Monitoring Port Drained and Attempt to Identify Leak Source	Pumped out See attachment {(see Daily QC Report)
Inspected By:		Signature:		Date: 11/23/98

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PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

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Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
November 24, 1998	123	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 58° F MIN.: 29° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.00
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Work Area:

No.	Trade	Hours	Location/Description of Work
1	Laborers	10.5	Site – general housekeeping, worked on equipment; Manhole No. 3 – pumped out water from LCS tank.
	Mechanic	10.0	Sitewide – performed general equipment maintenance.
	Hirsch & Associates	20.0	Cell 2 – collected Select Layer certification points.

Cell 1/Cell 2 Rad. Work Area:

No.	Trade	Hours	Location/Description of Work
6	Operators	60.0	Cell 1 – placed impacted material into cell; Cell 2 – continued to place Select Layer.
6	Laborers	60.0	Same as above.
2	Teamsters	20.0	Same as above.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
3	Operators	30.0	SWU – continued hauling AFP material to OSDF, removed trees/geomembrane at AFP and placed on stockpiles on South Fields, graded/sealed AFP, worked on transite storage area, placed used oil drums on spill containment; OSDF Decon. Pad – installed fire hose; SWU Wheel Wash – evaluated automatic wheel wash equipment.
5	Laborers	48.0	Same as above.
12	Teamsters	102.0	Same as above.

PETRO environmental technologies

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Hubbard Trucking H-5	06/26/98		06/29/98	8.5	1.5	0.0
Hubbard Trucking H-6	06/26/98		06/29/98	8.5	1.5	0.0
Hubbard Trucking H-7	06/26/98		06/29/98	8.0	2.0	0.0
Hubbard Trucking H-8	07/28/98		07/29/98	8.5	1.5	0.0
Hubbard Trucking H-9	07/28/98		07/29/98	8.5	1.5	0.0
Hubbard Trucking H-10	08/03/98		08/04/98	8.5	1.5	0.0
Hubbard Trucking H-11	08/10/98		08/11/98	8.5	1.5	0.0
Hubbard Trucking H-12	09/02/98		09/02/98	8.5	1.5	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or subcontractors):**

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- **OSDF Work Area:**

Petro Environmental performed the following work today: A surface water management and erosion control inspection was conducted today for this work area. Attached is a copy of the Summary Report; ***Site*** – performed general housekeeping and worked on equipment; ***Manhole No. 3*** – pumped out approximately 1,728 gallons of water from the LCS manhole. Hirsch & Associates worked at ***Cell 2*** collected Top of Select Layer certification points.

- **Cell 1/2 Rad. Work Area:**

Within this work area, Petro Environmental performed the following work: A surface water management and erosion control inspection was conducted today for this work area. Attached is a copy of the Summary Report; ***Cell 1*** – impacted material was placed into the cell as follows: 14 ROBs (from OMTA) of Category 2 material were placed into Grid Locations 5H/6H; staged 2 ROBs (from OMTA) of Category 4 material (not placed); 81 loads of Category 1 material (from WIMS) which was used to cover Category 2 material, construct perimeter berms, and fill in Grid Locations 6F/G; ***Cell 2*** – continued to place Category 1 flyash material (from AFP) during construction of the Select Layer (135 loads).

- **SWU Work Area:**

The following work was completed in this work area today by Petro Environmental: A surface water management and erosion control inspection was conducted across the work area. Attached are a copies of the Summary Reports; continued hauling flyash Category 1 material to the OSDF Cell 2 for construction of the Select Layer; removed trees/geomem-brane from the AFP and placed on stockpiles at the South Fields; graded and sealed the AFP surface; worked on transite storage area by bagging, wrapping, and relocating materials; placed used oil drums within spill containment; ***OSDF Decon. Pad*** – installed fire hose to assist with decontamination of the ROB trucks; ***SWU Wheel Wash*** – evaluated the automatic wheel wash with InterClean representatives.

4. **Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):**

Petro Environmental's QC Inspector provided quality control oversight for today's work activities. Attached are the Follow-Up Phase Inspection reports for the definable features of work that were performed today.

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
December 02, 1998	127	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 65° F MIN.: 30° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.00
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Work Area:

No.	Trade	Hours	Location/Description of Work
1	Laborers	10.0	Work Area – performed general clean-up work; Manhole Nos. 1-3 – pumped water.
[illegible]	Mechanic	10.5	Sitewide – performed general equipment maintenance.

Cell 1/Cell 2 Rad. Work Area:

No.	Trade	Hours	Location/Description of Work
6	Operators	60.0	Cell 1 – placed impacted materials into the cell; Cell 2 – resumed placing the Select Layer.
7	Laborers	70.0	Same as above.
2	Teamsters	20.0	Same as above.
2	Hirsch & Associates	20.0	Attended safety meeting; Cell 2 – collected Select Layer certification points and prepared for surveying – data collection transfer.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
3	Operators	30.0	Resumed excavating the AFP and hauling to Cell 2; discovered oil contamination at the AFP – containerized for future disposal and disposition.
4	Laborers	40.0	Same as above.
11	Teamsters	110.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
V[illegible] A25C Articulating Truck (#1)	03/23/98		03/23/98	0.0	10.0	0.0
V[illegible] A25C Articulating Truck (#2)	03/23/98		03/24/98	0.0	10.0	0.0
Volvo A25C Articulating Truck (#3)	03/23/98		03/24/98	0.0	10.0	0.0

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3. **Work Performed Today (Indicate location and description of work performed by prime and/or subcontractors):**

2195

OSDF Work Area:

Within this work area, Petro Environmental completed the following work activities: ***General Area*** – conducted general housekeeping/clean-up of work area; ***Manhole Nos. 1-3*** – pumped water as follows: ***Manhole No. 1***: pumped 1,051 gallons of water from the LCS containment vessel into the LDS secondary vessel and then into the manhole's inlet for the Leachate Transmission System main line; ***Manhole No. 2***: pumped 1,840 gallons of water from the LCS containment vessel into the LDS secondary vessel and then into the manhole's inlet for the Leatchate Transmission System main line; ***Manhole No. 3***: pumped 2,915 gallons of rainwater from the LCS containment vessel into the LDS containment vessel.

- **Cell 1/Cell 2 Rad. Work Area:**

The following work activities were conducted by Petro Environmental today as follows: ***Cell 1*** – placed 14 ROBs (from OMTA) of Category 2 material into Grid Location 6H; placed 78 loads of Category 1 material (from WIMS) in the haul road as 2 – 1-ft. lifts along the east side of Grid Locations 5H/6H and as cover for Category 2 material; ***Cell 2*** – resumed placing Select Layer into the cell, placing a total of 108 loads of Category 1 material (flyash from the AFP).

Hirsch & Associates performed the following survey work today following the Safety Meeting: ***Cell 2*** – prepared to conduct survey work – data collection transfer, and collected Select Layer certification points.

- **SWU Work Area:**

Petro Environmental completed the following work today in this work area: Resumed excavating the AFP and hauling the Category I material to OSDF Cell 2; discovered oil contamination in the AFP – containerized for future disposal and disposition.

4. **Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):**

None.

5. **Tests Required by Plans and/or Specifications Performed and Results of Tests:**

None.

6. **Materials Received (Note inspection results and storage provided):**

ISCO delivered the following pipe and appurtenances today: 3,480-l.f. of 4-in. HDPE SDR17 pipe, 12 SDR17 4-in. dia. flange adaptors, 4 molded SDR11 end caps, and 12 duct iron backup rings. These materials will be used to construct new water lines at the SWU. The pipe was stored on dunnage and the appurtenances were placed into the BEI trailer.

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
December 03, 1998	128	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 69° F MIN.: 52° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.00
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Work Area:

No.	Trade	Hours	Location/Description of Work
1	Laborers	10.5	Work Area – continued general clean-up work/equipment repair & maintenance; Manhole Nos. 2/3 – pumped water.
	Mechanic	10.5	Sitewide – performed general equipment maintenance.

Cell 1/Cell 2 Rad. Work Area:

No.	Trade	Hours	Location/Description of Work
5	Operators	50.0	Cell 1 – continued to place impacted materials into the cell; Cell 2 – continued to place Select Layer and staged Cat. 1 material into stockpiles.
7	Laborers	70.0	Same as above.
2	Teamsters	20.0	Same as above.
2	Hirsch & Associates	17.0	Cell 2 – safety meeting and collected Select Layer certification points.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
3	Operators	30.0	Continued to haul AFP material to OSDF Cell, performed cleanup of all areas, prepared to haul Category 4 material tomorrow, inspected perimeter rad. fencing at AFP and South Field, and removed woody debris to Cat. 4 stockpile.
4	Laborers	40.0	Same as above.
11	Teamsters	110.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo A25C Articulating Truck (#1)	03/23/98		03/23/98	0.0	10.0	0.0

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3. **Work Performed Today (Indicate location and description of work performed by prime and/or subcontractors):**

OSDF Work Area:

Within this work area, Petro Environmental completed the following work activities: ***General Area*** – conducted general housekeeping/clean-up of work area as well as equipment maintenance and repair; ***Manhole Nos. 2/3*** – pumped water as follows: *Manhole No. 2*: pumped 358 gallons of water from the LCS containment vessel into the LDS secondary vessel and then into the manhole's inlet to the LTS main line; *Manhole No. 3*: pumped 1,530 gallons of water from the LCS containment vessel into the LDS secondary vessel.

- **Cell 1/Cell 2 Rad. Work Area:**

The following work activities were conducted by Petro Environmental today as follows: ***Cell 1*** – placed 19 ROBs (from OMTA) of Category 4 material into Grid Location 5G (1 was sent back to the OMTA because could not unload it); placed 100 loads of Category 1 material (from WIMS) in the haul road as 1 – 1-ft. lift along the east side of Grid Locations 5H/6H and as daily cover for Category 2 material in Grid Location 5G; ***Cell 2*** – completed placing Select Layer into the cell (23 loads), and stockpiled 120 loads of Category 1 material (flyash) along the northeast slope of the cell and along the Intercell Berm (all from AFP).

Hirsch & Associates performed the following survey work today: ***Cell 2*** – attended safety meeting and then collected Select Layer certification points.

- **SWU Work Area:**

Petro Environmental completed the following work today in this work area: Continued to excavate the AFP and haul to OSDF Cells, continued to clean up all areas, prepared to haul Category 4 material tomorrow, inspected perimeter radiological fencing at the AFP and South Field and cleaned up liner area, and removed woody debris and placed in the Category 4 stockpile adjacent to the South Field Impacted Material Stockpile.

4. **Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):**

Petro Environmental's QC Inspector provided quality control oversight for today's work activities. Attached are the Follow-Up Phase Inspection reports for the definable features of work that were performed today.

5. **Tests Required by Plans and/or Specifications Performed and Results of Tests:**

None.

6. **Materials Received (Note inspection results and storage provided):**

None.

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
December 04, 1998	129	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 70° F MIN.: 57° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.00
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Work Area:

No.	Trade	Hours	Location/Description of Work
	Laborers	10.5	Manhole No. 3 – pumped out water; Site – general housekeeping and equipment repair.
	Mechanic	11.0	Sitewide – performed general equipment maintenance.

Cell 1/Cell 2 Rad. Work Area:

No.	Trade	Hours	Location/Description of Work
6	Operators	60.0	Cell 1 – continued to place impacted materials into the cell, placed material along haul road; Cell 2 – continued to place Select Layer and staged Cat. 1 material into stockpiles and graded South perimeter ditch.
7	Laborers	70.0	Same as above.
2	Teamsters	20.0	Same as above.
2	Hirsch & Associates	6.0	Cell 2 – placed grade stakes and collected clay wedge certification points.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
3	Operators	30.0	Continued to excavate the AFP and haul to OSDF Cells, hauled Cat. 4 materials to Cell 1, removed all trash from beside road, loaded out PPE from SMTA to Cell 1, and removed generators from both wheel wash areas and scanned out.
4	Laborers	40.0	Same as above.
11	Teamsters	110.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo A25C Articulating Truck (#1)	03/23/98		03/23/98	0.0	10.0	0.0

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3. **Work Performed Today (Indicate location and description of work performed by prime and/or subcontractors):**

OSDF Work Area:

Within this work area, Petro Environmental completed the following work activities: A surface water and erosion control inspection was conducted today by the QC Inspector. Attached is a copy of the Summary Report; ***General Area*** – conducted general housekeeping/clean-up of work area as well as equipment maintenance and repair; ***Manhole No. 3*** – pumped 717 gallons of water from the LCS containment vessel into the LDS secondary vessel. Attached is the Weekly Inspection Report for LDS/LCS Manhole Nos. 1 and 2.

- **Cell 1/Cell 2 Rad. Work Area:**

The following work activities were conducted by Petro Environmental today as follows: A surface water and erosion control inspection was conducted today by the QC Inspector. Attached is a copy of the Summary Report; ***Cell 1*** – placed 13 ROBs (from OMTA) of Category 2 material into Grid Location 6H; placed 5 ROBs (from SWU) of Category 4 material into Grid Location 5B; and placed 77 loads of Category 1 material (from WIMS) onto the haul road into Cell 1 along the north and east sides, as daily cover for Category 2 and 4 materials, and in the construction of perimeter berms; ***Cell 2*** – continued to stockpile Category 1 material (flyash from AFP) on the east side of the cell (150 loads); and began grading the South Perimeter Ditch for certification.

Hirsch & Associates performed the following survey work today: ***Cell 2*** – completed some preparatory work, set grade stakes, and collected clay wedge certification points for both the clean and dirty sides.

SWU Work Area:

Petro Environmental completed the following work today in this work area: A surface water and erosion control inspection was conducted today by the QC Inspector. Attached is a copy of the Summary Report; continued to excavate the AFP and haul to OSDF Cells, hauled Category 4 materials to Cell 1, removed all trash from stockpile at the south side of the haul road and took to SWU Wheel Wash Facility (5 loads), loaded out PPE and trash from the SMTA and hauled to Cell 1, cleaned up all trash and non-natural Category 4 material, and removed generators from both wheel wash sites and scanned out for return to rental company.

4. **Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):**

Petro Environmental's QC Inspector provided quality control oversight for today's work activities. Attached are the Follow-Up Phase Inspection reports for the definable features of work that were performed today.

5. **Tests Required by Plans and/or Specifications Performed and Results of Tests:**

None.

Materials Received (Note inspection results and storage provided):

None.

WEEKLY INSPECTION CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 1

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Alarm Light	
	Leakage from Primary Containment Vessel	~~No~~ / Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ / Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Strobe Light	
	Position of Butterfly Valve	~~Acceptable~~ / Unacceptable	Adjust Valve Flow to 200 gpm	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	No / ~~Yes~~	Keep Monitoring Port Drained and Attempt to Identify Leak Source	Pumped into L.D.S system
Inspected By: H. LEE OLIVER		Signature: H. Lee Oliver		Date: 12-4-98

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WEEKLY INSPECTION CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 2

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Alarm Light	
	Leakage from Primary Containment Vessel	~~No~~ / Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ / Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	Acceptable / ~~Unacceptable~~	Check Transmitter Operations, Electrical Connections, Strobe Light	Strobe light continues to Blink
	Position of Butterfly Valve	~~Acceptable~~ / Unacceptable	Adjust Valve Flow to 200 gpm	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	No / ~~Yes~~	Keep Monitoring Port Drained and Attempt to Identify Leak Source	pumped into L.D.S. system
Inspected By: H. LEE OLIVER		Signature: H. Lee Oliver		Date: 12-4-98

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PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
December 07, 1998	130	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 68° F MIN.: 45° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.29
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Work Area:

No.	Trade	Hours	Location/Description of Work
3	Laborers	2.5	Manhole No. 3 – pumped out water; Site - cleaned out tracks of equipment; Cell 2 – erected Grid Location signs around the perimeter of the cell.
	Mechanic	10.5	Sitewide – performed general equipment maintenance.

Cell 1/Cell 2 Rad. Work Area:

No.	Trade	Hours	Location/Description of Work
6	Operators	56.0	Cell 1 – continued to place impacted materials into the cell, placed material along haul road, pumped water from the Catchment Area; Cell 2 – continued to place Select Layer and staged Cat. 1 material into stockpiles and graded South perimeter ditch; OSDF Decon. Pad – deconned the FDF water truck; WIMS – relocated remainder of stockpile to the north; OMTA – staged ROBs in the Contamination Area and along Road A.
6	Laborers	60.0	Same as above.
2	Teamsters	8.0	Same as above.
2	Hirsch & Associates	12.0	Cell 2 – layed out grid and surveyed the ditch as-built conditions.
1	Jerry Istre Co.	10.0	Cell 1 – dismantled water lines/piping.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
2	Operators	20.0	Continued hauling AFP to the OSDF Cells, inspected/repaired perimeter fencing at AFP, and inspected silt fencing at IFP.
4	Laborers	40.0	Same as above.
11	Teamsters	105.0	Same as above.

PETRO environmental technologies

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Hubbard Trucking H-6	06/26/98		06/29/98	10.0	0.0	0.0
Hubbard Trucking H-7 (involved in accident)	06/26/98		06/29/98	0.0	10.0	0.0
Hubbard Trucking H-8	07/28/98		07/29/98	10.0	0.0	0.0
Hubbard Trucking H-9	07/28/98		07/29/98	10.0	0.0	0.0
Hubbard Trucking H-10	08/03/98		08/04/98	10.0	0.0	0.0
Hubbard Trucking H-11	08/10/98		08/11/98	10.0	0.0	0.0
Hubbard Trucking H-12	09/02/98		09/02/98	10.0	0.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or subcontractors):**

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- **OSDF Work Area:**

Within this work area, Petro Environmental completed the following work activities: ***General Area*** – cleaned up tracks of equipment; ***Manhole No. 3*** – pumped 430 gallons of water from the LCS containment vessel into the LDS secondary vessel at Manhole No. 3; ***Cell 2*** – erected Grid Location signs around the perimeter of the cell.

- **Cell 1/Cell 2 Rad. Work Area:**

The following work activities were conducted by Petro Environmental today as follows: ***Cell 1*** – placed 159 loads of Category 1 material (flyash from AFP) in 2 – 1-ft. thick lifts into the Catchment Area and compacted, pumped water from the Catchment Area; ***Cell 2*** – continued to stockpile Category 1 material (flyash from AFP) in the cell (13 loads), continued grading activities along the South Perimeter Ditch for certification; ***OSDF Decon. Pad*** – decontaminated FDF's water truck; ***OMTA*** – staged 12 ROBs within the Contamination Area and along Road "A"; ***WIMS*** – relocated the remainder of this stockpile to the north to make room for the EIDS and EISS within this area.

Hirsch & Associates performed the following survey work today: ***Cell 2*** – established the grid layout for the cell and surveyed the South Ditch as-built conditions. Jerry Istre Co. worked in ***Cell 1*** today to dismantle water lines/piping.

- **SWU Work Area:**

Petro Environmental completed the following work today in this work area: Continued to excavate the AFP and haul to OSDF Cells, inspected/repaired perimeter fencing at the AFP, inspected silt fencing at the south end of the IFP (no problems found) and noted that the previously seeded area was beginning to germinate.

4. **Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):**

Petro Environmental's QC Inspector provided quality control oversight for today's work activities. Attached are the Follow-Up Phase Inspection reports for the definable features of work that were performed today.

5. **Tests Required by Plans and/or Specifications Performed and Results of Tests:**

None.

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
December 09, 1998	132	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 47° F MIN.: 26° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.00
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Work Area:

No.	Trade	Hours	Location/Description of Work
1	Operators	5.0	Manholes – pumped water; Cell 1 – graded the access road on the west side of the cell.
	Laborers	12.0	Same as above.
	Mechanic	10.0	Sitewide – performed general equipment maintenance.

Cell 1/Cell 2 Rad. Work Area:

No.	Trade	Hours	Location/Description of Work
5	Operators	50.0	OSDF Decon. Pad – began deconning the D6R dozer; IMHR – cleaned the haul road; WIMS – continued to relocate material to the north; Cell 1 – graded the southern slope and re-graded around the 24-in. culvert pipe in Catchment Area; Cell 2 – placed 15 ROBs into cell.
4	Laborers	40.0	Same as above.
2	Teamsters	20.0	Same as above.
1	Jerry Istre Co.	10.0	Cell 1 – removed all sprinkler head from the cell.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
2	Operators	20.0	IFP – constructed haul road to load out Above WAC materials, hauled Above WAC material to SP-7, began excavation of IFP and stockpiled material on east side of South Fields; AFP – smooth drum rolled the AFP and washed the haul road at the entrance to the AFP; SWU Wheel Wash – decontaminated the articulated dump trucks.
4	Laborers	40.0	Same as above.
5	Teamsters	50.0	Same as above.

PETRO environmental technologies

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Hubbard Trucking H-6	06/26/98		06/29/98	0.0	10.0	0.0
Hubbard Trucking H-7 (involved in accident)	06/26/98		06/29/98	0.0	10.0	0.0
Hubbard Trucking H-8	07/28/98		07/29/98	0.0	10.0	0.0
Hubbard Trucking H-9	07/28/98		07/29/98	0.0	10.0	0.0
Hubbard Trucking H-10	08/03/98		08/04/98	0.0	10.0	0.0
Hubbard Trucking H-11	08/10/98		08/11/98	0.0	10.0	0.0
Hubbard Trucking H-12	09/02/98		09/02/98	0.0	10.0	0.0
Volvo A35C Articulating Truck (#1)	12/04/98		12/04/98	6.0	4.0	0.0
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	6.0	4.0	0.0
Volvo A25C Articulating Truck (#1)	03/23/98		03/23/98	6.0	4.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or subcontractors):**

2195

- **OSDF Work Area:**

The following work activities were conducted by Petro Environmental today as follows: ***Manhole No. 3*** – pumped 330 gallons of water from the LDS secondary containment vessel into the LCS containment vessel and then 1,768 gallons of water from the LCS containment vessel; ***Cell 1*** – graded the Access Road located outside the west side of the cell.

- **Cell 1/Cell 2 Rad. Work Area:**

The following work activities were conducted by Petro Environmental today as follows: ***Cell 1*** – re-graded the southern slope of the cell to achieve 3.5:1 slope; graded around the 24-in. culvert pipe located within the Catchment Runoff Area; ***Cell 2*** – placed 15 ROBs of Category 2 material (from OMTA) into Grid Locations 8I/9I and then covered with Category 1 material from within the Cell 2 stockpiles; ***OSDF Decon. Pad*** – began decontaminating the D6R dozer; ***WIMS*** – continued to relocate this stockpile to the north; and ***IMHR*** – cleaned the haul road. Jerry Istre worked at ***Cell 1*** today removing all sprinkler heads from within the cell.

- **SWU Work Area:**

Petro Environmental completed the following work today in this work area: Began work at ***IFP*** by constructing haul road to permit loading out of Above WAC materials, loaded out 2 loads (35 cy) of Above WAC material to SP-7; cleaned up area and notified FDF for HPGe survey verification; began excavating 3-ft. cuts of IFP at the southeast end and stockpiled material on east side of the South Fields (74 loads); ***AFP*** – smooth drum rolled the AFP and wash down the haul road at the entrance to the AFP; ***SWU Wheel Wash*** – decontaminated the 3 articulated haul trucks – FDF required Petro Environmental to remove the bedliners prior to the trucks being permitted to leave the Controlled Area to facilitate free release of the trucks.

4. **Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):**

Petro Environmental's QC Inspector provided quality control oversight for today's work activities. Attached are the Follow-Up Phase Inspection reports for the definable features of work that were performed today.

Tests Required by Plans and/or Specifications Performed and Results of Tests:

None.

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
December 14, 1998	134	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 46° F MIN.: 26° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.00
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Work Area:

No.	Trade	Hours	Location/Description of Work
1	Operators	10.0	Cells 1/2 - fine graded around the cell perimeter; Manhole Nos. 2/3 – pumped water; NE Laydown Area – smooth drum rolled this area.
	Laborers	10.5	Same as above.
	Mechanic	10.0	Sitewide – performed general equipment maintenance.
1	Schebor Bros.	4.0	Cells 2/3 – Applied pine sap to Intercell Berm; Cell 3 – applied pine sap to stockpiles.

Cell 1/Cell 2 Rad. Work Area:

No.	Trade	Hours	Location/Description of Work
4	Operators	40.0	EIMS – relocated construction fencing/rad. control rope, continued to excavate area to original grade; OSDF Decon. Pad – deconned haul truck H-7, continued to decon. other tools/ equipment; Cell 1 – began placement of Select Layer on NE corner of cell; performed general housekeeping of work area.
3	Laborers	30.0	Same as above.
2	Teamsters	20.0	Same as above.
2	Hirsch & Associates	7.0	WIMS – set grade stakes at this stockpile.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
2	Operators	20.0	IFP – continued to load out and stockpile materials; SWU Wheel Wash – continued to decon. haul trucks for free release from site, performed clean up of the wheel wash area.
3	Laborers	30.0	Same as above.
3	Teamsters	30.0	Same as above.
1	Jerry Istre Co.	10.0	Welded 1,600-lin. ft. of HDPE water line pipe for next year's work.

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Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Hubbard Trucking H-10	08/03/98	12/14/98	08/04/98	0.0	10.0	0.0
bbard Trucking H-11	08/10/98		08/11/98	0.0	10.0	0.0
vo A35C Articulating Truck (#1)	12/04/98		12/04/98	10.0	0.0	0.0
vo A35C Articulating Truck (#2)	12/04/98		12/04/98	10.0	0.0	0.0
Volvo A25C Articulating Truck (#1)	03/23/98		03/23/98	10.0	0.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or subcontractors):**

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- **OSDF Work Area:**

The following work activities were conducted by Petro Environmental today as follows: ***Cells 1/2*** - fine graded around the perimeter of the cells; ***NE Laydown Area*** – smooth drum rolled this surface to smooth out ruts and seal; ***Manhole Nos. 2 & 3*** – pumped water from these manholes as follows: ***Manhole No. 2***: pumped 2,112 gallons of water from the LDS primary and secondary containment vessels into the manhole's inlet to the LTS main line; ***Manhole No. 3***: pumped 2,844 gallons of water from the LCS containment vessel into the LDS secondary vessel. Attached is the Weekly Inspection Checklist from the Leachate Management System. Schebor Bros. worked onsite today as follows: ***Cells 2/3*** – applied pine sap emulsion along the Intercell Berm between these two cells; ***Cell 3*** – applied pine sap emulsion to two stockpiles located within the cell.

- **Cell 1/Cell 2 Rad. Work Area:**

The following work activities were conducted by Petro Environmental today as follows: ***EIMS*** – relocated construction fencing and rad. rope to provide access corridor between the stockpile and the IMHR, continued to excavate ±6-inches over the footprint of the stockpile to original grade; ***Cell 1*** – began placing Select Layer material (from the EIMS – 61 loads) on the northeast corner of the cell in a single 2-ft. thick lift; ***OSDF Decon. Pad*** – continued to decon. equipment/tools, the D6R dozer and Haul Truck H-7; and performed general housekeeping across this work area.

- **SWU Work Area:**

Petro Environmental completed the following work today in this work area: ***IFP*** – continued to excavate the IFP and haul materials to the South Fields for stockpiling (150 loads), re-graded the IFP area, placed #2 aggregate to stabilize the haul road; ***SWU Wheel Wash*** – continued decontamination of haul trucks for free release from the jobsite and removed all bed liners from the trucks, and performed general housekeeping and cleanup of the wheel wash facility. Jerry Istre welded 1,160-lin. ft. of 4-in. dia. HDPE water line pipe in preparation for next year.

4. **Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):**

Petro Environmental's QC Inspector provided quality control oversight for today's work activities. Attached are the Follow-Up Phase Inspection reports for the definable features of work that were performed today.

Tests Required by Plans and/or Specifications Performed and Results of Tests:

None.

WEEKLY INSPECTION CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 1

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Alarm Light	
	Leakage from Primary Containment Vessel	~~No~~ / Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ / Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Strobe Light	
	Position of Butterfly Valve	~~Acceptable~~ / Unacceptable	Adjust Valve Flow to 200 gpm	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
Inspected By: H. LEE OLIVER		Signature: H. Lee Oliver		Date: 12-14-98

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WEEKLY INSPECTION CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 2

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	Acceptable ~~Unacceptable~~	Check Transmitter Operations, Electrical Connections, Alarm Light	Pumped out
	Leakage from Primary Containment Vessel	~~No~~ Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	No ~~Yes~~	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
	Manhole Cover and Seal Intact	No ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ Unacceptable	Check Transmitter Operations, Electrical Connections, Strobe Light	
	Position of Butterfly Valve	~~Acceptable~~ Unacceptable	Adjust Valve Flow to 200 gpm	
	Manhole Cover and Seal Intact	No ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	~~No~~ Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
Inspected By: H. LEE OLIVER		Signature: H. Lee Oliver		Date: 12-14-98

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PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
December 16, 1998	136	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 42° F MIN.: 25° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.05
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Work Area:

No.	Trade	Hours	Location/Description of Work
1	Operators	10.0	Cells 1/2 – fine graded around the perimeter of the cells and assisted with hydroseeding operations; Manhole No. 2 – began pumping water from this manhole.
	Mechanic	10.0	Sitewide – performed general equipment maintenance.
1	Schebor Bros.	4.0	Cell 1/2 - hydroseeded the cell perimeters.

Cell 1/Cell 2 Rad. Work Area:

No.	Trade	Hours	Location/Description of Work
2	Operators	20.0	EIMS – completed loading out material and hauling to cell; Cell 1 – continued placing Select Layer on east slope of cell; OMTA – staged ROBs on clean side; OSDF Decon. Pad – continued to decon. equipment and tools.
4	Laborers	40.0	Same as above.
2	Teamsters	20.0	Same as above.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
2	Operators	20.0	IFP – continued to excavate and stockpile these materials, re-constructed haul road to IFP; and SWU Wheel Wash – continued to decon. and free release haul trucks, cleaned out trenches and oil/water separator.
3	Laborers	30.0	Same as above.
3	Teamsters	30.0	Same as above.

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3. **Work Performed Today (Indicate location and description of work performed by prime and/or subcontractors):**

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OSDF Work Area:

The following work activities were conducted by Petro Environmental today as follows: ***Cells 1/2*** – fine graded around the perimeter of the cells and assisted Schebor Bros. with hydroseeding; ***Manhole No. 2*** – began pumping water from this manhole today. Schebor Bros. hydroseeded with permanent seed mix around the Cell 1 access road and exterior perimeter slope of Cell 2.

- **Cell 1/Cell 2 Rad. Work Area:**

The following work activities were conducted by Petro Environmental today as follows: ***EIMS*** – completed loading out material and hauling to OSDF Cell 1; ***Cell 1*** – continued placing Select Layer material (from the EIMS – 44 loads) on the east slope of the cell; ***OSDF Decon. Pad*** – continued to decon. equipment/tools; ***OMTA*** – staged ROBs on the clean side.

- **SWU Work Area:**

Petro Environmental completed the following work today in this work area: ***IFP*** – continued to excavate the IFP and haul materials to the South Fields for stockpiling (143 loads) (sand stockpile is rapidly increasing); reconstructed haul road to the IFP (added more #2 limestone); ***SWU Wheel Wash*** – continued to decontaminate the haul trucks and mucked out wheel wash trenches and cleaned out the oil/water separator.

4. **Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):**

Petro Environmental's QC Inspector provided quality control oversight for today's work activities. Attached are the Follow-Up Phase Inspection reports for the definable features of work that were performed today.

5. **Tests Required by Plans and/or Specifications Performed and Results of Tests:**

None.

6. **Materials Received (Note inspection results and storage provided):**

None.

7. **Verbal Instructions Received (List any instructions given by the DOE/FDF/GeoSyntec/Parsons personnel on construction deficiencies, re-testing required, etc., with action to be taken):**

None.

8. **Remarks (Cover any conflicts in plans, specifications, or instructions; acceptability of incoming materials; offsite surveillance activities; progress of work, delays, causes and extent thereof; days of no work with reasons for same):**

Attached are copies of the Control Fugitive Emission Daily Record and Contractor Daily Report for Dust Emissions reports documenting dust control activities employed by Petro Environmental today.

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
December 30, 1998	142	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 23° F MIN.: 15° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.02
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Work Area:

No.	Trade	Hours	Location/Description of Work
2	Operators	16.0	EIMS – undercut area and stockpiled material to south, graded stockpile to facilitate drainage, cleaned equipment tracks; Cell 4 – pumped water; Borrow Area – performed general housekeeping; N. Access Rd. – cleaned mud from roadway; Manholes – pumped water.
[illegible]	Laborers	30.0	Same as above.
1	Mechanic	10.0	Sitewide – performed general equipment maintenance.

Cell 1/Cell 2 Rad. Work Area:

No work activities were performed within this work area today.

SWU Work Area:

No work activities were performed within this work area today.

2. Equipment (Not Hand Tools):

OSDF Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo A35C Articulating Truck (#1)	12/04/98		12/04/98	0.0	10.0	0.0
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	0.0	10.0	0.0
Volvo A25C Articulating Truck (#1)	03/23/98		03/23/98	0.0	10.0	0.0
Volvo A25C Articulating Truck (#2)	03/23/98		03/24/98	0.0	10.0	0.0
Volvo A25C Articulating Truck (#3)	03/23/98		03/24/98	0.0	10.0	0.0
Dynapac Smooth Drum Roller	11/17/98		11/17/98	0.0	10.0	0.0
Cat D6R LGP Dozer (#1)	05/30/97		05/30/97	0.0	10.0	0.0
[illegible]6R LGP Dozer (#3)	08/31/98		08/31/98	5.0	5.0	0.0
[illegible]Allis 30B Dozer	06/16/98		06/16/98	5.0	5.0	0.0

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Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Komatsu D-31E Dozer	05/30/97		05/30/97	0.0	10.0	0.0
C[illegible]80SL Backhoe	08/03/98		08/03/98	0.0	10.0	0.0
C[illegible]20 Excavator (Job Rentals)	10/28/98		10/28/98	0.0	10.0	0.0
K[illegible]co 400 Excavator	03/21/98		03/23/98	0.0	10.0	0.0
Volvo L150C Loader	05/20/98		05/20/98	0.0	10.0	0.0
Cat 613C Water Wagon (#1)	08/11/98		08/11/98	0.0	10.0	0.0
Extec Soil Screening Machine (#1)	06/25/98		07/08/98	0.0	10.0	0.0
Extec Soil Screening Machine (#2)	07/24/98		08/05/98	0.0	10.0	0.0

Cell 1/Cell 2 Rad.-Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Bomag Smooth Drum Roller (#1)	07/07/98		07/07/98	0.0	10.0	0.0
Cat D8R Dozer (#1)	06/09/98		06/10/98	0.0	10.0	0.0
Rex 3-55 Trash Compactor	08/01/98		08/04/98	0.0	10.0	0.0
Cat 826 Trash Compactor	10/12/98		10/12/98	0.0	10.0	0.0
Cat 815B Compactor (#1)	06/09/97		06/09/97	0.0	10.0	0.0
Ford Tractor	06/25/98		07/06/98	0.0	10.0	0.0
Kenworth Roll-Off Truck	07/27/98		07/28/98	0.0	10.0	0.0

SWU Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Cat D8R Dozer (#2)	06/30/98		07/06/98	0.0	10.0	0.0
C[illegible]5B Excavator	06/17/98		06/18/98	0.0	10.0	0.0
C[illegible]6B Backhoe (#1)	07/10/98		07/10/98	0.0	10.0	0.0
[illegible]HydroSeeder (T90)	06/08/98		06/08/98	0.0	10.0	0.0
International Lowboy	09/17/98		09/17/98	0.0	10.0	0.0
Mack Roll-Off Truck	07/01/98		07/06/98	0.0	10.0	0.0
Hubbard Trucking H-4	06/26/98		06/29/98	0.0	10.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or sub-contractors):**

- **OSDF Work Area:**

The following work activities were conducted by Petro Environmental today as follows: ***EIMS*** – undercut this stockpile by ±6-inches and stockpiled this material to the south and then graded to facilitate proper drainage; removed fencing in the area and re-installed, cleaned the tracks of the equipment; ***Cell 4*** – pumped water from the cell; ***Borrow Area*** – performed general housekeeping around the soil screeners; ***N. Access Road*** – removed mud from the street. An inspection of the sediment and erosion control features for this work area was conducted by the QC Inspector. A copy of the Summary Report is attached.

Petro Environmental also pumped water from ***Manhole No. 2*** during the week of December 28th as follows: *Dec. 28th:* pumped 2,112 gallons of water from the LDS containment vessel into the manhole's inlet to the LTS main line; *Dec. 29th:* pumped 475 gallons of water from the primary and secondary LDS containment vessels into the manhole's inlet to the LTS main line; *Dec. 30th:* pumped 211 gallons of water from the LDS primary containment vessel into the manhole's inlet to the LTS main line. Also attached is a copy of the Weekly Inspection Checklist for Manhole Nos. 1 and 2.

WEEKLY INSPECTION CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 1

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ Unacceptable	Check Transmitter Operations, Electrical Connections, Alarm Light	
	Leakage from Primary Containment Vessel	~~No~~ Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	~~No~~ Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
	Manhole Cover and Seal Intact	No ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ Unacceptable	Check Transmitter Operations, Electrical Connections, Strobe Light	
	Position of Butterfly Valve	~~Acceptable~~ Unacceptable	Adjust Valve Flow to 200 gpm	
	Manhole Cover and Seal Intact	No ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	~~No~~ Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
Inspected By: H. LEE OLIVER		Signature: H Lee Oliver		Date: 12-28-98

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WEEKLY INSPECTION CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 2

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	Acceptable ~~Unacceptable~~	Check Transmitter Operations, Electrical Connections, Alarm Light	Pumped out, see daily reports
	Leakage from Primary Containment Vessel	~~No~~ Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	No ~~Yes~~	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
	Manhole Cover and Seal Intact	No ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ Unacceptable	Check Transmitter Operations, Electrical Connections, Strobe Light	
	Position of Butterfly Valve	~~Acceptable~~ Unacceptable	Adjust Valve Flow to 200 gpm	
	Manhole Cover and Seal Intact	No ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	~~No~~ Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
Inspected By: H. LEE OLIVER		Signature: H. Lee Oliver		Date: 12-28-98

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PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
January 18, 1999	144	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 56° F MIN.: 35° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.02
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Non-Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
1	Operators	8.0	Cell 4 – pumped water; Cell 2 – repaired rad. fencing; Manhole No. 2 – pumped water; T-98 – received aggregate and stockpiled.
[illegible]	Laborers	16.0	Same as above.
1	Mechanic	8.0	Sitewide – performed general equipment maintenance.

Cell 1/Cell 2 Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	No work performed in this work area today.
0	Laborers	0.0	Same as above.
0	Teamsters	0.0	Same as above.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	Graded SWU parking lots (see OSDF for workers hours).
0	Laborers	0.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Non-Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo A35C Articulating Truck (#1)	12/04/98	01/05/99	12/04/98	0.0	8.0	0.0
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	0.0	8.0	0.0
Volvo A25C Articulating Truck (#1)	03/23/98	01/05/99	03/23/98	0.0	8.0	0.0
Volvo A25C Articulating Truck (#2)	03/23/98	01/06/99	03/24/98	0.0	8.0	0.0
Volvo A25C Articulating Truck (#3)	03/23/98	01/06/99	03/24/98	0.0	8.0	0.0

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Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Dynapac Smooth Drum Roller	11/17/98		11/17/98	0.0	8.0	0.0
[illegible]6R LGP Dozer (#1)	05/30/97	01/11/99	05/30/97	0.0	8.0	0.0
[illegible]6R LGP Dozer (#3)	08/31/98		08/31/98	0.0	8.0	0.0
Komatsu D-31E Dozer	05/30/97		05/30/97	0.0	8.0	0.0
Case 580SL Backhoe	08/03/98		08/03/98	8.0	0.0	0.0
Kobelco 400 Excavator	03/21/98		03/23/98	0.0	8.0	0.0
Volvo L150C Loader	05/20/98		05/20/98	0.0	8.0	0.0
Cat 613C Water Wagon (#1)	08/11/98		08/11/98	0.0	8.0	0.0
Extec Soil Screening Machine (#1)	06/25/98		07/08/98	0.0	8.0	0.0
Extec Soil Screening Machine (#2)	07/24/98		08/05/98	0.0	8.0	0.0

Cell 1/Cell 2 Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Bomag Smooth Drum Roller (#1)	07/07/98		07/07/98	0.0	8.0	0.0
Cat D8R Dozer (#1)	06/09/98		06/10/98	0.0	8.0	0.0
Fiat Allis 30B Dozer	06/16/98		06/16/98	0.0	8.0	0.0
Rex 3-55 Trash Compactor	08/01/98		08/04/98	0.0	8.0	0.0
Cat 826 Trash Compactor	10/12/98		10/12/98	0.0	8.0	0.0
Cat 815B Compactor (#1)	06/09/97		06/09/97	0.0	8.0	0.0
Ford Tractor	06/25/98		07/06/98	0.0	8.0	0.0
Kenworth Roll-Off Truck	07/27/98	01/05/99	07/28/98	0.0	8.0	0.0

SWU Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Cat D8R Dozer (#2)	06/30/98		07/06/98	0.0	8.0	0.0
Cat 345B Excavator	06/17/98	01/18/99	06/18/98	0.0	8.0	0.0
Cat 416B Backhoe (#1)	07/10/98		07/10/98	0.0	8.0	0.0
Finn HydroSeeder (T90)	06/08/98		06/08/98	0.0	8.0	0.0
International Lowboy	09/17/98		09/17/98	0.0	8.0	0.0
Mack Roll-Off Truck	07/01/98		07/06/98	0.0	8.0	0.0
Hubbard Trucking H-4	06/26/98		06/29/98	0.0	8.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or sub-contractors):**

- **OSDF Non-Rad. Work Areas:**

The following work activities were conducted by Petro Environmental today as follows: ***Cells 3/4*** – pumped water from these cells which collected during snow melt; ***Cell 2*** – repaired radiological fencing; ***Manhole No. 2*** – pumped 211 gallons of water from the LDS primary containment vessel into the manhole's inlet to the LTS main line today; ***T-98*** – received #304 aggregate and stockpiled.

During the period of time between January 1, 1999 and January 17, 1999, no field activities were performed by Petro Environmental. While no on-site activities were performed, surface water management and erosion control inspections were still conducted by the QC Inspector. Attached are Summary Reports for inspections conducted on January 4th, January 11th, and January 14th for all of Petro Environmental's work areas. Additionally, a surface water and erosion control inspection was conducted today for the SWU work area only and this Summary Sheet detailing the findings is also attached.

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PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

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Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
January 19, 1999	145	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 47° F MIN.: 29° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.00
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

SEE NEXT PAGE

OSDF Non-Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
1	Operators	8.0	T-96 – began constructing an aggregate walkway from trailer toward OMTA; Roads – cleaned off roads; Cells ¾ - pumped water out of cell.
2	Laborers	16.0	Same as above.
1	Mechanic	8.0	Sitewide – performed general equipment maintenance.

Cell 1/Cell 2 Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	No work performed in this work area today.
0	Laborers	0.0	Same as above.
0	Teamsters	0.0	Same as above.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	Wheel Wash – deconned equipment; AFP – surveyed erosion problem and planned for required work; SWA – coordinated with FDF for resurfacing of this support area.
2	Laborers	14.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Non-Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	0.0	8.0	0.0
Dynapac Smooth Drum Roller	11/17/98		11/17/98	0.0	8.0	0.0
Cat D6R LGP Dozer (#3)	08/31/98		08/31/98	0.0	8.0	0.0
Komatsu D-31E Dozer	05/30/97		05/30/97	1.0	7.0	0.0

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Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Case 580SL Backhoe	08/03/98		08/03/98	6.0	2.0	0.0
Hitachi 400 Excavator	03/21/98		03/23/98	0.0	8.0	0.0
Volvo L150C Loader	05/20/98		05/20/98	0.0	8.0	0.0
Cat 613C Water Wagon (#1)	08/11/98		08/11/98	0.0	8.0	0.0
Extec Soil Screening Machine (#1)	06/25/98		07/08/98	0.0	8.0	0.0
Extec Soil Screening Machine (#2)	07/24/98		08/05/98	0.0	8.0	0.0

Cell 1/Cell 2 Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Bomag Smooth Drum Roller (#1)	07/07/98		07/07/98	0.0	8.0	0.0
Cat D8R Dozer (#1)	06/09/98		06/10/98	0.0	8.0	0.0
Fiat Allis 30B Dozer	06/16/98		06/16/98	0.0	8.0	0.0
Rex 3-55 Trash Compactor	08/01/98		08/04/98	0.0	8.0	0.0
Cat 826 Trash Compactor	10/12/98		10/12/98	0.0	8.0	0.0
Cat 815B Compactor (#1)	06/09/97		06/09/97	0.0	8.0	0.0
Ford Tractor	06/25/98		07/06/98	0.0	8.0	0.0

SWU Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Cat D8R Dozer (#2)	06/30/98		07/06/98	0.0	8.0	0.0
Cat 416B Backhoe (#1)	07/10/98		07/10/98	0.0	8.0	0.0
Finn HydroSeeder (T90)	06/08/98		06/08/98	0.0	8.0	0.0
International Lowboy	09/17/98		09/17/98	0.0	8.0	0.0
Mack Roll-Off Truck	07/01/98		07/06/98	0.0	8.0	0.0
Hubbard Trucking H-4	06/26/98		06/29/98	0.0	8.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or sub-contractors):**

- **OSDF Non-Rad. Work Areas:**

  The following work activities were conducted by Petro Environmental today as follows: ***T-96*** – began constructing an aggregate walkway from the Rad. Control Point toward the OMTA, but suspended work due to wet soil conditions; ***Haul Roads*** – scraped mud/debris off of roadways with backhoe; ***Cells 3/4*** – continued to pump surfaced water from these cells. Also attached is a Weekly Inspection Checklist for Manhole Nos. 1 and 2.

- **Cell 1/Cell 2 Rad. Work Areas:**

  No work performed in this work area today.

- **SWU Work Area:**

  Petro Environmental completed the following work today in this work area: ***Wheel Wash*** – decontaminated the Hubbard Truck and Mack Roll-Off Truck for free release by the Rad. Techs. (accomplished) and began decontamination of the water wagon; ***AFP*** – surveyed the erosion problem and planned for repairs; ***SWA*** – coordinated with FDF for resurfacing of this support area (see Section 7 below).

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WEEKLY INSPECTION CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 1

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Alarm Light	
	Leakage from Primary Containment Vessel	~~No~~ / Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ / Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Strobe Light	
	Position of Butterfly Valve	~~Acceptable~~ / Unacceptable	Adjust Valve Flow to 200 gpm	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
Inspected By: H. LEE OLIVER		Signature: H Lee Oliver		Date: 1-18-99

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WEEKLY INSPECTION CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 2

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Alarm Light	
	Leakage from Primary Containment Vessel	~~No~~ / Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ / Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Strobe Light	
	Position of Butterfly Valve	~~Acceptable~~ / Unacceptable	Adjust Valve Flow to 200 gpm	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
Inspected By: H.LEE OLIVER		Signature: H Lee Oliver		Date: 1-18-99

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PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
January 20, 1999	146	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 57° F MIN.: 37° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.00
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Non-Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
1	Operators	2.5	Cells 3/4 – continued to pump water out of cell; Manhole No. 2 – pumped out water.
2	Laborers	16.0	Same as above.
[illegible]	Mechanic	8.0	Sitewide – performed general equipment maintenance.
2	Hirsch & Associates	7.0	EIMS – surveyed the topography.

Cell 1/Cell 2 Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	IMHR – cut diversion ditch (worker's hours recorded above).
0	Laborers	0.0	Same as above.
0	Teamsters	0.0	Same as above.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
1	Operators	7.0	AFP – removed silt from ditch, repaired silt fencing, & placed straw bales; Wheel Wash – deconned water wagon for free release.
3	Laborers	30.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Non-Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	0.0	8.0	0.0
[illegible]apac Smooth Drum Roller	11/17/98		11/17/98	0.0	8.0	0.0
[illegible]6R LGP Dozer (#3)	08/31/98		08/31/98	0.0	8.0	0.0
Komatsu D-31E Dozer	05/30/97		05/30/97	0.0	8.0	0.0

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Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Case 580SL Backhoe	08/03/98		08/03/98	0.0	8.0	0.0
[illegible]elco 400 Excavator	03/21/98		03/23/98	0.0	8.0	0.0
[illegible]o L150C Loader	05/20/98		05/20/98	0.0	8.0	0.0
Cat 613C Water Wagon (#1)	08/11/98		08/11/98	0.0	8.0	0.0
Extec Soil Screening Machine (#1)	06/25/98		07/08/98	0.0	8.0	0.0
Extec Soil Screening Machine (#2)	07/24/98		08/05/98	0.0	8.0	0.0

Cell 1/Cell 2 Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Bomag Smooth Drum Roller (#1)	07/07/98		07/07/98	0.0	8.0	0.0
Cat D8R Dozer (#1)	06/09/98		06/10/98	1.0	7.0	0.0
Fiat Allis 30B Dozer	06/16/98		06/16/98	0.0	8.0	0.0
Rex 3-55 Trash Compactor	08/01/98		08/04/98	0.0	8.0	0.0
Cat 826 Trash Compactor	10/12/98		10/12/98	0.0	8.0	0.0
Cat 815B Compactor (#1)	06/09/97		06/09/97	0.0	8.0	0.0
Ford Tractor	06/25/98		07/06/98	0.0	8.0	0.0

SWU Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Cat D8R Dozer (#2)	06/30/98		07/06/98	0.0	8.0	0.0
Cat 416B Backhoe (#1)	07/10/98		07/10/98	5.0	3.0	0.0
Finn HydroSeeder (T90)	06/08/98		06/08/98	0.0	8.0	0.0
I[illegible]ational Lowboy	09/17/98		09/17/98	0.0	8.0	0.0
[illegible] Roll-Off Truck	07/01/98	1/20/99	07/06/98	0.0	8.0	0.0
Hubbard Trucking H-4	06/26/98	1/20/99	06/29/98	0.0	8.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or sub-contractors):**

- **OSDF Non-Rad. Work Areas:**

  The following work activities were conducted by Petro Environmental today as follows: ***Cells 3/4*** – continued to pump surface water from these cells; ***Manhole No. 2*** – pumped 211 gallons of water from the LDS primary containment vessel into the manhole's inlet to the LTS main line today. Hirsch & Associates surveyed the topography of the EIMS today and then met with Petro Environmental to discuss additional surveying needs.

- **Cell 1/Cell 2 Rad. Work Areas:**

  Petro Environmental completed the following work today in this work area: ***IMHR*** – cut a diversion ditch between Cells 1 and 2 to deflect water from running onto clean soils.

- **SWU Work Area:**

  Petro Environmental completed the following work today in this work area: ***Wheel Wash*** – completed decontamination of the water wagon for free release from site; ***AFP*** – removed flyash from drainage channel at bottom of the stockpile and placed/graded back on top of the AFP, repaired/installed new silt fence and placed straw bale barriers against silt fence, and constructed berms at top of the AFP washout area.

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

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Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
January 21, 1999	147	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 54° F MIN.: 44° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.49
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Non-Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
1	Operators	4.0	Cells 3/4 – continued to pump water out of cell and Manhole No. 3.
[illegible]	Laborers	24.0	Same as above.
1	Mechanic	8.0	Sitewide – performed general equipment maintenance.

Cell 1/Cell 2 Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	No work was performed at this work area today.
0	Laborers	0.0	Same as above.
0	Teamsters	0.0	Same as above.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
1	Operators	6.0	AFP – installed erosion control blankets, re-graded surface of the stockpile, continued to clean ditches/repair silt fence/place straw bales.
2	Laborers	16.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Non-Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	0.0	8.0	0.0
Dynapac Smooth Drum Roller	11/17/98		11/17/98	0.0	8.0	0.0
[illegible] D6R LGP Dozer (#3)	08/31/98		08/31/98	0.0	8.0	0.0
Komatsu D-31E Dozer	05/30/97		05/30/97	0.0	8.0	0.0
Case 580SL Backhoe	08/03/98		08/03/98	4.0	4.0	0.0

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Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Kobelco 400 Excavator	03/21/98		03/23/98	0.0	8.0	0.0
[illegible] L150C Loader	05/20/98		05/20/98	0.0	8.0	0.0
[illegible] Soil Screening Machine (#1)	06/25/98		07/08/98	0.0	8.0	0.0
Extec Soil Screening Machine (#2)	07/24/98		08/05/98	0.0	8.0	0.0

Cell 1/Cell 2 Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Bomag Smooth Drum Roller (#1)	07/07/98		07/07/98	0.0	8.0	0.0
Cat D8R Dozer (#1)	06/09/98		06/10/98	1.0	7.0	0.0
Fiat Allis 30B Dozer	06/16/98		06/16/98	0.0	8.0	0.0
Rex 3-55 Trash Compactor	08/01/98		08/04/98	0.0	8.0	0.0
Cat 826 Trash Compactor	10/12/98		10/12/98	0.0	8.0	0.0
Cat 815B Compactor (#1)	06/09/97		06/09/97	0.0	8.0	0.0
Ford Tractor	06/25/98		07/06/98	0.0	8.0	0.0

SWU Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Cat D8R Dozer (#2)	06/30/98		07/06/98	0.0	8.0	0.0
Cat 416B Backhoe (#1)	07/10/98		07/10/98	6.0	2.0	0.0
Finn HydroSeeder (T90)	06/08/98		06/08/98	0.0	8.0	0.0
International Lowboy	09/17/98		09/17/98	0.0	8.0	0.0
Cat 613C Water Wagon (#1)	08/11/98		08/11/98	0.0	8.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or sub-contractors):**

- **OSDF Non-Rad. Work Areas:**

  The following work activities were conducted by Petro Environmental today as follows: *Cells 3/4* – continued to pump surface water from these cells and Manhole No. 3.

- **Cell 1/Cell 2 Rad. Work Areas:**

  Petro Environmental completed the following work today in this work area: *IMHR* – cut a diversion ditch between Cells 1 and 2 to deflect water from running onto clean soils.

- **SWU Work Area:**

  Petro Environmental completed the following work today in this work area: *AFP* – continued to remove flyash and clean the drainage channel, make repairs to silt fence, and place straw bales; re-graded the AFP surface to move ponding water away from the edge towards the center of the pile; and placed erosion control blankets over the crest of and down through ruts (see attached Follow-Up Phase Report).

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
January 22, 1999	148	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: C
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 68° F MIN.: 53° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.72
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Non-Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
[illegible]	Operators	4.0	Cells 3/4 – continued to pump water out of cell and Manhole No. 3.
[illegible]	Laborers	25.0	Same as above.
1	Mechanic	8.0	Sitewide – performed general equipment maintenance.

Cell 1/Cell 2 Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	Cell 1 - constructed a berm to prevent water from running onto clean side (see above for operator/labor hours).
0	Laborers	0.0	Same as above.
1	B&J Electric	1.5	Decon. Pad – checked out circuit breaker.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	No work was performed in this area today.
0	Laborers	0.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Non-Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	0.0	8.0	0.0
[illegible]pac Smooth Drum Roller	11/17/98		11/17/98	0.0	8.0	0.0
[illegible]06R LGP Dozer (#3)	08/31/98		08/31/98	0.0	8.0	0.0
Komatsu D-31E Dozer	05/30/97		05/30/97	0.0	8.0	0.0
Case 580SL Backhoe	08/03/98		08/03/98	3.0	5.0	0.0

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Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Kobelco 400 Excavator	03/21/98		03/23/98	0.0	8.0	0.0
[illegible] L150C Loader	05/20/98		05/20/98	0.0	8.0	0.0
[illegible] Soil Screening Machine (#1)	06/25/98		07/08/98	0.0	8.0	0.0
Extec Soil Screening Machine (#2)	07/24/98		08/05/98	0.0	8.0	0.0

Cell 1/Cell 2 Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Bomag Smooth Drum Roller (#1)	07/07/98		07/07/98	0.0	8.0	0.0
Cat D8R Dozer (#1)	06/09/98		06/10/98	1.0	7.0	0.0
Fiat Allis 30B Dozer	06/16/98		06/16/98	0.0	8.0	0.0
Rex 3-55 Trash Compactor	08/01/98		08/04/98	0.0	8.0	0.0
Cat 826 Trash Compactor	10/12/98		10/12/98	0.0	8.0	0.0
Cat 815B Compactor (#1)	06/09/97		06/09/97	0.0	8.0	0.0
Ford Tractor	06/25/98		07/06/98	0.0	8.0	0.0

SWU Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Cat D8R Dozer (#2)	06/30/98		07/06/98	0.0	8.0	0.0
Cat 416B Backhoe (#1)	07/10/98		07/10/98	0.0	8.0	0.0
Finn HydroSeeder (T90)	06/08/98		06/08/98	0.0	8.0	0.0
International Lowboy	09/17/98		09/17/98	0.0	8.0	0.0
Cat 613C Water Wagon (#1)	08/11/98		08/11/98	0.0	8.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or sub-contractors):**

- **OSDF Non-Rad. Work Areas:**

  The following work activities were conducted by Petro Environmental today as follows: The QC Inspector conducted a surface water management and erosion control features for this work area. Attached is a Summary Report of those findings. ***Cells 3/4*** – continued to pump surface water from these cells and Manhole No. 3.

- **Cell 1/Cell 2 Rad. Work Areas:**

  Petro Environmental completed the following work today in this work area: The QC Inspector conducted a surface water management and erosion control features for this work area. Attached is a Summary Report of those findings. ***Cell 1*** – constructed a berm to prevent water from running onto the clean area at the Cool-Down Trailer; B&J Electric worked at the ***Decon. Pad*** to check out the circuit breaker because the pump is not working.

- **SWU Work Area:**

  No work was performed in this work area today.

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

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Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
January 23, 1999	149	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 62° F MIN.: 41° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.46
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Non-Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	Cells 3/4 – continued to pump water out of cell and Manhole No. 3.
[illegible]	Laborers	4.0	Same as above.
0	Mechanic	0.0	Sitewide – performed general equipment maintenance.

Cell 1/Cell 2 Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	No work performed in this work area today.
0	Laborers	0.0	Same as above.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	No work was performed in this area today.
0	Laborers	0.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Non-Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	0.0	8.0	0.0
Dynapac Smooth Drum Roller	11/17/98		11/17/98	0.0	8.0	0.0
Cat D6R LGP Dozer (#3)	08/31/98		08/31/98	0.0	8.0	0.0
Komatsu D-31E Dozer	05/30/97		05/30/97	0.0	8.0	0.0
[illegible]e 580SL Backhoe	08/03/98		08/03/98	0.0	8.0	0.0
Kobelco 400 Excavator	03/21/98		03/23/98	0.0	8.0	0.0
Volvo L150C Loader	05/20/98		05/20/98	0.0	8.0	0.0

PETRO environmental technologies

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Extec Soil Screening Machine (#1)	06/25/98		07/08/98	0.0	8.0	0.0
[illegible] Soil Screening Machine (#2)	07/24/98		08/05/98	0.0	8.0	0.0

Cell 1/Cell 2 Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Bomag Smooth Drum Roller (#1)	07/07/98		07/07/98	0.0	8.0	0.0
Cat D8R Dozer (#1)	06/09/98		06/10/98	0.0	8.0	0.0
Fiat Allis 30B Dozer	06/16/98		06/16/98	0.0	8.0	0.0
Rex 3-55 Trash Compactor	08/01/98		08/04/98	0.0	8.0	0.0
Cat 826 Trash Compactor	10/12/98		10/12/98	0.0	8.0	0.0
Cat 815B Compactor (#1)	06/09/97		06/09/97	0.0	8.0	0.0
Ford Tractor	06/25/98		07/06/98	0.0	8.0	0.0

SWU Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Cat D8R Dozer (#2)	06/30/98		07/06/98	0.0	8.0	0.0
Cat 416B Backhoe (#1)	07/10/98		07/10/98	0.0	8.0	0.0
Finn HydroSeeder (T90)	06/08/98		06/08/98	0.0	8.0	0.0
International Lowboy	09/17/98		09/17/98	0.0	8.0	0.0
Cat 613C Water Wagon (#1)	08/11/98		08/11/98	0.0	8.0	0.0

Work Performed Today (Indicate location and description of work performed by prime and/or sub-contractors):

- **OSDF Non-Rad. Work Areas:**

  The following work activities were conducted by Petro Environmental today as follows: *Cells 3/4* – continued to pump surface water from these cells and Manhole No. 3.

- **Cell 1/Cell 2 Rad. Work Areas:**

  No work was performed in this work area today.

- **SWU Work Area:**

  No work was performed in this work area today.

4. **Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):**

   None.

5. **Tests Required by Plans and/or Specifications Performed and Results of Tests:**

   None.

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
January 24, 1999	150	.20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 41° F MIN.: 30° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.00
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Non-Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	Cells 3/4 – continued to pump water out of cell and Manhole No. 3 & check pumps.
[illegible]	Laborers	4.0	Same as above.
[illegible]	Mechanic	0.0	Sitewide – performed general equipment maintenance.

Cell 1/Cell 2 Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	No work performed in this work area today.
0	Laborers	0.0	Same as above.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	No work was performed in this area today.
0	Laborers	0.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Non-Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	0.0	8.0	0.0
Dynapac Smooth Drum Roller	11/17/98		11/17/98	0.0	8.0	0.0
Cat D6R LGP Dozer (#3)	08/31/98		08/31/98	0.0	8.0	0.0
Komatsu D-31E Dozer	05/30/97		05/30/97	0.0	8.0	0.0
C[illegible]30SL Backhoe	08/03/98		08/03/98	0.0	8.0	0.0
Ko[illegible]co 400 Excavator	03/21/98		03/23/98	0.0	8.0	0.0
Volvo L150C Loader	05/20/98		05/20/98	0.0	8.0	0.0

PETRO environmental technologies

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Extec Soil Screening Machine (#1)	06/25/98		07/08/98	0.0	8.0	0.0
Extec Soil Screening Machine (#2)	07/24/98		08/05/98	0.0	8.0	0.0

Cell 1/Cell 2 Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Bomag Smooth Drum Roller (#1)	07/07/98		07/07/98	0.0	8.0	0.0
Cat D8R Dozer (#1)	06/09/98		06/10/98	0.0	8.0	0.0
Fiat Allis 30B Dozer	06/16/98		06/16/98	0.0	8.0	0.0
Rex 3-55 Trash Compactor	08/01/98		08/04/98	0.0	8.0	0.0
Cat 826 Trash Compactor	10/12/98		10/12/98	0.0	8.0	0.0
Cat 815B Compactor (#1)	06/09/97		06/09/97	0.0	8.0	0.0
Ford Tractor	06/25/98		07/06/98	0.0	8.0	0.0

SWU Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Cat D8R Dozer (#2)	06/30/98		07/06/98	0.0	8.0	0.0
Cat 416B Backhoe (#1)	07/10/98		07/10/98	0.0	8.0	0.0
Finn HydroSeeder (T90)	06/08/98		06/08/98	0.0	8.0	0.0
International Lowboy	09/17/98		09/17/98	0.0	8.0	0.0
Cat 613C Water Wagon (#1)	08/11/98		08/11/98	0.0	8.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or subcontractors):**

- **OSDF Non-Rad. Work Areas:**

  The following work activities were conducted by Petro Environmental today as follows: *Cells 3/4* – continued to pump surface water from these cells and Manhole No. 3 and check the pumps.

- **Cell 1/Cell 2 Rad. Work Areas:**

  No work was performed in this work area today.

- **SWU Work Area:**

  No work was performed in this work area today.

4. **Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):**

   None.

5. **Tests Required by Plans and/or Specifications Performed and Results of Tests:**

   None.

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
January 25, 1999	151	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 48° F MIN.: 30° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.00
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Non-Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
1	Operators	8.0	Cells 3/4 – continued to pump water from cells and Manhole No. 3.
[illegible]	Laborers	24.0	Same as above.
[illegible]	Mechanic	8.0	Sitewide – performed general equipment maintenance.
2	Hirsch & Associates	17.0	WIMS – surveyed the topography; Borrow Area – surveyed the existing sed. Basin and checked horizontal/vertical controls.

Cell 1/Cell 2 Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	Decon. Pad – decontaminated equipment for free release.
0	Laborers	0.0	Same as above.
2	B&J Electric	2.0	Decon. Pad – made repairs to the sump pump.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	No work was performed in this area today.
0	Laborers	0.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Non-Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	0.0	8.0	0.0
[illegible]pac Smooth Drum Roller	11/17/98		11/17/98	0.0	8.0	0.0
Cat D6R LGP Dozer (#3)	08/31/98		08/31/98	0.0	8.0	0.0
Komatsu D-31E Dozer	05/30/97		05/30/97	0.0	8.0	0.0

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Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Case 580SL Backhoe	08/03/98		08/03/98	0.0	8.0	0.0
Kobelco 400 Excavator	03/21/98		03/23/98	0.0	8.0	0.0
Volvo L150C Loader	05/20/98		05/20/98	0.0	8.0	0.0
Extec Soil Screening Machine (#1)	06/25/98		07/08/98	0.0	8.0	0.0
Extec Soil Screening Machine (#2)	07/24/98		08/05/98	0.0	8.0	0.0
Cat 613C Water Wagon (#1)	08/11/98		08/11/98	0.0	8.0	0.0

Cell 1/Cell 2 Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Bomag Smooth Drum Roller (#1)	07/07/98		07/07/98	0.0	8.0	0.0
Cat D8R Dozer (#1)	06/09/98		06/10/98	0.0	8.0	0.0
Fiat Allis 30B Dozer	06/16/98		06/16/98	0.0	8.0	0.0
Rex 3-55 Trash Compactor	08/01/98		08/04/98	0.0	8.0	0.0
Cat 826 Trash Compactor	10/12/98		10/12/98	0.0	8.0	0.0
Cat 815B Compactor (#1)	06/09/97		06/09/97	0.0	8.0	0.0
Ford Tractor	06/25/98		07/06/98	0.0	8.0	0.0

SWU Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Cat D8R Dozer (#2)	06/30/98		07/06/98	0.0	8.0	0.0
Cat 416B Backhoe (#1)	07/10/98		07/10/98	0.0	8.0	0.0
Finn HydroSeeder (T90)	06/08/98		06/08/98	0.0	8.0	0.0
International Lowboy	09/17/98		09/17/98	0.0	8.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or sub-contractors):**

- **OSDF Non-Rad. Work Areas:**

  The following work activities were conducted by Petro Environmental today as follows: The QC Inspector conducted a surface water management and erosion control features for this work area. Attached is a Summary Report of those findings. ***Cells 3/4*** – continued to pump surface water from these cells and Manhole No. 3. Hirsch & Associates performed the following survey work today: ***WIMS*** – surveyed the topography of this stockpile; ***Borrow Area*** – surveyed the existing sedimentation basin and checked horizontal/vertical controls.

- **Cell 1/Cell 2 Rad. Work Areas:**

  The following work activities were conducted by Petro Environmental today as follows: The QC Inspector conducted a surface water management and erosion control features for this work area. Attached is a Summary Report of those findings. ***Decon. Pad*** – performed decontamination of the 815 Compactor and Bomag Smooth Drum Roller; moved Cat 613 water wagon to the SWA at the OSDF. B&J Electric also worked at the Decon. Pad today to make repairs to the sump pump.

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
January 26, 1999	152	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 49° F MIN.: 26° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.00
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Non-Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	Cells 3 & 4 – pumped water from cells (see below for manhours).
[illegible]	Laborers	0.0	Same as above.

Cell 1/Cell 2 Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
1	Operators	8.0	Cell 1 – installed silt fence; Cells 1 & 2 – performed maintenance on Rad. Fencing, prepped for placement of surfactant in the cells tomorrow.
3	Laborers	24.0	Same as above.
2	Hirsch & Associates	3.0	Cell 2 – surveyed the topography of placed materials

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
1	Laborers	8.0	AFP - Re-staked erosion control blankets.
2	Hirsch & Associates	6.0	SWU – surveyed the topography of the IFP.

2. Equipment (Not Hand Tools):

OSDF Non-Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	0.0	8.0	0.0
Dynapac Smooth Drum Roller	11/17/98		11/17/98	0.0	8.0	0.0
Cat D6R LGP Dozer (#3)	08/31/98		08/31/98	0.0	8.0	0.0
[illegible]itsu D-31E Dozer	05/30/97		05/30/97	0.0	8.0	0.0
Case 580SL Backhoe	08/03/98		08/03/98	4.0	4.0	0.0
Kobelco 400 Excavator	03/21/98		03/23/98	0.0	8.0	0.0

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Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo L150C Loader	05/20/98		05/20/98	0.0	8.0	0.0
[illegible] Soil Screening Machine (#1)	06/25/98		07/08/98	0.0	8.0	0.0
[illegible] Soil Screening Machine (#2)	07/24/98		08/05/98	0.0	8.0	0.0
Cat 613C Water Wagon (#1)	08/11/98	01/26/99	08/11/98	0.0	8.0	0.0

Cell 1/Cell 2 Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Bomag Smooth Drum Roller (#1)	07/07/98		07/07/98	0.0	8.0	0.0
Cat D8R Dozer (#1)	06/09/98		06/10/98	0.0	8.0	0.0
Fiat Allis 30B Dozer	06/16/98		06/16/98	0.0	8.0	0.0
Rex 3-55 Trash Compactor	08/01/98		08/04/98	0.0	8.0	0.0
Cat 826 Trash Compactor	10/12/98		10/12/98	0.0	8.0	0.0
Cat 815B Compactor (#1)	06/09/97		06/09/97	0.0	8.0	0.0
Ford Tractor	06/25/98		07/06/98	0.0	8.0	0.0

SWU Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Cat D8R Dozer (#2)	06/30/98		07/06/98	0.0	8.0	0.0
Cat 416B Backhoe (#1)	07/10/98		07/10/98	0.0	8.0	0.0
Finn HydroSeeder (T90)	06/08/98		06/08/98	0.0	8.0	0.0
International Lowboy	09/17/98		09/17/98	0.0	8.0	0.0

Work Performed Today (Indicate location and description of work performed by prime and/or sub-contractors):

- **OSDF Non-Rad. Work Areas:**

The following work activities were conducted by Petro Environmental today as follows: ***Cells 3/4*** – continued to pump surface water from these cells. Pumping of water from the manholes conducted on January 23rd, January 24th, and January 25th were reported today, so this data shall be recorded into the Quality Control records as of today. The volume of water pumped was recorded as follows: ***January 23rd***: Manhole No. 1: pumped 211 gallons of water from the LDS primary containment vessel into the manhole's inlet to the LTS main line; Manhole No. 2: pumped 871 gallons from the LDS primary containment vessel and secondary containment vessel into the LTS main line inlet; Manhole No. 3: pumped approximately 3,307 gallons of surface water from the LDS and LCS containment vessels. ***January 24th***: Manhole No. 2: pumped 211 gallons of water from the LDS primary containment vessel into the manhole's inlet to the LTS main line; Manhole No. 3: pumped approximately 4,000 gallons of surface water from the LDS and LCS containment vessels. ***January 25th***: Manhole No. 2: pumped 1,267 gallons of water from the LDS primary and secondary containment vessels into the LTS main line inlet; Manhole No. 3: pumped 5,736 gallons of surface water from the LCS containment vessel.

- **Cell 1/Cell 2 Rad. Work Areas:**

The following work activities were conducted by Petro Environmental today as follows: The QC Inspector performed a Follow-Up surface water and erosion control inspection today to verify silt fence repairs were completed. A copy of this inspection report is attached. ***Cell 1*** – installed approximately 20-lin. ft. of silt fence for erosion control purposes; ***Cells 1/2*** - performed maintenance on the Radiological Fencing along

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
February 01, 1999	158	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 44 ° F MIN.: 36 ° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.33
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Non-Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	No work was performed in this work area today.
0	Laborers	0.0	Same as above.

Cell 1/Cell 2 Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
2	Operators	12.0	Cells 1-3 – pumped water; Decon. Pad Area – continued to assist FDF on the LTS pipe change order work.
2	Laborers	16.0	Same as above.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	Wheel Wash Facility – deconned a utility truck and assisted laborers at OSDF to relocate pumps.
2	Laborers	12.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Non-Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	0.0	8.0	0.0
Kobelco 400 Excavator	03/21/98		03/23/98	0.0	8.0	0.0
Dynapac Smooth Drum Roller	11/17/98		11/17/98	0.0	8.0	0.0
Case D6R LGP Dozer (#3)	08/31/98		08/31/98	0.0	8.0	0.0
Extec Soil Screening Machine (#1)	06/25/98		07/08/98	0.0	8.0	0.0
Extec Soil Screening Machine (#2)	07/24/98		08/05/98	0.0	8.0	0.0

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Cell 1/Cell 2 Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Bomag Smooth Drum Roller (#1)	07/07/98		07/07/98	0.0	8.0	0.0
Cat D8R Dozer (#1)	06/09/98		06/10/98	0.0	8.0	0.0
Fiat Allis 30B Dozer	06/16/98		06/16/98	0.0	8.0	0.0
Komatsu D-31E Dozer	05/30/97		05/30/97	0.0	8.0	0.0
Rex 3-55 Trash Compactor	08/01/98		08/04/98	0.0	8.0	0.0
Cat 826 Trash Compactor	10/12/98		10/12/98	0.0	8.0	0.0
Cat 815B Compactor (#1)	06/09/97		06/09/97	0.0	8.0	0.0
Ford Tractor	06/25/98		07/06/98	0.0	8.0	0.0
Finn HydroSeeder (T90)	06/08/98		06/08/98	0.0	8.0	0.0
Volvo L150C Loader	05/20/98		05/20/98	0.0	8.0	0.0
Case 580SL Backhoe	08/03/98		08/03/98	0.0	8.0	0.0
Cat 416B Backhoe (#1)	07/10/98		07/10/98	0.0	8.0	0.0

SWU Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Cat D8R Dozer (#2)	06/30/98		07/06/98	0.0	8.0	0.0
International Lowboy	09/17/98		09/17/98	0.0	8.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or sub-contractors):**

OSDF Non-Rad. Work Areas:

No work was performed in this work area today.

- **Cell 1/Cell 2 Rad. Work Areas:**

  The following work activities were conducted by Petro Environmental today as follows: ***Cells 1-3*** – pumped water from each of these cell's Impacted Runoff Catchment Area; ***Decon. Pad Area*** – continued to assist FDF on the LTS change order work (see Section 8 below).

- **SWU Work Area:**

  Petro Environmental performed minimal work in this work area today by working at the Wheel Wash Facility to decontaminate a utility truck requiring some maintenance/repair work. These laborers also assisted laborers at the OSDF by relocating pumps.

4. **Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):**

   None.

5. **Tests Required by Plans and/or Specifications Performed and Results of Tests:**

   None.

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
February 02, 1999	159	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 46° F MIN.: 31° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.11
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Non-Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	No work was performed in this work area today.
0	Laborers	0.0	Same as above.

Cell 1/Cell 2 Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
1	Operators	9.0	Cells 1-3 – pumped water; Decon. Pad Area – continued to assist FDF on the LTS pipe change order work.
2	Laborers	16.0	Same as above.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	No work was performed in this work area today.
0	Laborers	0.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Non-Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	0.0	8.0	0.0
Kobelco 400 Excavator	03/21/98		03/23/98	0.0	8.0	0.0
Dynapac Smooth Drum Roller	11/17/98		11/17/98	0.0	8.0	0.0
Cat D6R LGP Dozer (#3)	08/31/98		08/31/98	0.0	8.0	0.0
E[illegible] Soil Screening Machine (#1)	06/25/98		07/08/98	0.0	8.0	0.0
E[illegible] Soil Screening Machine (#2)	07/24/98		08/05/98	0.0	8.0	0.0

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Cell 1/Cell 2 Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
[illegible]ag Smooth Drum Roller (#1)	07/07/98		07/07/98	0.0	8.0	0.0
Cat D8R Dozer (#1)	06/09/98		06/10/98	0.0	8.0	0.0
Fiat Allis 30B Dozer	06/16/98		06/16/98	0.0	8.0	0.0
Komatsu D-31E Dozer	05/30/97		05/30/97	0.0	8.0	0.0
Rex 3-55 Trash Compactor	08/01/98		08/04/98	0.0	8.0	0.0
Cat 826 Trash Compactor	10/12/98		10/12/98	0.0	8.0	0.0
Cat 815B Compactor (#1)	06/09/97		06/09/97	0.0	8.0	0.0
Ford Tractor	06/25/98		07/06/98	0.0	8.0	0.0
Finn HydroSeeder (T90)	06/08/98		06/08/98	0.0	8.0	0.0
Volvo L150C Loader	05/20/98		05/20/98	0.0	8.0	0.0
Case 580SL Backhoe	08/03/98		08/03/98	0.0	8.0	0.0
Cat 416B Backhoe (#1)	07/10/98		07/10/98	8.0	0.0	0.0

SWU Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Cat D8R Dozer (#2)	06/30/98		07/06/98	0.0	8.0	0.0
International Lowboy	09/17/98		09/17/98	0.0	8.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or sub-contractors):**

- **OSDF Non-Rad. Work Areas:**

No work was performed in this work area today. The QC Inspector conducted a surface water and erosion control inspection of this work area today. Attached is a copy of the Summary Report detailing the findings.

- **Cell 1/Cell 2 Rad. Work Areas:**

The following work activities were conducted by Petro Environmental today as follows: The QC Inspector conducted a surface water and erosion control inspection of this work area today. Attached is a copy of the Summary Report detailing the findings. ***Cells 1-3*** – continued pumping water from each of these cell's Impacted Runoff Catchment Area; ***Decon. Pad Area*** – continued to assist FDF on the LTS change order work (see Section 8 below).

- **SWU Work Area:**

No work was performed in this work area today. The QC Inspector conducted a surface water and erosion control inspection of this work area today. Attached is a copy of the Summary Report detailing the findings.

4. **Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):**

None.

5. **Tests Required by Plans and/or Specifications Performed and Results of Tests:**

None.

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PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
February 05, 1999	162	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 48° F MIN.: 18° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.00
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Non-Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
2	Operators	12.0	Manhole Nos. 1/2 – completed weekly inspection of these manholes; pumped water from AIPII Sedimentation Basin; N. Access Rd. – applied water for dust control; Decon. Pad Area (Change Order) – made up sandbags for placement into Cell 2, located/ capped water service line to Rad. Trailers, and removed excess #304 stone from the trailer pads.
3	Laborers	26.0	Same as above.
1	Mechanic	3.5	Site – equipment repair and maintenance.

Cell 1/Cell 2 Rad. Work Areas:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	See above description for OSDF work area.
0	Laborers	0.0	Same as above.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
0	Operators	0.0	No work was performed in this work area today.
0	Laborers	0.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Non-Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	0.0	8.0	0.0
D6R LGP Dozer (#3)	08/31/98		08/31/98	2.0	6.0	0.0
580SL Backhoe	08/03/98		08/03/98	4.0	4.0	0.0
Volvo L150C Loader	05/20/98		05/20/98	2.0	6.0	0.0

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Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Kobelco 400 Excavator	03/21/98		03/23/98	0.0	8.0	0.0
[illegible]pac Smooth Drum Roller	11/17/98		11/17/98	0.0	8.0	0.0
[illegible] Soil Screening Machine (#1)	06/25/98		07/08/98	0.0	6.0	2.0
Extec Soil Screening Machine (#2)	07/24/98		08/05/98	0.0	8.0	0.0
International Lowboy	09/17/98		09/17/98	0.0	8.0	0.0

Cell 1/Cell 2 Rad. Work Areas:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Bomag Smooth Drum Roller (#1)	07/07/98		07/07/98	0.0	8.0	0.0
Cat D8R Dozer (#1)	06/09/98		06/10/98	0.0	8.0	0.0
Fiat Allis 30B Dozer	06/16/98		06/16/98	0.0	8.0	0.0
Komatsu D-31E Dozer	05/30/97		05/30/97	0.0	8.0	0.0
Rex 3-55 Trash Compactor	08/01/98		08/04/98	0.0	8.0	0.0
Cat 826 Trash Compactor	10/12/98		10/12/98	0.0	8.0	0.0
Cat 815B Compactor (#1)	06/09/97		06/09/97	0.0	8.0	0.0
Ford Tractor	06/25/98		07/06/98	0.0	8.0	0.0
Finn HydroSeeder (T90)	06/08/98		06/08/98	0.0	8.0	0.0
Cat 416B Backhoe (#1)	07/10/98		07/10/98	0.0	8.0	0.0

SWU Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Cat D8R Dozer (#2)	06/30/98		07/06/98	0.0	8.0	0.0

3. Work Performed Today (Indicate location and description of work performed by prime and/or subcontractors):

- **OSDF Non-Rad. Work Areas:**

  Petro Environmental completed the following limited work activities in this work area today: ***Manhole Nos. 1/2*** – completed weekly inspection of Manhole Nos. 1 & 2; attached is the Weekly Inspection Checklist. Due to Change Order work being performed on the LTS main line, FDF has been adjusting the butterfly valves. ***AIPII*** – pumped water out of the Sedimentation Basin into the 48-in. dia. pipes running beneath the road and into the temporary Sed. Trap in the Outfall Area; ***Former N. Access Road*** – applied water for dust control purposes.

- **Cell 1/Cell 2 Rad. Work Areas:**

  The following work activities were conducted by Petro Environmental today as follows: ***Decon. Pad Area*** – continued to assist FDF on the LTS change order work (see Section 8 below).

- **SWU Work Area:**

  No work was performed in this work area today.

4. Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):

None.

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WEEKLY INSPECTION CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 1

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Alarm Light	
	Leakage from Primary Containment Vessel	~~No~~ / Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ / Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Strobe Light	
	Position of Butterfly Valve	Acceptable / Unacceptable	Adjust Valve Flow to 200 gpm	Furnco has been adjusting valves due to repair work
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
Inspected By: H. LEE OLIVER		Signature: H. Lee Oliver		Date: 2-5-99

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WEEKLY INSPECTION CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 2

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Alarm Light	
	Leakage from Primary Containment Vessel	~~No~~ / Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ / Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Strobe Light	
	Position of Butterfly Valve	Acceptable / Unacceptable	Adjust Valve Flow to 200 gpm	Ferrco has been adjusting valves due to repair work.
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
Inspected By: H. LEE OLIVER		Signature: H. Lee Oliver		Date: 2-5-99

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PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
December 17, 1998	137	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 37° F MIN.: 28° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 0.00
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Work Area:

No.	Trade	Hours	Location/Description of Work
1	Laborers	10.5	Work Area – performed general housekeeping; Manhole Nos. 2/3 – completed pumping water from Manhole No. 2, pumped water from Manhole No. 3.
	Mechanic	11.0	Sitewide – performed general equipment maintenance.

Cell 1/Cell 2 Rad. Work Area:

No.	Trade	Hours	Location/Description of Work
2	Operators	20.0	Cell 2 – placed ROBs into cell; OSDF Decon. Pad – decontaminated equipment.
4	Laborers	40.0	Same as above.
2	Teamsters	20.0	Same as above.
2	Hirsch & Associates	12.0	Cell 1 – located previously placed impacted materials.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
2	Operators	20.0	IFP – continued to excavate and stockpile these materials, placed prohibited items in white boxes; and SWU Wheel Wash – continued to cleanup the wash facility.
3	Laborers	30.0	Same as above.
3	Teamsters	30.0	Same as above.
1	Jerry Istre	10.0	SWU – performed final cleanup at the SWU and attended meeting at Petro's main office.

2. Equipment (Not Hand Tools):

OSDF Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
apac Smooth Drum Roller	11/17/98		11/17/98	0.0	10.0	0.0
Cat D6R LGP Dozer (#1)	05/30/97		05/30/97	0.0	10.0	0.0

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Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Komatsu D-31E Dozer	05/30/97		05/30/97	0.0	10.0	0.0
[illegible]e 580SL Backhoe	08/03/98		08/03/98	0.0	10.0	0.0
[illegible] 20 Excavator (Job Rentals)	10/28/98		10/28/98	0.0	10.0	0.0
Hitachi 200 LC Excavator	10/01/98		10/01/98	0.0	10.0	0.0
Volvo L150C Loader	05/20/98		05/20/98	0.0	10.0	0.0
Cat 613C Water Wagon (#1)	08/11/98		08/11/98	0.0	10.0	0.0
Extec Soil Screening Machine (#1)	06/25/98		07/08/98	0.0	10.0	0.0
Extec Soil Screening Machine (#2)	07/24/98		08/05/98	0.0	10.0	0.0
ASV Posi-Trac (#4)	10/02/98		10/02/98	0.0	10.0	0.0
Volvo L120 C Loader	06/15/98		06/15/98	0.0	10.0	0.0

Cell 1/Cell 2 Rad. Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Bomag Smooth Drum Roller (#1)	07/07/98		07/07/98	2.0	8.0	0.0
Cat D8R Dozer (#1)	06/09/98		06/10/98	10.0	0.0	0.0
Cat D6R LGP Dozer (#3)	08/31/98		08/31/98	0.0	10.0	0.0
Fiat Allis 30B Dozer	06/16/98		06/16/98	0.0	10.0	0.0
Kobelco 400 Excavator	03/21/98		03/23/98	0.0	10.0	0.0
Caterpillar 320 Excavator	10/28/98		10/28/98	0.0	10.0	0.0
Rex 3-55 Trash Compactor	08/01/98		08/04/98	0.0	10.0	0.0
Cat 826 Trash Compactor	10/12/98		10/12/98	2.0	8.0	0.0
Cat 815B Compactor (#1)	06/09/97		06/09/97	0.0	10.0	0.0
Ford Tractor	06/25/98		07/06/98	0.0	10.0	0.0
Mack Roll-Off Truck	07/01/98		07/06/98	0.0	10.0	0.0
[illegible]worth Roll-Off Truck	07/27/98		07/28/98	0.0	10.0	0.0
[illegible] 13C Water Wagon	09/30/98		09/30/98	0.0	10.0	0.0
McCallister 613C Water Wagon	09/30/98		09/30/98	0.0	10.0	0.0
Volvo A25C Articulating Truck (#2)	03/23/98		03/24/98	0.0	10.0	0.0
Volvo A25C Articulating Truck (#3)	03/23/98		03/24/98	0.0	10.0	0.0

SWU Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Cat D8R Dozer (#2)	06/30/98		07/06/98	8.0	2.0	0.0
Cat 345B Excavator	06/17/98		06/18/98	9.0	1.0	0.0
Cat 416B Backhoe (#1)	07/10/98		07/10/98	2.0	8.0	0.0
Finn HydroSeeder (T90)	06/08/98		06/08/98	0.0	10.0	0.0
Kenworth Lowboy	09/17/98		09/17/98	0.0	10.0	0.0
Hubbard Trucking H-4	06/26/98		06/29/98	0.0	10.0	0.0
Hubbard Trucking H-7 (involved in accident)	06/26/98	12/17/98	06/29/98	0.0	10.0	0.0
Volvo A35C Articulating Truck (#1)	12/04/98		12/04/98	9.0	1.0	0.0
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	9.0	1.0	0.0
Volvo A25C Articulating Truck (#1)	03/23/98		03/23/98	9.0	1.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or sub-contractors):**

OSDF Work Area:

The following work activities were conducted by Petro Environmental today as follows: ***Site*** – performed general housekeeping; ***Manhole Nos. 2/3*** – pumped water from these manholes as follows: ***Manhole No. 3***:

completed pumping water from this manhole today, pumping a total of 2,112 gallons from the LDS containment vessel into the manhole's inlet to the LTS main line; *Manhole No. 3*: pumped 1,960 gallons from the LCS containment vessel.

Cell 1/Cell 2 Rad. Work Area:

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The following work activities were conducted by Petro Environmental today as follows: ***Cell 2*** – placed a total of 16 ROBs containing Category 2 material (from OMTA) into Grid Location 9I and provided daily cover with Category 1 material obtained from existing stockpiles within the cell; ***OSDF Decon. Pad*** – continued to decon. equipment/tools, including the Cat 320 excavator. Hirsch & Associates performed surveying work today in Cell 1 locating previously placed impacted materials and then directly downloaded this information onto FDF's computer system. Attached is a copy of the Cell 1 footprint showing the different categories of impacted materials and their relative location.

- **SWU Work Area:**

Petro Environmental completed the following work today in this work area: ***IFP*** – continued to excavate the IFP and haul materials to the South Fields for stockpiling (138 loads) (sand stockpile is rapidly increasing), loaded encountered prohibited items (i.e. – bricks, drums, metallic debris) into a white metal box and staged box at the north ditch; ***SWU Wheel Wash*** – continued to clean up the wash facility. Jerry Istre worked at SWU today to perform final cleanup and then attended meetings at Petro Environmental's main office. Jerry will leave site for home tomorrow.

4. **Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):**

Petro Environmental's QC Inspector provided quality control oversight for today's work activities. Attached are the Follow-Up Phase Inspection reports for the definable features of work that were performed today.

5. **Tests Required by Plans and/or Specifications Performed and Results of Tests:**

None.

6. **Materials Received (Note inspection results and storage provided):**

None.

7. **Verbal Instructions Received (List any instructions given by the DOE/FDF/GeoSyntec/Parsons personnel on construction deficiencies, re-testing required, etc., with action to be taken):**

None.

8. **Remarks (Cover any conflicts in plans, specifications, or instructions; acceptability of incoming materials; offsite surveillance activities; progress of work, delays, causes and extent thereof; days of no work with reasons for same):**

No dust control activities were necessary for today's work activities. During placement of Category 2 materials today in Cell 2, WAO requested that piping be removed. Petro Environmental suspended operations for approximately 1-hour while WAO decided what should be done with the piping (2-hrs. for backhoe &

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
DAILY QUALITY CONTROL REPORT

2195

Date:	Daily Report No.:	Project Nos.:	Contract No.:	Description/Location of Work:
December 21, 1998	138	20102/20402	FSC 614	SWU Excavation/OSDF (Phase II) Fernald Facility, Hamilton, Ohio

WEATHER CLASSIFICATION:		METEOROLOGICAL DATA:
CLASS A:	No interruptions of any kind from weather conditions occurring on this or previous shifts.	CLASSIFICATION CLASS: A
CLASS B:	Weather occurred during this shift that caused a complete stoppage of all work.	TEMPERATURE: MAX.: 60° F MIN.: 34° F
CLASS C:	Weather occurred during this shift that caused a partial stoppage of work.	PRECIPITATION: INCHES: 3.00
CLASS D:	Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.	
CLASS E:	Work overhead excellent or suitable during shift, but work partially stopped due to previous adverse weather.	
OTHER:	Explain.	

1. Contract/Subcontractors and Area of Responsibility:

OSDF Work Area:

No.	Trade	Hours	Location/Description of Work
2	Laborers	8.0	Work Area – performed general housekeeping; Manhole Nos. 2/3 – pumped water.
[illegible]	Mechanic	5.0	Sitewide – performed general equipment maintenance.

Cell 1/Cell 2 Rad. Work Area:

No.	Trade	Hours	Location/Description of Work
1	Operators	10.0	Cell 2 – placed ROBs into cell and sealed off surface via smooth drum roller; OSDF Decon. Pad – deconned the articulating trucks, compactor.
5	Laborers	50.0	Same as above.
2	Teamsters	20.0	Same as above.

SWU Work Area:

No.	Trade	Hours	Location/Description of Work
2	Operators	20.0	IFP – completed excavation and stockpiling, graded exit ramp area and placed #2 aggregate; Work Area – drained water system/shut down well house #2, stored loose materials into ISO box, cleaned out cool-down trailer, stored wheel wash equipment, cleaned up roads and sealed off stockpiles; SWU Wheel Wash – decontaminated articulated trucks.
3	Laborers	30.0	Same as above.
3	Teamsters	30.0	Same as above.

2. Equipment (Not Hand Tools):

OSDF Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
[illegible]apac Smooth Drum Roller	11/17/98		11/17/98	0.0	10.0	0.0
Cat D6R LGP Dozer (#1)	05/30/97		05/30/97	0.0	10.0	0.0

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Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Komatsu D-31E Dozer	05/30/97		05/30/97	0.0	10.0	0.0
[illegible] 580SL Backhoe	08/03/98		08/03/98	0.0	10.0	0.0
[illegible]320 Excavator (Job Rentals)	10/28/98		10/28/98	0.0	10.0	0.0
Hitachi 200 LC Excavator	10/01/98		10/01/98	0.0	10.0	0.0
Volvo L150C Loader	05/20/98		05/20/98	0.0	10.0	0.0
Cat 613C Water Wagon (#1)	08/11/98		08/11/98	0.0	10.0	0.0
Extec Soil Screening Machine (#1)	06/25/98		07/08/98	0.0	10.0	0.0
Extec Soil Screening Machine (#2)	07/24/98		08/05/98	0.0	10.0	0.0
ASV Posi-Trac (#4)	10/02/98		10/02/98	0.0	10.0	0.0
Volvo L120 C Loader	06/15/98		06/15/98	0.0	10.0	0.0

Cell 1/Cell 2 Rad. Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Bomag Smooth Drum Roller (#1)	07/07/98		07/07/98	1.0	9.0	0.0
Cat D8R Dozer (#1)	06/09/98		06/10/98	9.0	1.0	0.0
Cat D6R LGP Dozer (#3)	08/31/98		08/31/98	0.0	10.0	0.0
Fiat Allis 30B Dozer	06/16/98		06/16/98	0.0	10.0	0.0
Kobelco 400 Excavator	03/21/98		03/23/98	0.0	10.0	0.0
Caterpillar 320 Excavator	10/28/98		10/28/98	0.0	10.0	0.0
Rex 3-55 Trash Compactor	08/01/98		08/04/98	0.0	10.0	0.0
Cat 826 Trash Compactor	10/12/98		10/12/98	2.0	8.0	0.0
Cat 815B Compactor (#1)	06/09/97		06/09/97	0.0	10.0	0.0
Ford Tractor	06/25/98		07/06/98	0.0	10.0	0.0
Mack Roll-Off Truck	07/01/98		07/06/98	10.0	0.0	0.0
[illegible]orth Roll-Off Truck	07/27/98		07/28/98	10.0	0.0	0.0
[illegible]613C Water Wagon	09/30/98		09/30/98	0.0	10.0	0.0
McCallister 613C Water Wagon	09/30/98		09/30/98	0.0	10.0	0.0
Volvo A25C Articulating Truck (#2)	03/23/98		03/24/98	0.0	10.0	0.0
Volvo A25C Articulating Truck (#3)	03/23/98		03/24/98	0.0	10.0	0.0

SWU Work Area:

Equipment	Arrival Date	Departure Date	Date of Safety Check	Hours Used	Hours Idle	Hours for Repair
Cat D8R Dozer (#2)	06/30/98		07/06/98	8.0	2.0	0.0
Cat 345B Excavator	06/17/98		06/18/98	5.0	5.0	0.0
Cat 416B Backhoe (#1)	07/10/98		07/10/98	5.0	5.0	0.0
Finn HydroSeeder (T90)	06/08/98		06/08/98	1.0	9.0	0.0
Kenworth Lowboy	09/17/98		09/17/98	0.0	10.0	0.0
Hubbard Trucking H-4	06/26/98		06/29/98	0.0	10.0	0.0
Volvo A35C Articulating Truck (#1)	12/04/98		12/04/98	8.0	2.0	0.0
Volvo A35C Articulating Truck (#2)	12/04/98		12/04/98	0.0	10.0	0.0
Volvo A25C Articulating Truck (#1)	03/23/98		03/23/98	8.0	2.0	0.0

3. **Work Performed Today (Indicate location and description of work performed by prime and/or sub-contractors):**

- **OSDF Work Area:**

The following work activities were conducted by Petro Environmental today as follows: ***Site*** – performed general housekeeping; ***Manhole Nos. 2/3*** – pumped water from these manholes as follows: ***Manhole No. 3***: pumped 2,915 gallons of water from the LCS containment vessel on 12/18/98; pumped 3,179 gallons of

water from the LCS containment vessel on 12/19/98; pumped 1,530 gallons of water from the LCS containment vessel today; *Manhole No. 2*: pumped 1,716 gallons of water from the LDS containment vessel into the manhole's inlet to the LTS main line today. Also attached is a copy of the Weekly Inspection Checklist for Manhole Nos. 1 and 2.

- **Cell 1/Cell 2 Rad. Work Area:**

  The following work activities were conducted by Petro Environmental today as follows: ***Cell 2*** – placed a total of 12 ROBs containing Category 2 material (from OMTA) into Grid Location 10I and provided daily cover with Category 1 material obtained from existing stockpiles within the cell, smooth drum rolled all surfaces to seal from predicted rains; ***OSDF Decon. Pad*** – decontaminated the Volvo articulating trucks and began decontaminating the 815 Compactor. The articulated trucks could not be released from the Controlled Area due to rain which prevented a survey by the Rad. Techs.

- **SWU Work Area:**

  Petro Environmental completed the following work today in this work area: ***IFP*** – completed excavation of the IFP and haul materials to the South Fields for stockpiling (~40 loads), graded exit ramp area and placed 3 loads of #2 aggregate, per FDF's request, onto the access road and ramp to the IFP excavation area; ***Work Area*** – prepared for winterization of site by draining water system, shutting down Well House #2, loaded up loose materials and placed into ISO box, cleaned out the cool down trailer, stored wheel wash equipment for cold weather, cleaned up roads and sealed off stockpiles; ***SWU Wheel Wash*** – decontaminated the articulated trucks.

4. **Type and Results of Inspections (Indicate whether: Preparatory, Initial, or Follow-Up & include satisfactory work completed or deficiencies with action to be taken):**

   Petro Environmental's QC Inspector provided quality control oversight for today's work activities. Attached are the Follow-Up Phase Inspection reports for the definable features of work that were performed today.

5. **Tests Required by Plans and/or Specifications Performed and Results of Tests:**

   None.

6. **Materials Received (Note inspection results and storage provided):**

   James Bunnell delivered #2 aggregate today (total amount unsure due to not receiving weight tickets from the SWU Area Manager). This material was placed on the access road and ramp to the IFP and required no special storage provisions.

7. **Verbal Instructions Received (List any instructions given by the DOE/FDF/GeoSyntec/Parsons personnel on construction deficiencies, re-testing required, etc., with action to be taken):**

   None.

WEEKLY INSPECTION CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 2

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	Acceptable ~~Unacceptable~~	Check Transmitter Operations, Electrical Connections, Alarm Light	
	Leakage from Primary Containment Vessel	~~No~~ Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	~~No~~ Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
	Manhole Cover and Seal Intact	No ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #2	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ Unacceptable	Check Transmitter Operations, Electrical Connections, Strobe Light	
	Position of Butterfly Valve	~~Acceptable~~ Unacceptable	Adjust Valve Flow to 200 gpm	
	Manhole Cover and Seal Intact	No ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	~~No~~ Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
Inspected By: H. LEE OLIVER		Signature: H. Lee Oliver		Date: 12-21-98

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WEEKLY INSPE[illegible]ON CHECKLIST
LEACHATE MANAGEMENT SYSTEM
LDS/LCS MANHOLES No. 1

Component	Conditions to Check	Status	Remedy	Volume of Liquid or Other Comments
LDS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Alarm Light	
	Leakage from Primary Containment Vessel	~~No~~ / Yes	Check for Source of Leak: Take Appropriate Corrective Measures	
	Liquid in LDS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Odors/Bacterial Growth in Containment Vessel	~~No~~ / Yes	Flush or Spray Sodium Hypochlorite Into Containment Vessel	
LCS Manhole #1	Condition of Submersible Level Transmitter and Appurtenances	~~Acceptable~~ / Unacceptable	Check Transmitter Operations, Electrical Connections, Strobe Light	
	Position of Butterfly Valve	~~Acceptable~~ / Unacceptable	Adjust Valve Flow to 200 gpm	
	Manhole Cover and Seal Intact	No / ~~Yes~~	Repair or Replace	
	Liquid in LCS Containment Port	~~No~~ / Yes	Keep Monitoring Port Drained and Attempt to Identify Leak Source	
Inspected By: H. LEE OLIVER		Signature: H. Lee Oliver		Date: 12-21-98

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APPENDIX F
CCT VIDEO SURVEY

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CCT Video Tables

CCT Video by LTS Station

TABLE E-1
LEACHATE TRANSMISSION SYSTEM INVESTIGATION
CCT VIDEO PICTURES SORTED BY STATION NUMBER

STATION (FT)	IMAGE NAME	DEFLECTION (PERCENT)	DISTANCE (FT)
6.3	run-18end	0	388.7
11.9	rund-17	0	383.1
47.8	rund-16	15	347.2
86.5	rund-14	12	308.5
86.5	rund-15	12	308.5
125.5	rund-13	1	269.5
163.4	rund-12	13	231.6
201.5	rund-11	4	193.5
240.7	rund-10	2	154.3
279.9	rund-9	14	115.1
319.1	rund-8	15	75.9
354.7	rund-7	0	40.3
378.3	rund-6	14	16.7
379.6	rund-5	3	15.4
383.7	rund-4	4	11.3
388.9	rund-3	15	6.1
391.2	rund-2	6	3.8
394.1	rund-1	0	0.9
400.4	runc-19end*	0	394.6
401.8	runc-18*	0	393.2
402.0	runc-17	4	393.0
405.4	runc-16	0	389.6
438.9	runc-15	2	356.1
478.3	runc-14	6	316.7
517.7	runc-13	7	277.3
556.6	runc-12	0	238.4
595.3	runc-11	1	199.7
634.7	runc-10	3	160.3
673.9	runc-9	3	121.1
713.1	runc-7	0	81.9
713.1	runc-8	0	81.9
752.1	runc-6	6	42.9
782.6	runc-4	1	12.4
787.4	runc-3	0	7.6
790.8	runc-2	3	4.2
791.9	runc-1	0	3.1
795.0	runc-5	4	
831.4	T3R10-768,6	12	768.6
850.9	T3R9-749,1	2	749.1
854.1	T3R9-745,9	0	745.9
856.9	T3R9-743,1	12	743.1
870.9	T3R10-729,1	3	729.1
895.9	T3R9-704,1	26	704.1
911.9	T3R10-688,1	0	688.1
934.7	T3R9-665,3	16	665.3
952.8	T3R10-647,2	3	647.2
973.5	T3R9-626,5	19	626.5
993.3	T3R10-606,7	7	606.7
1007.2	T3R9-592,8	15	592.8
1033.8	T3R10-566,2	14	566.2
1046.1	T3R9-553,9	21	553.9
1074.8	T3R10-525,2	15	525.2
1083.2	T3R9-516,8	5	516.8
1100.0	T3R9-500,0	2	500.0
1115.5	T3R10-484,5	15	484.5
1119.7	T3R9-480,3	19	480.3

STATION (FT)	IMAGE NAME	DEFLECTION (PERCENT)	DISTANCE (FT)
1156.9	T3R10-443,1	16	443.1
1198.9	T3R10-401,1	13	401.1
1201.3	T3R10-398,7	4	398.7
1204.4	T3R10-395,6	3	395.6
1204.6	T1R1-115,4	5	115.4
1207.0	T3R10-393,0	1	393.0
1211.8	T1R1-108,2	7	108.2
1215.1	T3R9-384,9	0	384.9
1217.3	T3R9-382,7	3	382.7
1219.7	T3R10-380,3	12	380.3
1220.3	T3R9-379,7	3	379.7
1223.8	T3R9-376,2	8	376.2
1262.3	T3R9-337,7	13	337.7
1273.6	T1R1-046,4	0	46.4
1275.5	T3R10-324,5	0	324.5
1300.9	T3R9-299,1	15	299.1
1302.3	T1R1-017,7	14	17.7
1309.5	T3R10-290,5	19	290.5
1312.0	T1R1-008,0	4	8.0
1321.9	T3R10-278,1	2	278.1
1326.1	T3R10-273,9	24	273.9
1327.0	T1R3-007,0	34	7.0
1327.9	T1R3-007,9	26	7.9
1339.6	T3R9-260,4	17	260.4
1350.1	T3R10-249,9	25	249.9
1351.6	T3R10-248,4	32	248.4
1364.9	T1R3-044,9	32	44.9
1365.2	T1R3-045,2	32	45.2
1378.4	T3R9-221,6	15	221.6
1390.7	T3R10-209,3	16	209.3
1401.1	T1R3-081,1	34	81.1
1417.9	T3R9-182,1	0	182.1
1432.2	T3R10-167,8	18	167.8
1433.4	T1R3-113,4	26	113.4
1451.5	T2R4-001,5	2	1.5
1453.1	T3R9-146,9	2	146.9
1455.3	T2R4-005,3	10	5.3
1458.2	T2R6-008,2	24	8.2
1468.8	T3R10-131,2	15	131.2
1471.3	T1R3-151,3	16	151.3
1473.5	T2R4-023,5	42	23.5
1492.0	T3R9-108,0	0	108.0
1498.7	T2R6-048,7	21	48.7
1509.3	T1R3-189,3	26	189.3
1510.6	T3R10-089,4	21	89.4
1531.1	T3R9-068,9	2	68.9
1548.5	T1R3-228,5	29	228.5
1551.3	T1R3,231,3	10	231.3
1551.4	T3R10-048,6	23	48.6
1553.7	T1R3-233,7	2	233.7
1569.9	T3R9-030,1	12	30.1
1579.6	T2R6-129,6	17	129.6
1590.5	T3R10-009,5	19	9.5
1593.8	T3R10-006,2	4	6.2
1595.3	T1R2-004,7	44	0.4
1595.3	T1R2-004,7	44	4.7

STATION (FT)	IMAGE NAME	DEFLECTION (PERCENT)	DISTANCE (FT)
1596.8	T3R10-003,2	2	3.2
1597.9	T1R2-002,1	10	0.1
1597.9	T1R2-002,1	10	2.1
1598.1	T1R2-001,9	12	1.9
1615.0	T4R12=1445,0	0	1445.0
1620.5	T2R6-170,5	26	170.5
1638.2	T4R12=1421,8	21	1421.8
1660.9	T2R6-210,9	27	210.9
1677.4	T4R12=1382,6	16	1382.6
1701.4	T2R6-251,4	30	251.4
1716.5	T4R12=1343,5	18	1343.5
1732.3	T2R6-282,3	8	282.3
1772.2	T2R6-322,2	21	322.2
1794.9	T4R12-1265,1	21	1265.1
1812.6	T2R6-362,6	21	362.6
1833.8	T4R12-1226,2	21	1226.2
1852.6	T2R6-402,6	21	402.6
1853.6	T2R6-403,6	26	403.6
1854.6	T2R6-404,6	27	404.6
1855.9	T2R6-405,9	9	405.9
1856.1	T2R6-406,1	6	406.1
1859.1	T2R6-409,1	3	409.1
1860.4	T2R6-410,4	11	410.4
1873.3	T4R12-1186,7	19	1186.7
1887.4	T2R6-437,4	32	437.4
1902.8	T4R12-1157,2	5	1157.2
1928.3	T2R6-478,3	30	478.3
1941.1	T4R12=1118,9	14	1118.9
1980.4	T4R12=1079,6	11	1079.6
2009.4	T2R6-559,4	27	559.4
2009.6	T2R6-559,6	21	559.6
2018.7	T4R12=1041,3	19	1041.3
2019.8	T4R12=1040,2	30	1040.2
2020.8	T4R12=1039,2	28	1039.2
2023.0	T4R12=1037,0	4	1037.0
2025.0	T4R12=1035,0	4	1035.0
2026.6	T4R12=1033,4	0	1033.4
2053.0	T4R12-1007,0	27	1007.0
2083.1	T4R12-976,9	27	976.9
2088.0	T2R6-638,0	27	638.0
2127.5	T2R6-677,5	21	677.5
2167.1	T2R6-717,1	18	717.1
2169.6	T4R12-890,4	22	890.4
2207.6	T2R6-757,6	26	757.6
2208.3	T4R12-851,7	15	851.7
2211.0	T2R6-761,0	6	761.0
2215.5	T2R6-765,5	6	765.5
2244.9	T4R12-815,1	21	815.1
2283.1	T4R12-776,9	25	776.9
2292.2	T2R6-842,2	25	842.2
2322.2	T4R12-737,8	16	737.8
2333.2	T2R6-883,2	27	883.2
2361.3	T4R12-698,7	18	698.7
2365.2	T4R12-694,8	2	694.8
2369.4	T4R12-690,6	1	690.6
2374.6	T2R6-924,6	26	924.6

STATION (FT)	IMAGE NAME	DEFLECTION (PERCENT)	DISTANCE (FT)
2415.5	T2R6-965,5	26	965.5
2443.4	T4R12-616,6	22	616.6
2456.2	T2R6-1006,2	4	1006.2
2483.2	T4R12-576,8	22	576.8
2495.1	T2R6-1045,1	33	1045.1
2514.4	T2R6-1064,4	30	1064.4
2521.8	T4R12-538,2	20	538.2
2555.0	T2R6-1105,0	29	1105.0
2560.6	T4R12-499,4	23	499.4
2636.5	T4R12-423,5	34	423.5
2655.1	T4R12-404,9	24	404.9
2678.0	T2R6-1228,0	36	1228.0
2680.6	T2R6-1230,6	12	1230.6
2683.4	T2R6-1233,4	6	1233.4
2686.1	T2R6-1236,1	30	1236.1
2686.7	T2R6-1236,7	31	1236.7
2691.3	T2R6-241,3	27	1241.3
2693.7	T4R12-366,3	25	366.3
2732.7	T2R6-1282,7	23	1282.7
2811.6	T4R12-248,4	32	248.4
2816.4	T4R12-243,6	7	243.6
2819.2	T4R12-240,8	25	240.8
2824.4	T4R12-235,6	22	235.6
2855.4	T2R6-1405,4	29	1405.4
2862.1	T4R12-197,9	20	197.9
2894.6	T2R6-1444,6	30	1444.6
2912.3	T2R6-1462,3	30	1462.3
2977.5	T4R12-082,5	25	82.5
3013.8	T4R12-046,2	30	46.2
3053.9	T4R12-006,1	0	6.1
3063.0	T3R7-003,0	26	3.0
3101.8	T3R7-041,8	25	41.8
3136.1	T3R7-076,1	27	76.1
3171.5	T3R7-111,5	6	111.5
3174.0	T3R7-114,0	27	114.0
3246.6	T3R7-186,6	36	186.6
3285.2	T3R7-225,2	32	225.2
3323.0	T3R7-263,0	30	263.0
3361.6	T3R7-301,6	37	301.6
3399.2	T3R7-339,2	25	339.2
3472.5	T3R7-412,5	12	412.5
3511.5	T3R7-451,5	23	451.5
3551.0	T3R7-491,0	30	491.0
3586.8	T3R7-526,8	5	526.8
3602.8	T3R8-002,8	0	2.8
3604.1	T3R8-004,1	0	4.1

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CCT Video by
Tape and Run

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TABLE E-2
LEACHATE TRANSMISSION SYSTEM INVESTIGATION
CCT VIDEO PICTURES SORTED BY IMAGE NAME

IMAGE NAME	DEFLECTION (PERCENT)	DISTANCE (FT)	STATION (FT)
T1R1-008,0	4	8.0	1312.0
T1R1-017,7	14	17.7	1302.3
T1R1-046,4	0	46.4	1273.6
T1R1-108,2	7	108.2	1211.8
T1R1-115,4	5	115.4	1204.6
T1R2-001,9	12	1.9	1598.1
T1R2-002,1	10	0.1	1597.9
T1R2-002,1	10	2.1	1597.9
T1R2-004,7	44	0.4	1595.3
T1R2-004,7	44	4.7	1595.3
T1R3,231,3	10	231.3	1551.3
T1R3-007,0	34	7.0	1327.0
T1R3-007,9	26	7.9	1327.9
T1R3-044,9	32	44.9	1364.9
T1R3-045,2	32	45.2	1365.2
T1R3-081,1	34	81.1	1401.1
T1R3-113,4	26	113.4	1433.4
T1R3-151,3	16	151.3	1471.3
T1R3-189,3	26	189.3	1509.3
T1R3-228,5	29	228.5	1548.5
T1R3-233,7	2	233.7	1553.7
T2R4-001,5	2	1.5	1451.5
T2R4-005,3	10	5.3	1455.3
T2R4-023,5	42	23.5	1473.5
T2R6-008,2	24	8.2	1458.2
T2R6-048,7	21	48.7	1498.7
T2R6-1006,2	4	1006.2	2456.2
T2R6-1045,1	33	1045.1	2495.1
T2R6-1064,4	30	1064.4	2514.4
T2R6-1105,0	29	1105.0	2555.0
T2R6-1228,0	36	1228.0	2678.0
T2R6-1230,6	12	1230.6	2680.6
T2R6-1233,4	6	1233.4	2683.4
T2R6-1236,1	30	1236.1	2686.1
T2R6-1236,7	31	1236.7	2686.7
T2R6-1282,7	23	1282.7	2732.7
T2R6-129,6	17	129.6	1579.6
T2R6-1405,4	29	1405.4	2855.4
T2R6-1444,6	30	1444.6	2894.6
T2R6-1462,3	30	1462.3	2912.3
T2R6-170,5	26	170.5	1620.5
T2R6-210,9	27	210.9	1660.9
T2R6-241,3	27	1241.3	2691.3
T2R6-251,4	30	251.4	1701.4
T2R6-282,3	8	282.3	1732.3
T2R6-322,2	21	322.2	1772.2
T2R6-362,6	21	362.6	1812.6
T2R6-402,6	21	402.6	1852.6
T2R6-403,6	26	403.6	1853.6
T2R6-404,6	27	404.6	1854.6
T2R6-405,9	9	405.9	1855.9
T2R6-406,1	6	406.1	1856.1
T2R6-409,1	3	409.1	1859.1
T2R6-410,4	11	410.4	1860.4
T2R6-437,4	32	437.4	1887.4
T2R6-478,3	30	478.3	1928.3

IMAGE NAME	DEFLECTION (PERCENT)	DISTANCE (FT)	STATION (FT)
T2R6-559,4	27	559.4	2009.4
T2R6-559,6	21	559.6	2009.6
T2R6-638,0	27	638.0	2088.0
T2R6-677,5	21	677.5	2127.5
T2R6-717,1	18	717.1	2167.1
T2R6-757,6	26	757.6	2207.6
T2R6-761,0	6	761.0	2211.0
T2R6-765,5	6	765.5	2215.5
T2R6-842,2	25	842.2	2292.2
T2R6-883,2	27	883.2	2333.2
T2R6-924,6	26	924.6	2374.6
T2R6-965,5	26	965.5	2415.5
T3R10-003,2	2	3.2	1596.8
T3R10-006,2	4	6.2	1593.8
T3R10-009,5	19	9.5	1590.5
T3R10-048,6	23	48.6	1551.4
T3R10-089,4	21	89.4	1510.6
T3R10-131,2	15	131.2	1468.8
T3R10-167,8	18	167.8	1432.2
T3R10-209,3	16	209.3	1390.7
T3R10-248,4	32	248.4	1351.6
T3R10-249,9	25	249.9	1350.1
T3R10-273,9	24	273.9	1326.1
T3R10-278,1	2	278.1	1321.9
T3R10-290,5	19	290.5	1309.5
T3R10-324,5	0	324.5	1275.5
T3R10-380,3	12	380.3	1219.7
T3R10-393,0	1	393.0	1207.0
T3R10-395,6	3	395.6	1204.4
T3R10-398,7	4	398.7	1201.3
T3R10-401,1	13	401.1	1198.9
T3R10-443,1	16	443.1	1156.9
T3R10-484,5	15	484.5	1115.5
T3R10-525,2	15	525.2	1074.8
T3R10-566,2	14	566.2	1033.8
T3R10-606,7	7	606.7	993.3
T3R10-647,2	3	647.2	952.8
T3R10-688,1	0	688.1	911.9
T3R10-729,1	3	729.1	870.9
T3R10-768,6	12	768.6	831.4
T3R7-003,0	26	3.0	3063.0
T3R7-041,8	25	41.8	3101.8
T3R7-076,1	27	76.1	3136.1
T3R7-111,5	6	111.5	3171.5
T3R7-114,0	27	114.0	3174.0
T3R7-186,6	36	186.6	3246.6
T3R7-225,2	32	225.2	3285.2
T3R7-263,0	30	263.0	3323.0
T3R7-301,6	37	301.6	3361.6
T3R7-339,2	25	339.2	3399.2
T3R7-412,5	12	412.5	3472.5
T3R7-451,5	23	451.5	3511.5
T3R7-491,0	30	491.0	3551.0
T3R7-526,8	5	526.8	3586.8
T3R8-002,8	0	2.8	3602.8
T3R8-004,1	0	4.1	3604.1

IMAGE NAME	DEFLECTION (PERCENT)	DISTANCE (FT)	STATION (FT)
T3R9-030,1	12	30.1	1569.9
T3R9-068,9	2	68.9	1531.1
T3R9-108,0	0	108.0	1492.0
T3R9-146,9	2	146.9	1453.1
T3R9-182,1	0	182.1	1417.9
T3R9-221,6	15	221.6	1378.4
T3R9-260,4	17	260.4	1339.6
T3R9-299,1	15	299.1	1300.9
T3R9-337,7	13	337.7	1262.3
T3R9-376,2	8	376.2	1223.8
T3R9-379,7	3	379.7	1220.3
T3R9-382,7	3	382.7	1217.3
T3R9-384,9	0	384.9	1215.1
T3R9-480,3	19	480.3	1119.7
T3R9-500,0	2	500.0	1100.0
T3R9-516,8	5	516.8	1083.2
T3R9-553,9	21	553.9	1046.1
T3R9-592,8	15	592.8	1007.2
T3R9-626,5	19	626.5	973.5
T3R9-665,3	16	665.3	934.7
T3R9-704,1	26	704.1	895.9
T3R9-743,1	12	743.1	856.9
T3R9-745,9	0	745.9	854.1
T3R9-749,1	2	749.1	850.9
T4R12=1033,4	0	1033.4	2026.6
T4R12=1035,0	4	1035.0	2025.0
T4R12=1037,0	4	1037.0	2023.0
T4R12=1039,2	28	1039.2	2020.8
T4R12=1040,2	30	1040.2	2019.8
T4R12=1041,3	19	1041.3	2018.7
T4R12=1079,6	11	1079.6	1980.4
T4R12=1118,9	14	1118.9	1941.1
T4R12=1343,5	18	1343.5	1716.5
T4R12=1382,6	16	1382.6	1677.4
T4R12=1421,8	21	1421.8	1638.2
T4R12=1445,0	0	1445.0	1615.0
T4R12-006,1	0	6.1	3053.9
T4R12-046,2	30	46.2	3013.8
T4R12-082,5	25	82.5	2977.5
T4R12-1007,0	27	1007.0	2053.0
T4R12-1157,2	5	1157.2	1902.8
T4R12-1186,7	19	1186.7	1873.3
T4R12-1226,2	21	1226.2	1833.8
T4R12-1265,1	21	1265.1	1794.9
T4R12-197,9	20	197.9	2862.1
T4R12-235,6	22	235.6	2824.4
T4R12-240,8	25	240.8	2819.2
T4R12-243,6	7	243.6	2816.4
T4R12-248,4	32	248.4	2811.6
T4R12-366,3	25	366.3	2693.7
T4R12-404,9	24	404.9	2655.1
T4R12-423,5	34	423.5	2636.5
T4R12-499,4	23	499.4	2560.6
T4R12-538,2	20	538.2	2521.8
T4R12-576,8	22	576.8	2483.2
T4R12-616,6	22	616.6	2443.4

IMAGE NAME	DEFLECTION (PERCENT)	DISTANCE (FT)	STATION (FT)
T4R12-690,6	1	690.6	2369.4
T4R12-694,8	2	694.8	2365.2
T4R12-698,7	18	698.7	2361.3
T4R12-737,8	16	737.8	2322.2
T4R12-776,9	25	776.9	2283.1
T4R12-815,1	21	815.1	2244.9
T4R12-851,7	15	851.7	2208.3
T4R12-890,4	22	890.4	2169.6
T4R12-976,9	27	976.9	2083.1
runc-1	0	3.1	791.9
runc-10	3	160.3	634.7
runc-11	1	199.7	595.3
runc-12	0	238.4	556.6
runc-13	7	277.3	517.7
runc-14	6	316.7	478.3
runc-15	2	356.1	438.9
runc-16	0	389.6	405.4
runc-17	4	393.0	402.0
runc-18*	0	393.2	401.8
runc-19end*	0	394.6	400.4
runc-2	3	4.2	790.8
runc-3	0	7.6	787.4
runc-4	1	12.4	782.6
runc-5	4		795.0
runc-6	6	42.9	752.1
runc-7	0	81.9	713.1
runc-8	0	81.9	713.1
runc-9	3	121.1	673.9
rund-1	0	0.9	394.1
rund-10	2	154.3	240.7
rund-11	4	193.5	201.5
rund-12	13	231.6	163.4
rund-13	1	269.5	125.5
rund-14	12	308.5	86.5
rund-15	12	308.5	86.5
rund-16	15	347.2	47.8
rund-17	0	383.1	11.9
rund-18end	0	388.7	6.3
rund-2	6	3.8	391.2
rund-3	15	6.1	388.9
rund-4	4	11.3	383.7
rund-5	3	15.4	379.6
rund-6	14	16.7	378.3
rund-7	0	40.3	354.7
rund-8	15	75.9	319.1
rund-9	14	115.1	279.9

CCT Video Pictures

Written by: GKM Date: 99/4/1 (YY/MM/DD) Reviewed by: [illegible] Date: 99/04/01 (YY/MM/DD)

Client: FDF Project: LTS INVESTIGATION Project/Proposal No.: [illegible] Task No.: [illegible]

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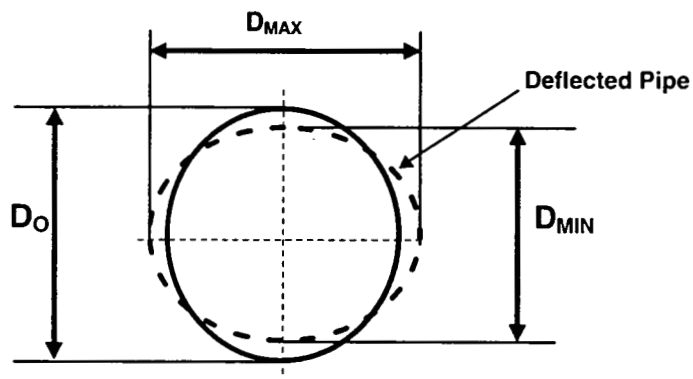
PIPE DEFLECTION CALCULATIONS FROM CCT VIDEO

DEFINITION OF % DEFLECTION AND % OVALITY



$$\%\,RingDeflection = \left(1 - \frac{D_{MIN}}{D_O}\right) \times 100\% \qquad \%\,Ovality = \left(\frac{D_{MAX}}{D_{MIN}} - 1\right) \times 100\%$$

The CCT video was used to evaluate the percent deflection of the carrier pipe of the LTS gravity line. Using video capturing software, still frame snapshots were taken at each butt fusion and electrofusion joint. The distortion of the snapshots appeared minimal based on the roundness the pipe where the buckling pressure was not exceeded. Additionally, the water surface in the pipe showed no indication of distortion. For snapshots that have water in the pipe, the dimensions were estimated based on assuming an elliptical shape for the pipe. The following steps were followed to evaluate the snapshots:

1. Scale the major diameter (D_{max}) and minor diameter (D_{min}). The values shown for D_{max} and D_{min} are relative and do not correspond to physical units. The pipe dimensions were generally measured using a 30 scale for consistency.
2. The ovality was calculated as D_{max} / D_{max}. (Note: Ovality in the following tables corresponds to ovality ratio not percent ovality.)
3. Using the circumference of an ellipse, the percent deflection was found using the following table.

Deflection Percent (%)	Major Diameter (in)	Major Radius (in)	Minor Diameter (in)	Minor Radius (in)	Circle Circumference (in)	Area (in^2)	Ellipse Circumference (in)	Ovality Ratio (-)
0%	6.625	3.31	6.625	3.31	20.81	34.472	20.81	1.00
1%	6.691	3.345	6.559	3.279	20.813	34.465	20.813	0.98
2%	6.755	3.377	6.493	3.246	20.813	34.445	20.813	0.96
3%	6.818	3.409	6.426	3.213	20.813	34.411	20.813	0.94
4%	6.880	3.440	6.360	3.180	20.813	34.366	20.813	0.92
5%	6.940	3.470	6.294	3.147	20.813	34.307	20.813	0.91
6%	7.000	3.500	6.228	3.114	20.813	34.237	20.813	0.89
7%	7.058	3.529	6.161	3.081	20.813	34.156	20.813	0.87
8%	7.116	3.558	6.095	3.048	20.813	34.063	20.813	0.86
9%	7.172	3.586	6.029	3.014	20.813	33.958	20.813	0.84
10%	7.227	3.614	5.963	2.981	20.813	33.844	20.813	0.83
11%	7.281	3.641	5.896	2.948	20.813	33.718	20.813	0.81
12%	7.334	3.667	5.830	2.915	20.813	33.583	20.813	0.79
13%	7.387	3.693	5.764	2.882	20.813	33.438	20.813	0.78
14%	7.438	3.719	5.698	2.849	20.813	33.282	20.813	0.77
15%	7.488	3.744	5.631	2.816	20.813	33.118	20.813	0.75
16%	7.537	3.769	5.565	2.783	20.813	32.944	20.813	0.74
17%	7.586	3.793	5.499	2.749	20.813	32.761	20.813	0.72
18%	7.633	3.817	5.433	2.716	20.813	32.569	20.813	0.71
19%	7.680	3.840	5.366	2.683	20.813	32.369	20.813	0.70
20%	7.726	3.863	5.300	2.650	20.813	32.160	20.813	0.69
21%	7.771	3.886	5.234	2.617	20.813	31.943	20.813	0.67
22%	7.815	3.908	5.168	2.584	20.813	31.719	20.813	0.66
23%	7.859	3.929	5.101	2.551	20.813	31.486	20.813	0.65
24%	7.901	3.951	5.035	2.518	20.813	31.245	20.813	0.64
25%	7.943	3.972	4.969	2.484	20.813	30.998	20.813	0.63
26%	7.984	3.992	4.903	2.451	20.813	30.742	20.813	0.61
27%	8.024	4.012	4.836	2.418	20.813	30.480	20.813	0.60
28%	8.064	4.032	4.770	2.385	20.813	30.211	20.813	0.59
29%	8.103	4.051	4.704	2.352	20.813	29.934	20.813	0.58
30%	8.141	4.070	4.638	2.319	20.813	29.652	20.813	0.57
31%	8.178	4.089	4.571	2.286	20.813	29.362	20.813	0.56
32%	8.215	4.108	4.505	2.253	20.813	29.066	20.813	0.55
33%	8.251	4.125	4.439	2.219	20.813	28.764	20.813	0.54
34%	8.286	4.143	4.373	2.186	20.813	28.456	20.813	0.53
35%	8.321	4.160	4.306	2.153	20.813	28.142	20.813	0.52
36%	8.355	4.177	4.240	2.120	20.813	27.822	20.813	0.51
37%	8.388	4.194	4.174	2.087	20.813	27.497	20.813	0.50
38%	8.421	4.210	4.108	2.054	20.813	27.166	20.813	0.49
39%	8.453	4.226	4.041	2.021	20.813	26.829	20.813	0.48
40%	8.484	4.242	3.975	1.988	20.813	26.487	20.813	0.47
41%	8.515	4.257	3.909	1.954	20.813	26.140	20.813	0.46
42%	8.545	4.272	3.843	1.921	20.813	25.788	20.813	0.45
43%	8.574	4.287	3.776	1.888	20.813	25.431	20.813	0.44
44%	8.603	4.302	3.710	1.855	20.813	25.069	20.813	0.43
45%	8.632	4.316	3.644	1.822	20.813	24.702	20.813	0.42
46%	8.659	4.330	3.578	1.789	20.813	24.330	20.813	0.41
47%	8.686	4.343	3.511	1.756	20.813	23.955	20.813	0.40
48%	8.713	4.356	3.445	1.723	20.813	23.574	20.813	0.40
49%	8.739	4.369	3.379	1.689	20.813	23.190	20.813	0.39
50%	8.764	4.382	3.313	1.656	20.813	22.801	20.813	0.38
52%	8.813	4.406	3.180	1.590	20.813	22.011	20.813	0.36
54%	8.860	4.430	3.048	1.524	20.813	21.206	20.813	0.34
56%	8.904	4.452	2.915	1.458	20.813	20.385	20.813	0.33
58%	8.946	4.473	2.783	1.391	20.813	19.551	20.813	0.31
60%	8.987	4.493	2.650	1.325	20.813	18.704	20.813	0.29

Tape #1, Run #1

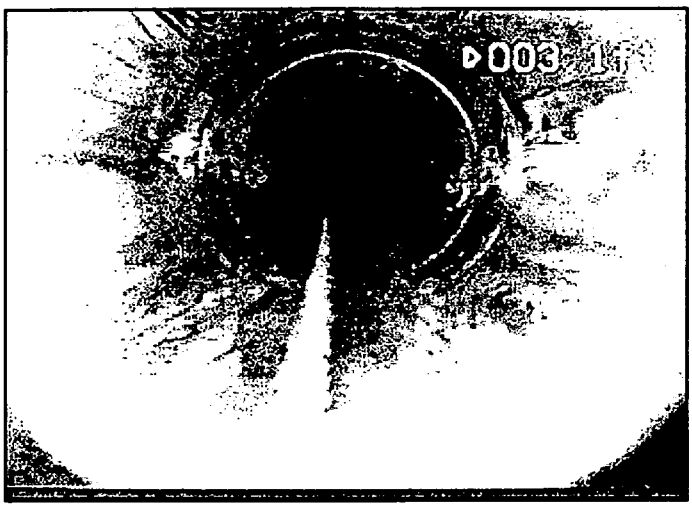
PLS INTERNATIONAL CCTV
INSPECTION TAPE FOR:
FLUOR DANIEL 2/12/99

INSPECT: 6" LEACHATE
CONVEYANCE SYSTEM
ENTER: EXCAVATION #1 SOUTH
TOWARDS MANHOLE #3.

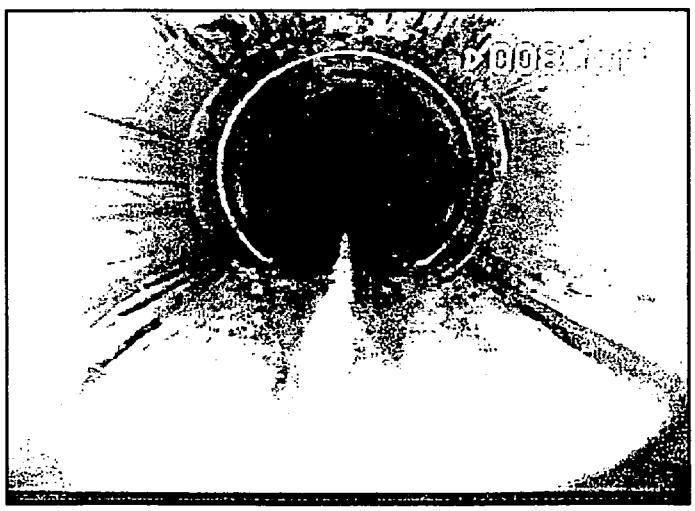
RUN#1
TAPE#1

Filename: T1R1-0	
Major Diameter	
Minor Diameter	
Ovality	
% Deflection	
Station #	

2195

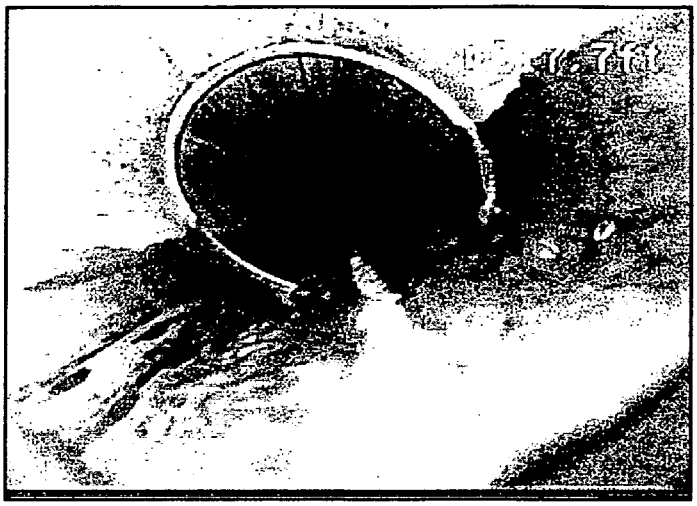


Filename: T1R1-003,1	
Major Diameter	36
Minor Diameter	34
Ovality	0.94
% Deflection	3%
Station #	1316.9

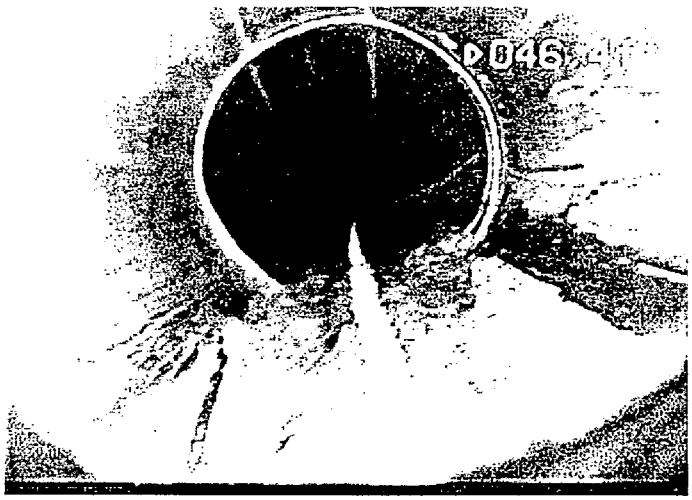


Filename: T1R1-008,0	
Major Diameter	38
Minor Diameter	35
Ovality	0.92
% Deflection	4%
Station #	1312

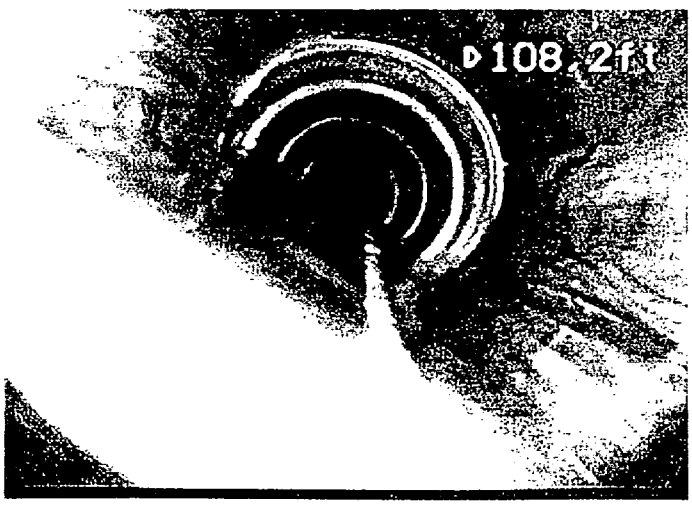
2195



Filename: T1R1-017,7	
Major Diameter	47
Minor Diameter	36
Ovality	0.77
% Deflection	14%
Station #	1302.3

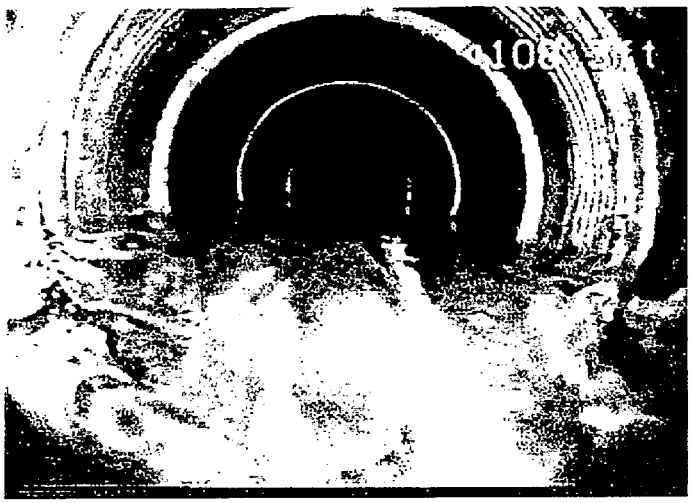


Filename: T1R1-046,4	
Major Diameter	43
Minor Diameter	43
Ovality	1.00
% Deflection	0%
Station #	1273.6



Filename: T1R1-108,2	
Major Diameter	42
Minor Diameter	37
Ovality	0.88
% Deflection	7%
Station #	1211.8

2195



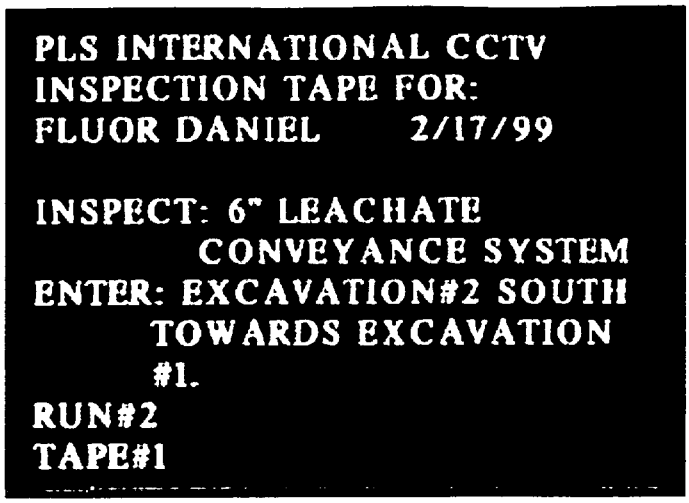
Filename:	T1R1-108,3leak

Major Diameter	
Minor Diameter	
Ovality	
% Deflection	
Station #	

Filename:	T1R1-115,4

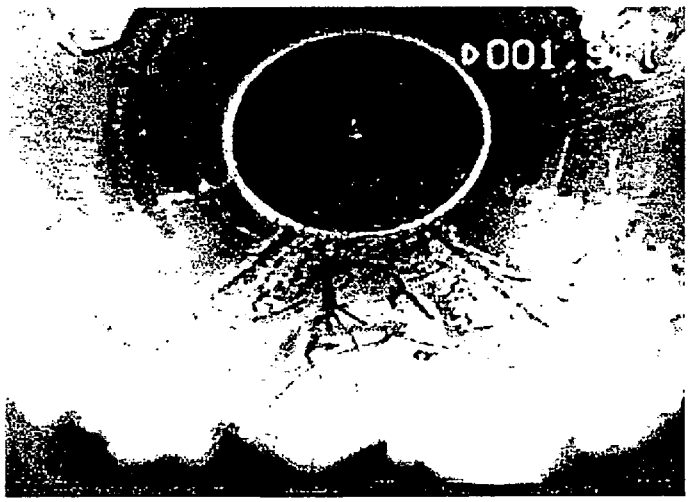
Major Diameter	56
Minor Diameter	51
Ovality	0.91
% Deflection	5%
Station #	1204.6

Tape #1, Run #2

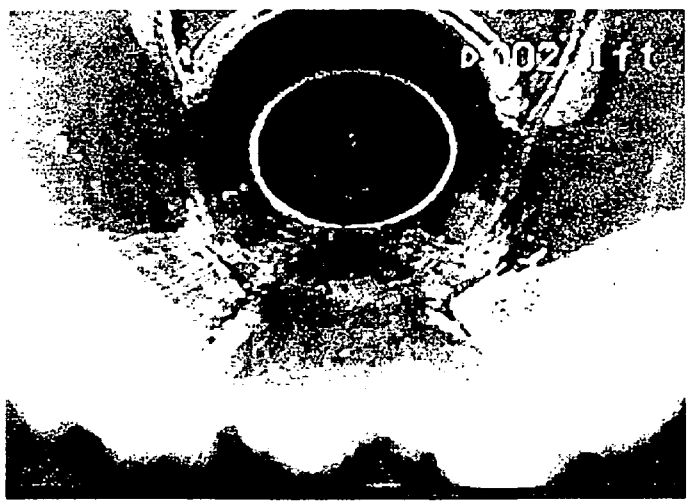


Filename: T1R2-0	
Major Diameter	
Minor Diameter	
Ovality	
% Deflection	
Station #	

2195

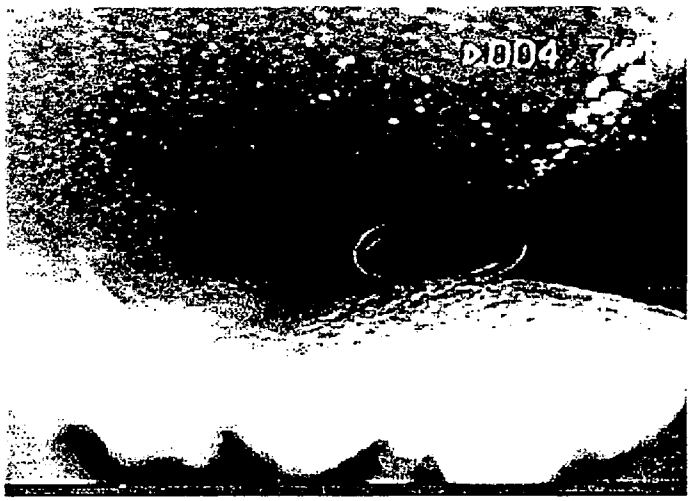


Filename: T1R2-001,9	
Major Diameter	39
Minor Diameter	31
Ovality	0.79
% Deflection	12%
Station #	1598.1



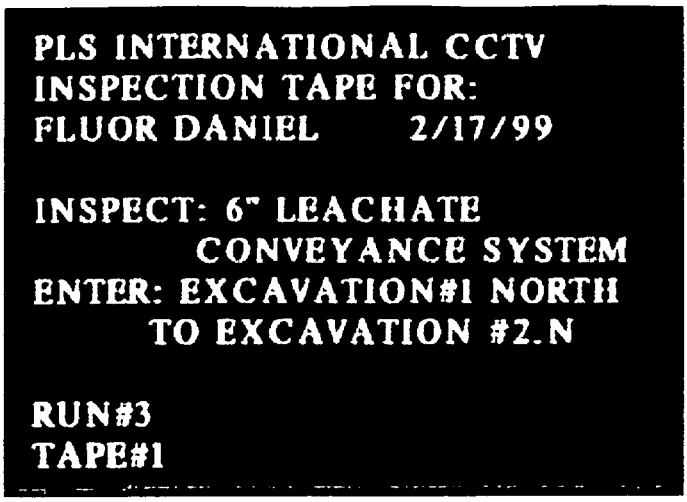
Filename: T1R2-002,1	
Major Diameter	29
Minor Diameter	24
Ovality	0.83
% Deflection	10%
Station #	1597.9

2195



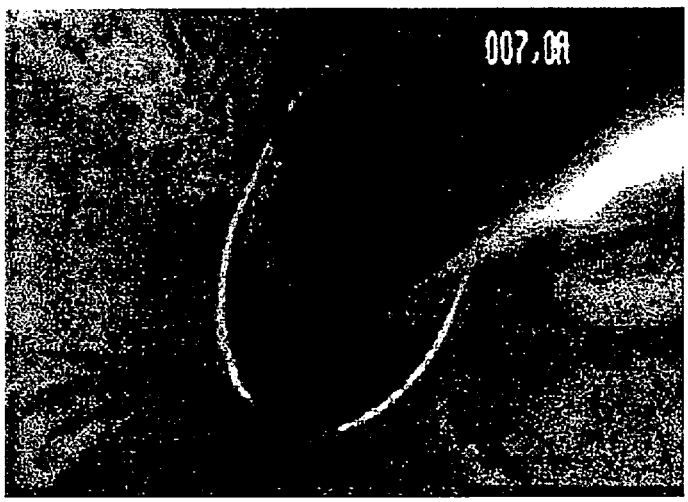
Filename: T1R2-004,7	
Major Diameter	21
Minor Diameter	9
Ovality	0.43
% Deflection	44%
Station #	1595.3

Tape #1, Run #3

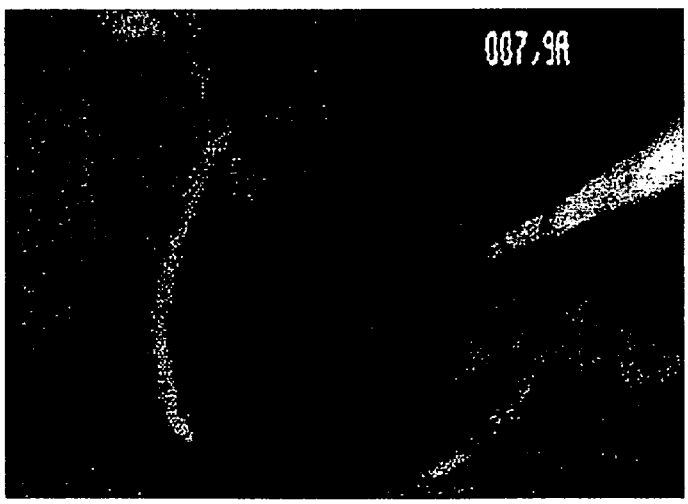


Filename: T1R3-0	
Major Diameter	
Minor Diameter	
Ovality	
% Deflection	
Station #	

2195



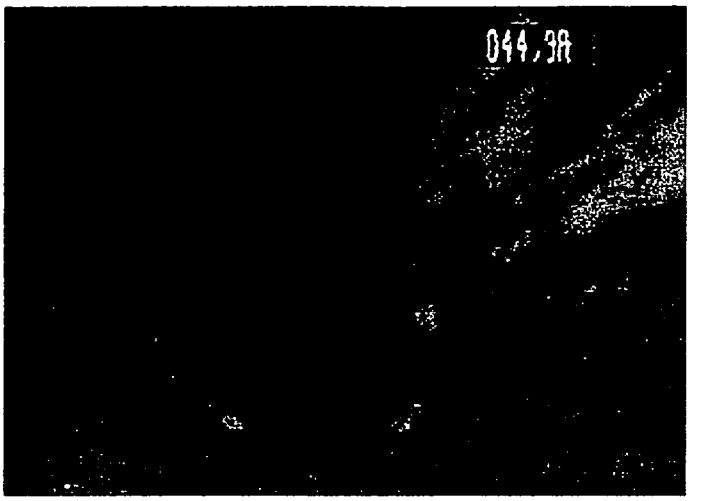
Filename: T1R3-007,0	
Major Diameter	64
Minor Diameter	34
Ovality	0.53
% Deflection	34%
Station #	1327



Filename: T1R3-007,9	
Major Diameter	92
Minor Diameter	56
Ovality	0.61
% Deflection	26%
Station #	1327.9

377

2195

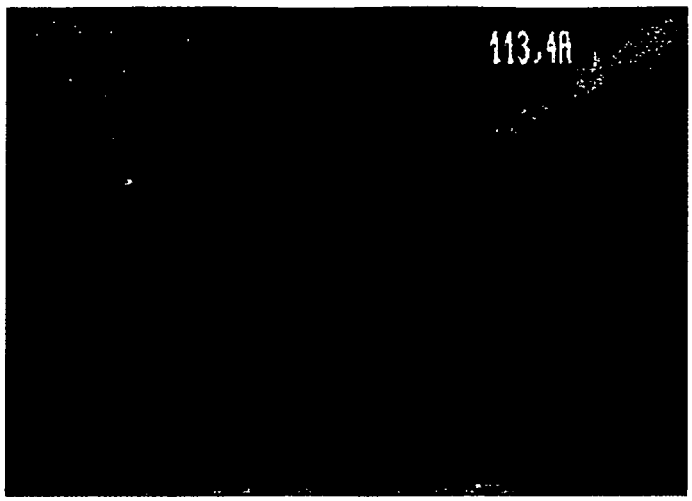


Filename: T1R3-044,9	
Major Diameter	73
Minor Diameter	40
Ovality	0.55
% Deflection	32%
Station #	1364.9

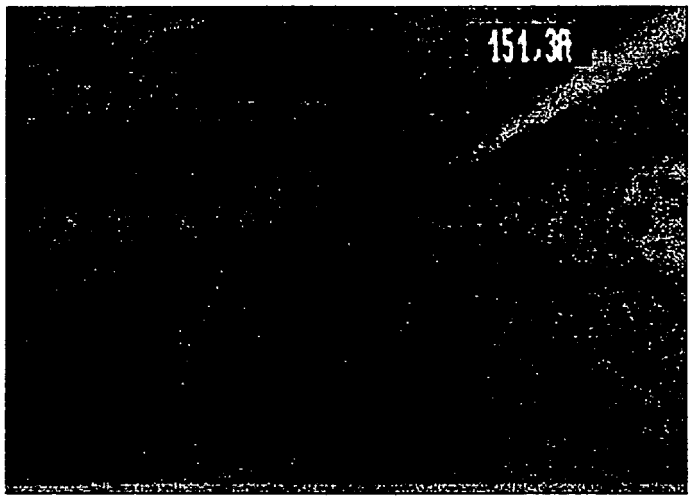
Filename: T1R3-045,2	
Major Diameter	74
Minor Diameter	41
Ovality	0.55
% Deflection	32%
Station #	1365.2

Filename: T1R3-081,1	
Major Diameter	60
Minor Diameter	32
Ovality	0.53
% Deflection	34%
Station #	1401.1

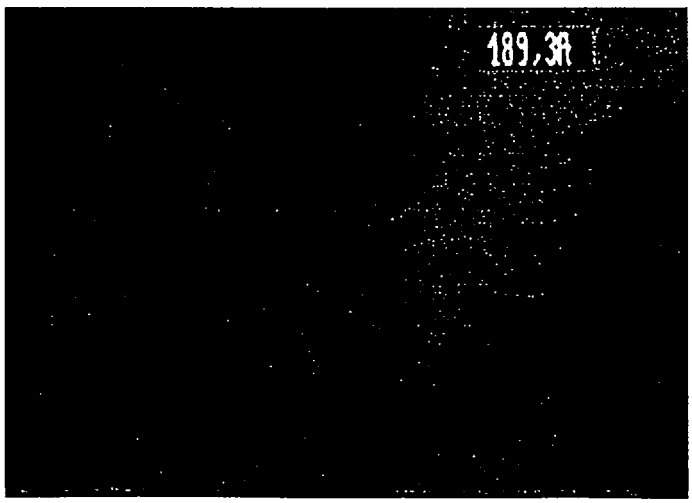
2195



Filename: T1R3-113,4	
Major Diameter	26
Minor Diameter	16
Ovality	0.62
% Deflection	26%
Station #	1433.4

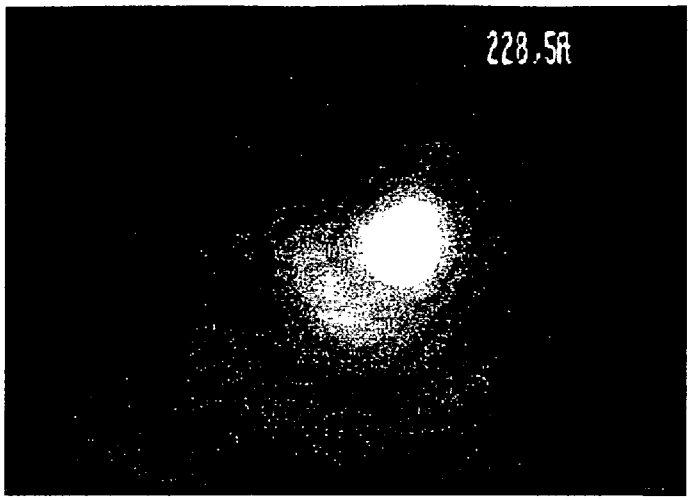


Filename: T1R3-151,3	
Major Diameter	34
Minor Diameter	25
Ovality	0.74
% Deflection	16%
Station #	1471.3

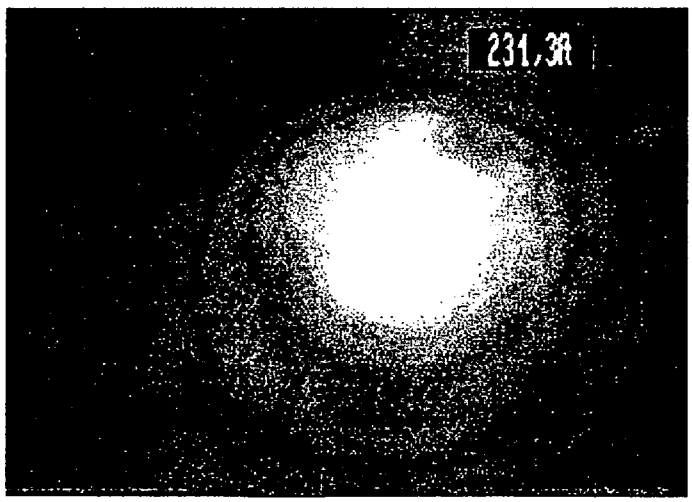


Filename: T1R3-189,3	
Major Diameter	50
Minor Diameter	31
Ovality	0.62
% Deflection	26%
Station #	1509.3

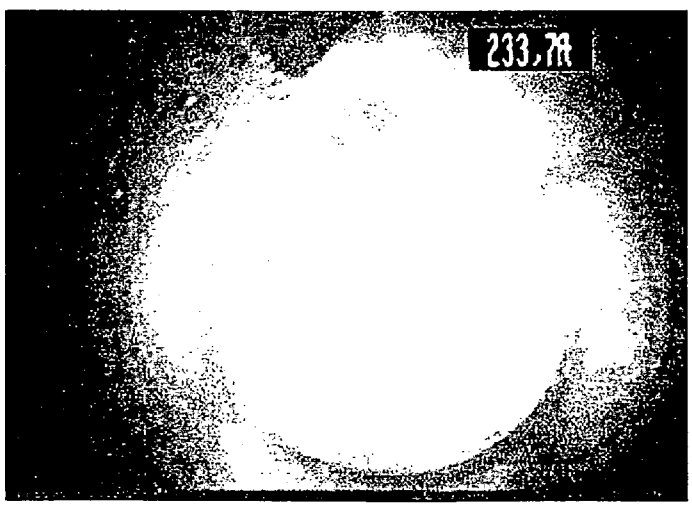
2195



Filename: T1R3-228,5	
Major Diameter	55
Minor Diameter	32
Ovality	0.58
% Deflection	29%
Station #	1548.5

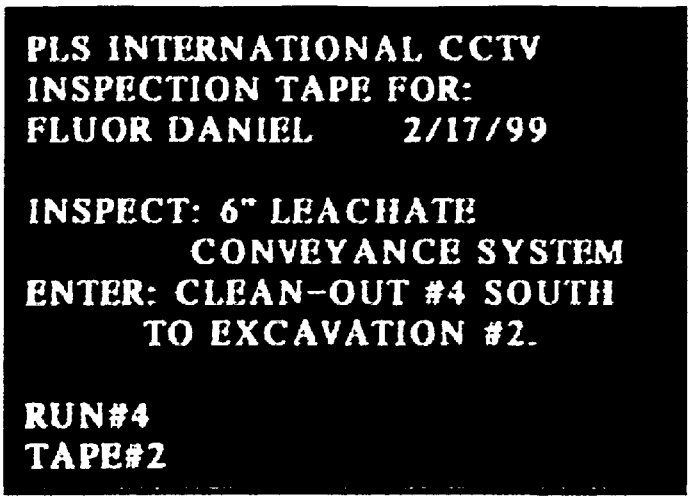


Filename: T1R3,231,3	
Major Diameter	66
Minor Diameter	55
Ovality	0.83
% Deflection	10%
Station #	1551.3



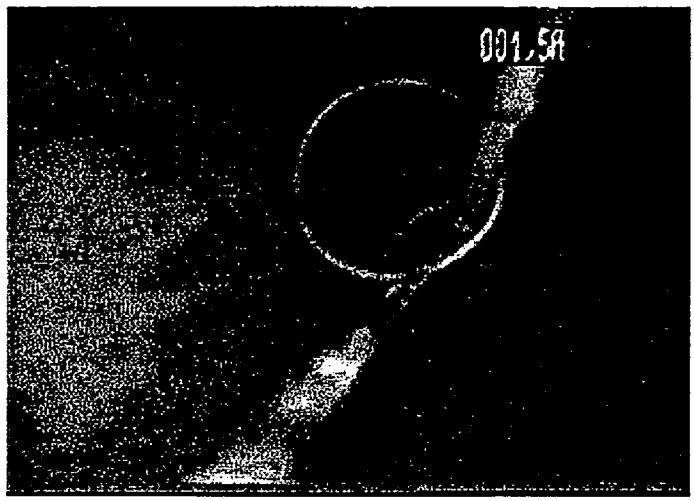
Filename: T1R3-233,7	
Major Diameter	55
Minor Diameter	53
Ovality	0.96
% Deflection	2%
Station #	1553.7

Tape #2, Run #4

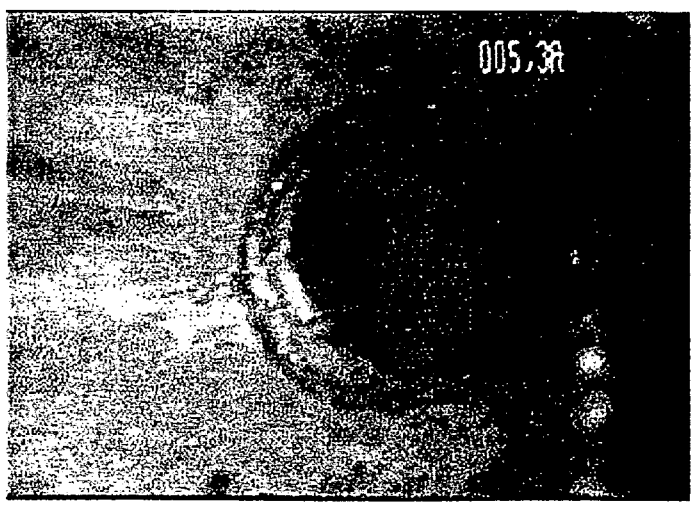


Filename: T2R4-0	
Major Diameter	
Minor Diameter	
Ovality	
% Deflection	
Station #	

2195

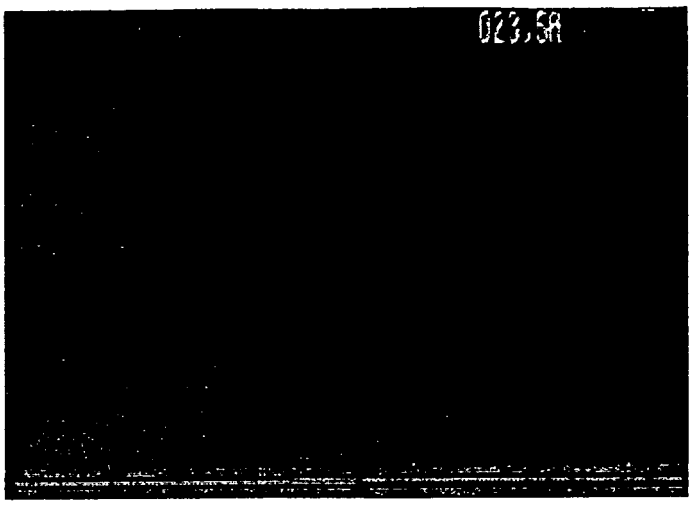


Filename: T2R4-001,5	
Major Diameter	30
Minor Diameter	29
Ovality	0.97
% Deflection	2%
Station #	1451.5



Filename: T2R4-005,3	
Major Diameter	52
Minor Diameter	43
Ovality	0.83
% Deflection	10%
Station #	1455.3

2195



Filename: T2R4-023,5	

Major Diameter	38
Minor Diameter	17
Ovality	0.45
% Deflection	42%
Station #	1473.5

Tape #2, Run #6

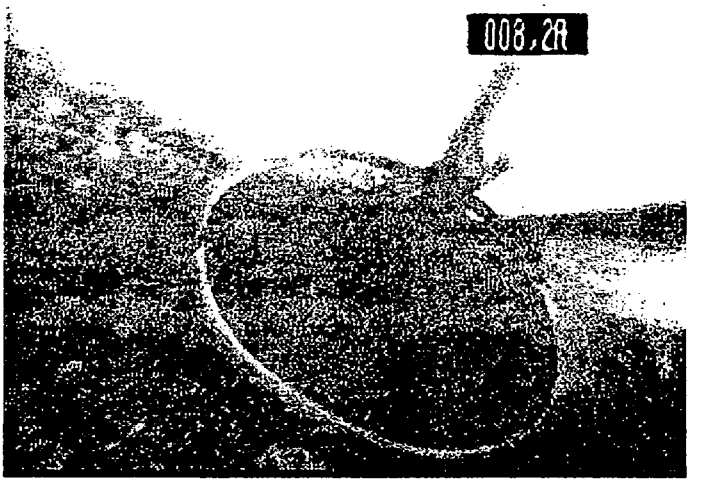
PLS INTERNATIONAL CCTV
INSPECTION TAPE FOR:
FLUOR DANIEL 2/19/99

INSPECT: 6" LEACHATE
CONVEYANCE SYSTEM
ENTER: SAME RUN, FILMED
DURING PULLBACK.

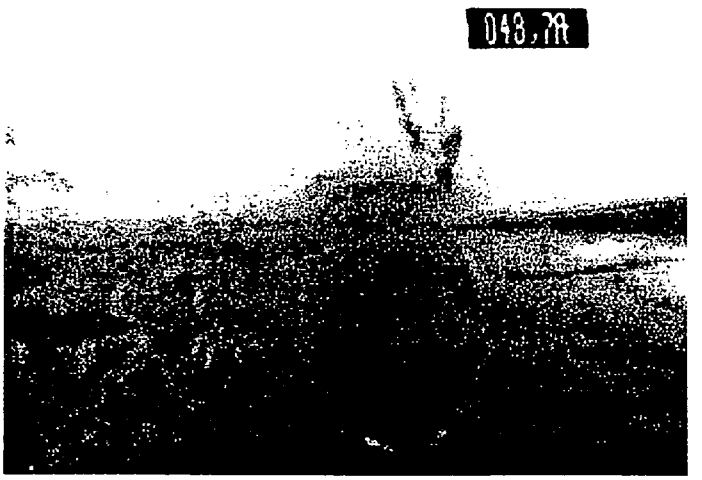
TAPE#2
RUN#6

Filename: T2R6-0	
Major Diameter	
Minor Diameter	
Ovality	
% Deflection	
Station #	

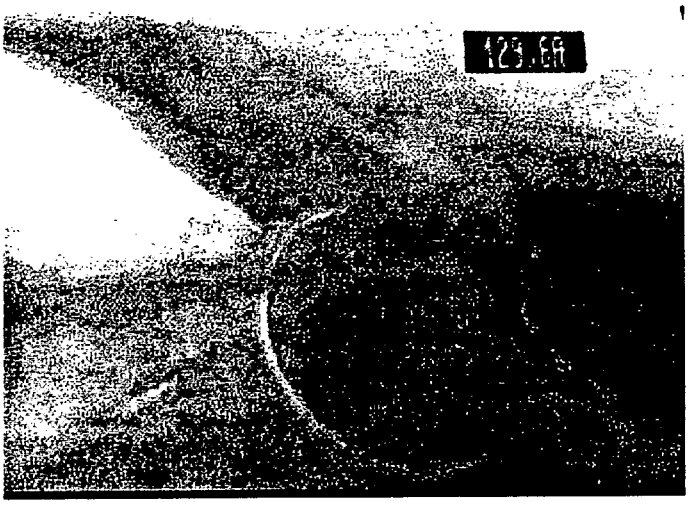
2195



Filename: T2R6-008,2	
Major Diameter	59
Minor Diameter	38
Ovality	0.64
% Deflection	24%
Station #	1458.2

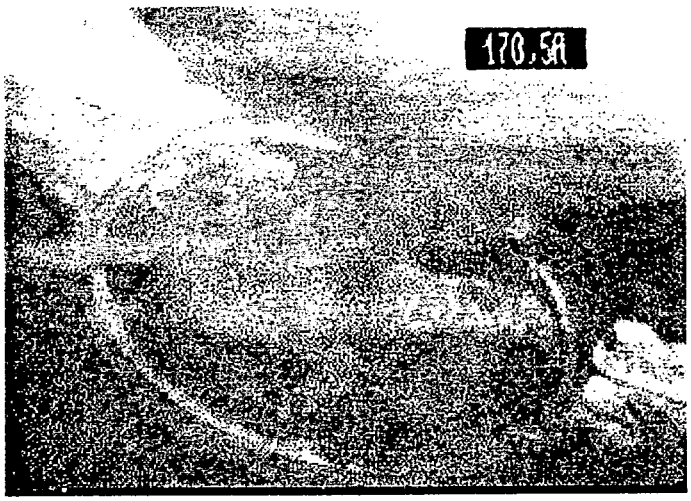


Filename: T2R6-048,7	
Major Diameter	40
Minor Diameter	27
Ovality	0.68
% Deflection	21%
Station #	1498.7

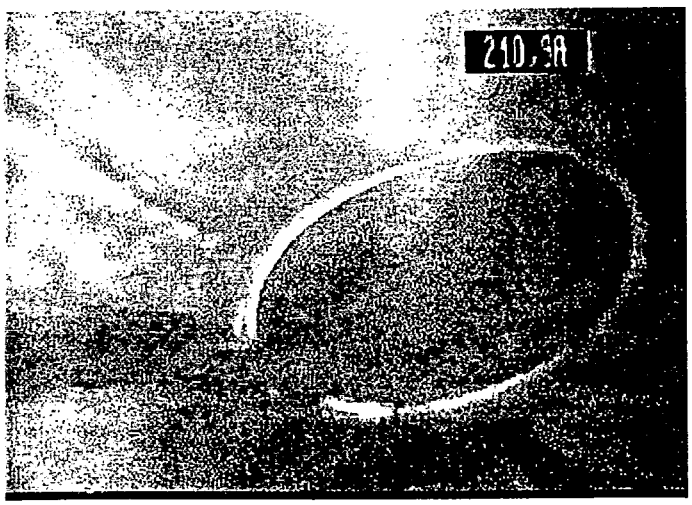


Filename: T2R6-129,6	
Major Diameter	46
Minor Diameter	33
Ovality	0.72
% Deflection	17%
Station #	1579.6

2195



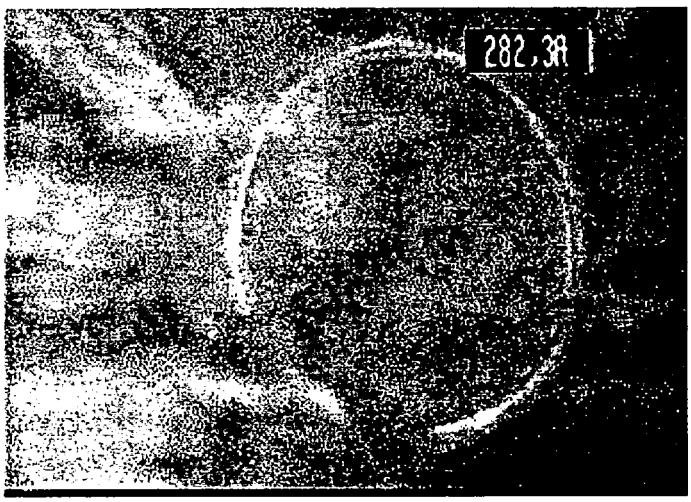
Filename: T2R6-170,5	
Major Diameter	73
Minor Diameter	45
Ovality	0.62
% Deflection	26%
Station #	1620.5



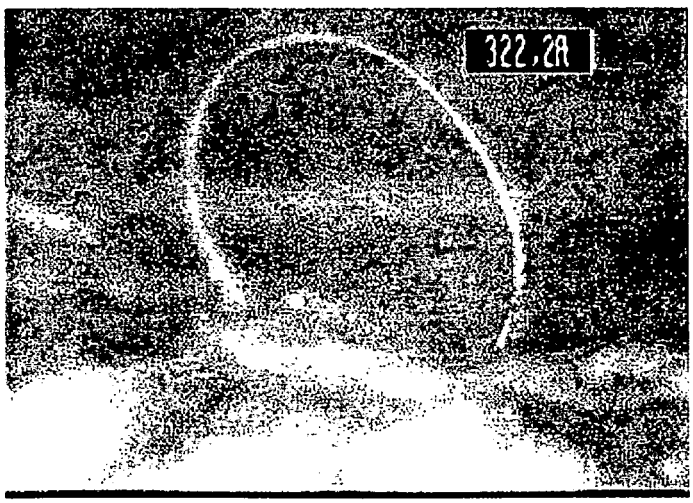
Filename: T2R6-210,9	
Major Diameter	60
Minor Diameter	36
Ovality	0.60
% Deflection	27%
Station #	1620.9

Filename: T2R6-251,4	
Major Diameter	61
Minor Diameter	35
Ovality	0.57
% Deflection	30%
Station #	1701.4

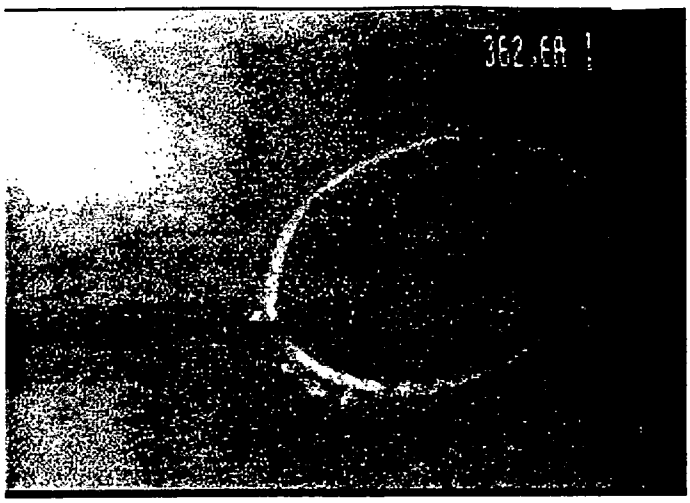
2195



Filename: T2R6-282,3	
Major Diameter	58
Minor Diameter	50
Ovality	0.86
% Deflection	8%
Station #	1732.3



Filename: T2R6-322,2	
Major Diameter	60
Minor Diameter	41
Ovality	0.68
% Deflection	21%
Station #	1772.2



Filename: T2R6-362,6	
Major Diameter	53
Minor Diameter	36
Ovality	0.68
% Deflection	21%
Station #	1812.6

2195

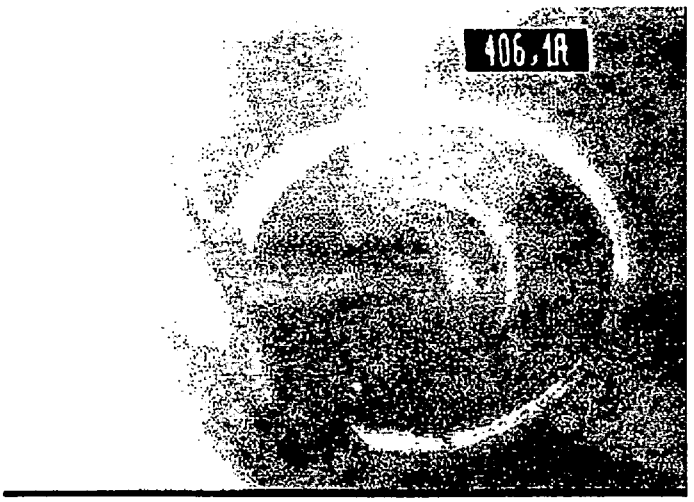
Filename: T2R6-402,6	
Major Diameter	60
Minor Diameter	41
Ovality	0.68
% Deflection	21%
Station #	1852.6

Filename: T2R6-403,6	
Major Diameter	65
Minor Diameter	40
Ovality	0.62
% Deflection	26%
Station #	1853.6

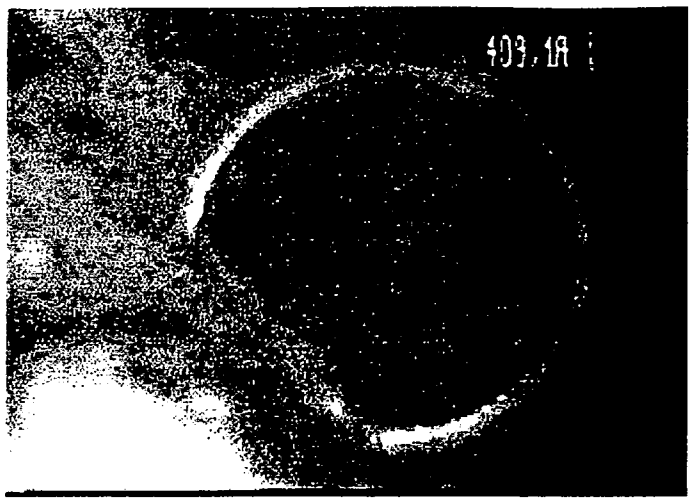
Filename: T2R6-404,6	
Major Diameter	65
Minor Diameter	39
Ovality	0.60
% Deflection	27%
Station #	1854.6

2195

Filename: T2R6-405,9	
Major Diameter	49
Minor Diameter	41
Ovality	0.84
% Deflection	9%
Station #	1855.9



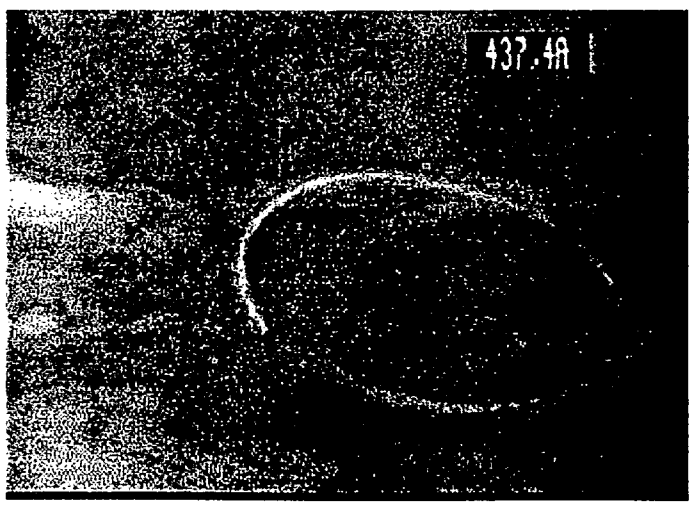
Filename: T2R6-406,1	
Major Diameter	55
Minor Diameter	49
Ovality	0.89
% Deflection	6%
Station #	1856.1



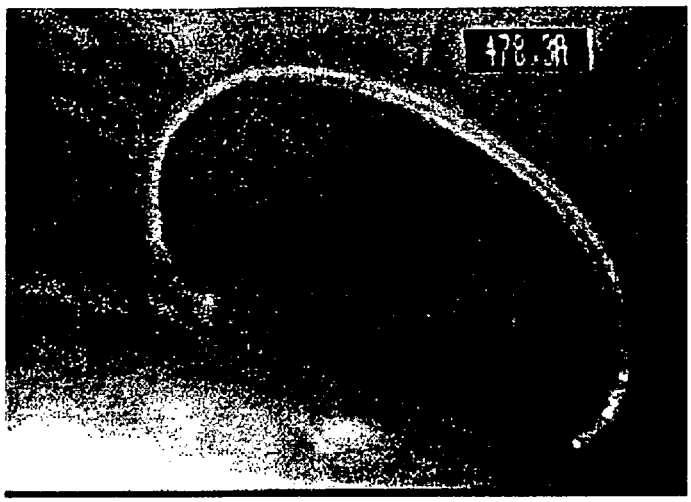
Filename: T2R6-409,1	
Major Diameter	58
Minor Diameter	55
Ovality	0.95
% Deflection	3%
Station #	1859.1

2195

Filename: T2R6-410,4	
Major Diameter	51
Minor Diameter	42
Ovality	0.82
% Deflection	11%
Station #	1860.4

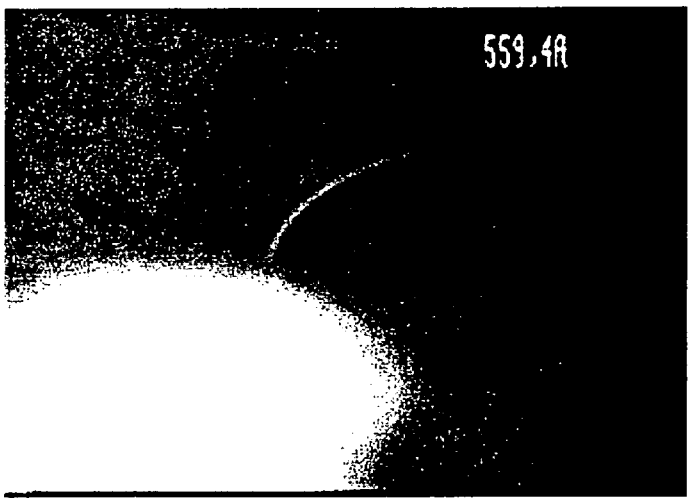


Filename: T2R6-437,4	
Major Diameter	58
Minor Diameter	32
Ovality	0.55
% Deflection	32%
Station #	1887.4

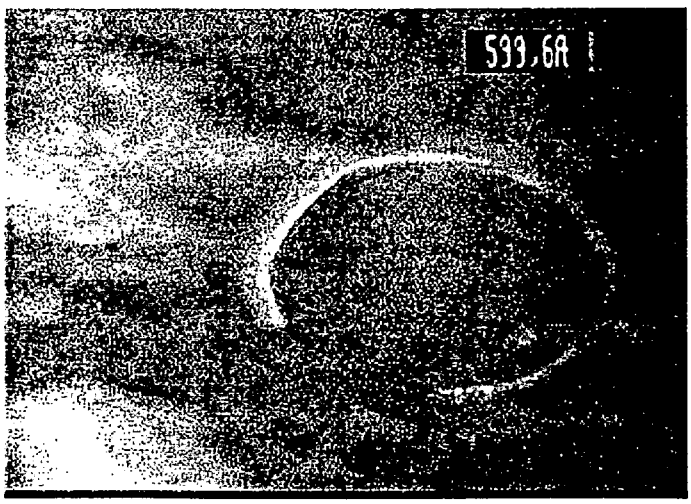


Filename: T2R6-478,3	
Major Diameter	79
Minor Diameter	45
Ovality	0.57
% Deflection	30%
Station #	1928.3

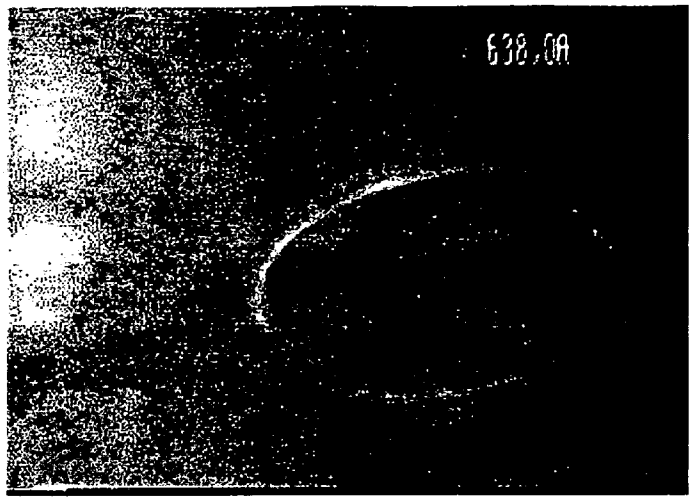
2195



Filename: T2R6-559,4	
Major Diameter	60
Minor Diameter	36
Ovality	0.60
% Deflection	27%
Station #	2009.4

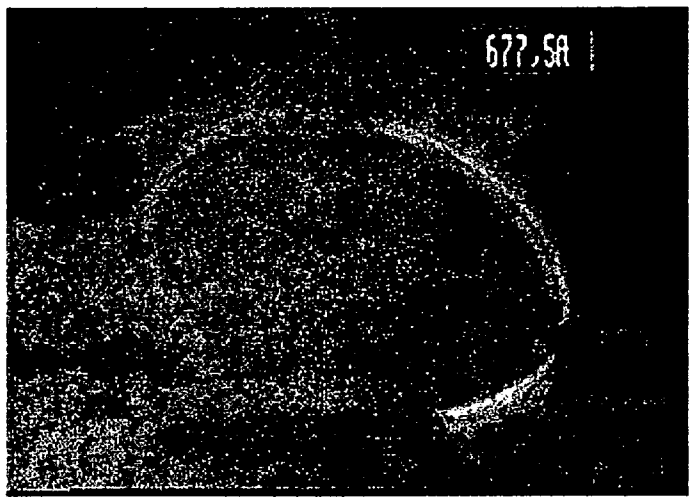


Filename: T2R6-559,6	
Major Diameter	52
Minor Diameter	35
Ovality	0.67
% Deflection	21%
Station #	2009.6

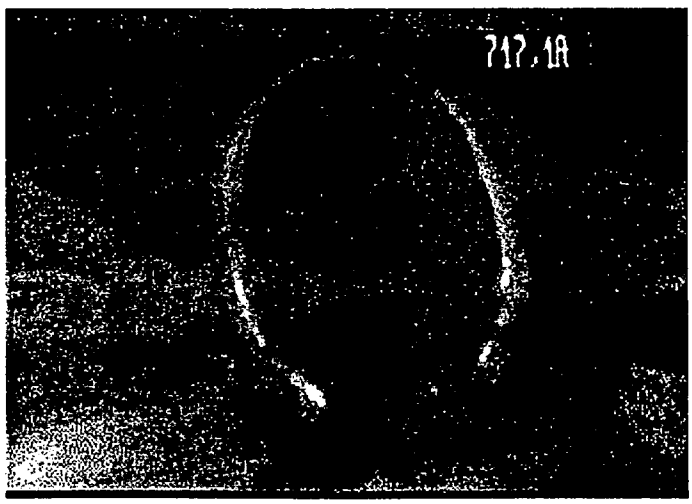


Filename: T2R6-638,0	
Major Diameter	55
Minor Diameter	33
Ovality	0.60
% Deflection	27%
Station #	2088

2195



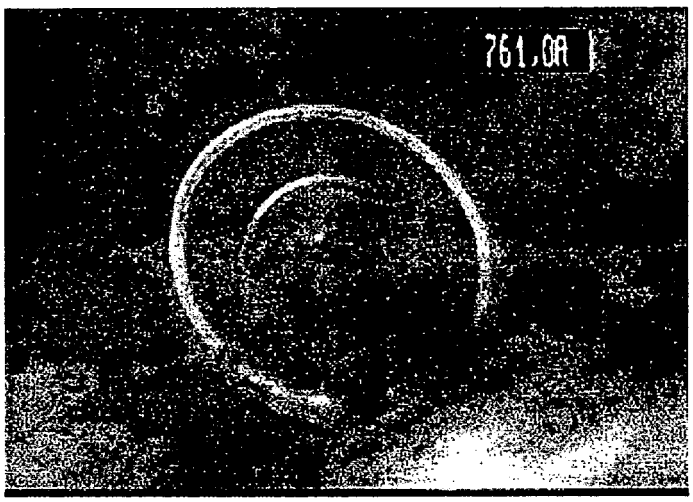
Filename: T2R6-677,5	
Major Diameter	65
Minor Diameter	44
Ovality	0.68
% Deflection	21%
Station #	2127.5



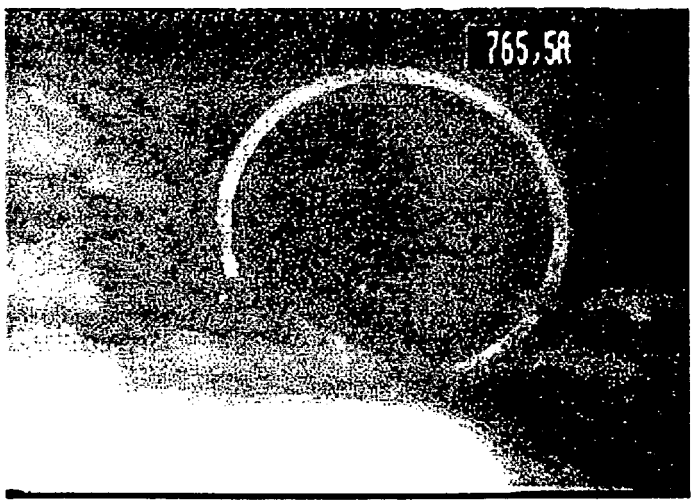
Filename: T2R6-717,1	
Major Diameter	55
Minor Diameter	39
Ovality	0.71
% Deflection	18%
Station #	2167.1

Filename: T2R6-757,6	
Major Diameter	57
Minor Diameter	35
Ovality	0.61
% Deflection	26%
Station #	2207.6

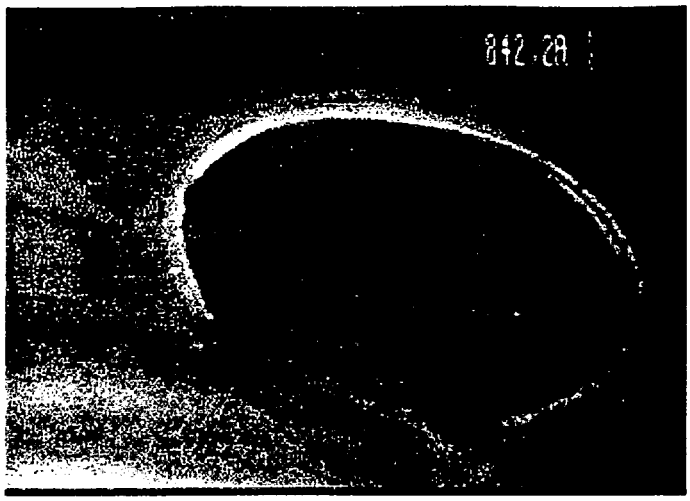
2195



Filename: T2R6-761,0	
Major Diameter	47
Minor Diameter	42
Ovality	0.89
% Deflection	6%
Station #	2211

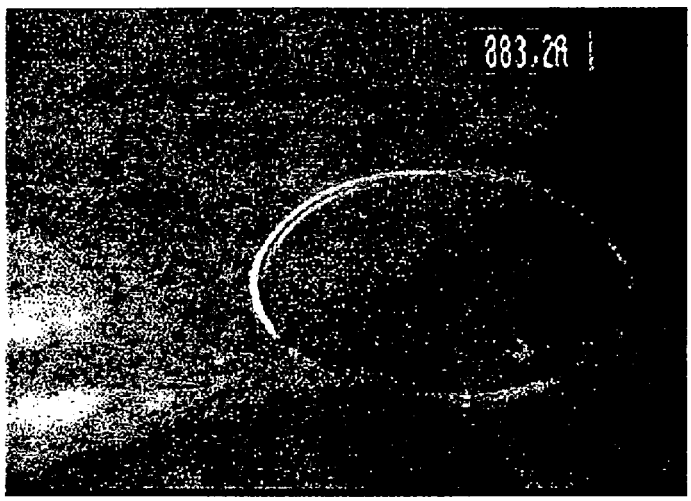


Filename: T2R6-765,5	
Major Diameter	49
Minor Diameter	44
Ovality	0.90
% Deflection	6%
Station #	2215.5

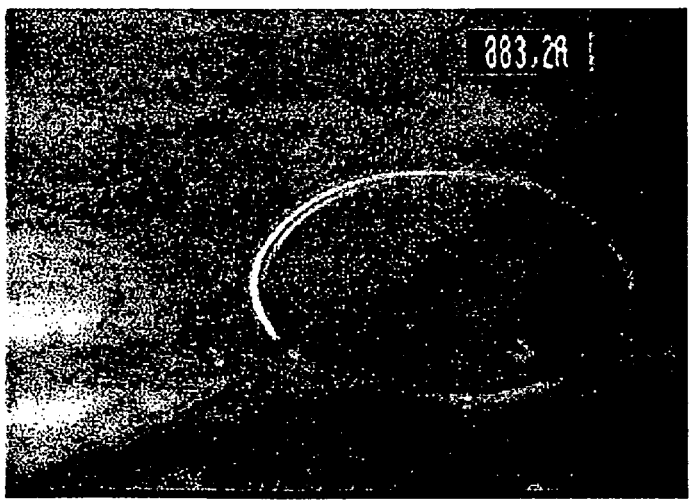


Filename: T2R6-842,2	
Major Diameter	72
Minor Diameter	45
Ovality	0.63
% Deflection	25%
Station #	2292.2

2195



Filename: T2R6-883,2	
Major Diameter	57
Minor Diameter	34
Ovality	0.60
% Deflection	27%
Station #	2333.2

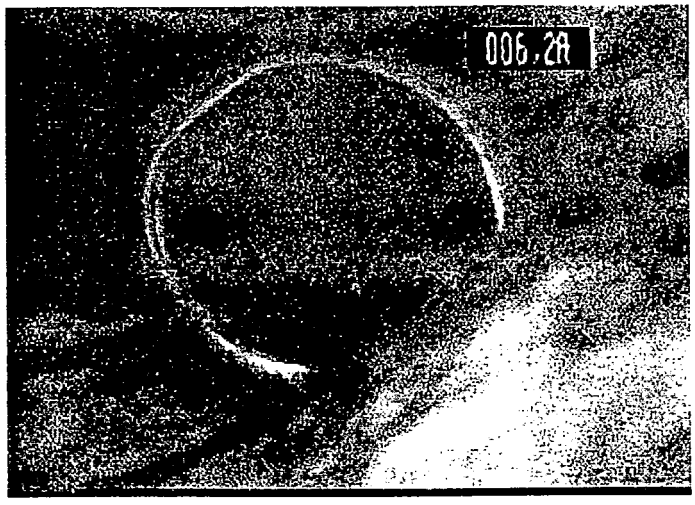


Filename: T2R6-883,2	
Major Diameter	57
Minor Diameter	34
Ovality	0.60
% Deflection	27%
Station #	233.2

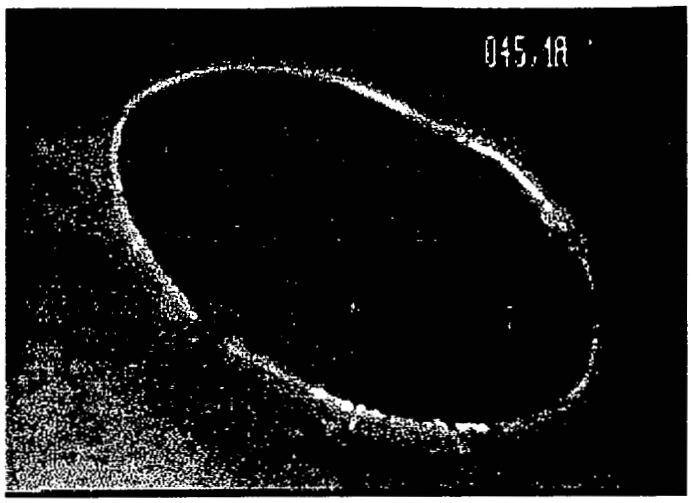
Filename: T2R6-924,6	
Major Diameter	53
Minor Diameter	33
Ovality	0.62
% Deflection	26%
Station #	2374.6

2195

Filename: T2R6-965,5	
Major Diameter	44
Minor Diameter	27
Ovality	0.61
% Deflection	26%
Station #	2415.5

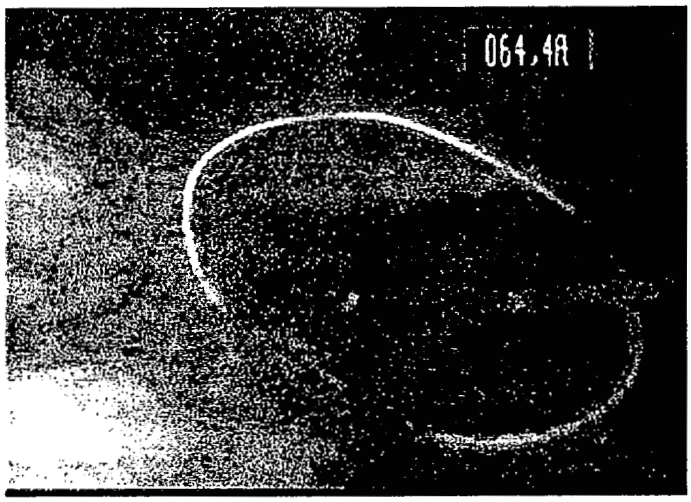


Filename: T2R6-1006,2	
Major Diameter	52
Minor Diameter	48
Ovality	0.92
% Deflection	4%
Station #	2456.2

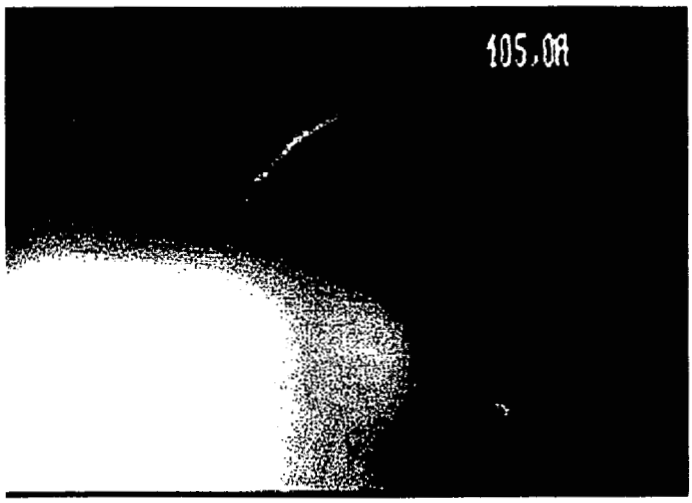


Filename: T2R6-1045,1	
Major Diameter	81
Minor Diameter	44
Ovality	0.54
% Deflection	33%
Station #	2495.1

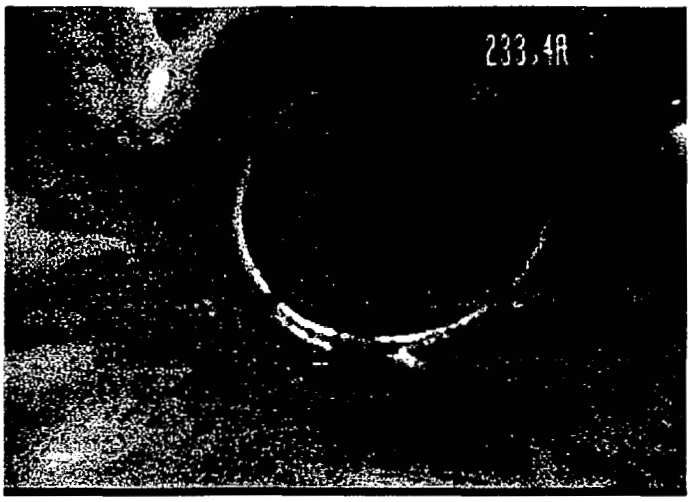
2195



Filename: T2R6-1064,4	
Major Diameter	72
Minor Diameter	41
Ovality	0.57
% Deflection	30%
Station #	2514.4

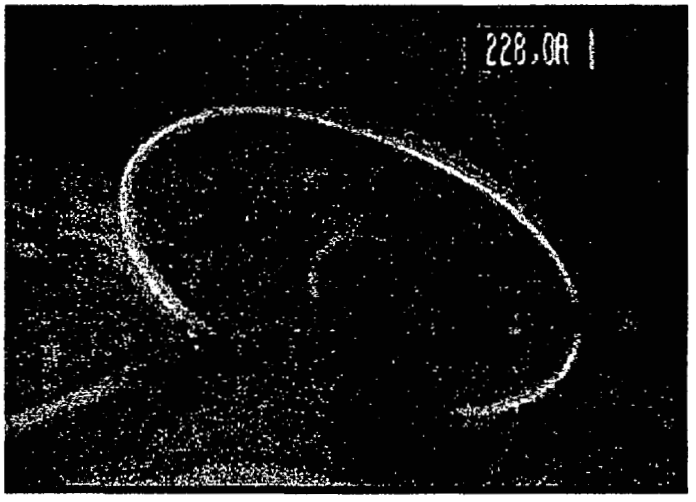


Filename: T2R6-1105,0	
Major Diameter	59
Minor Diameter	34
Ovality	0.58
% Deflection	29%
Station #	2555

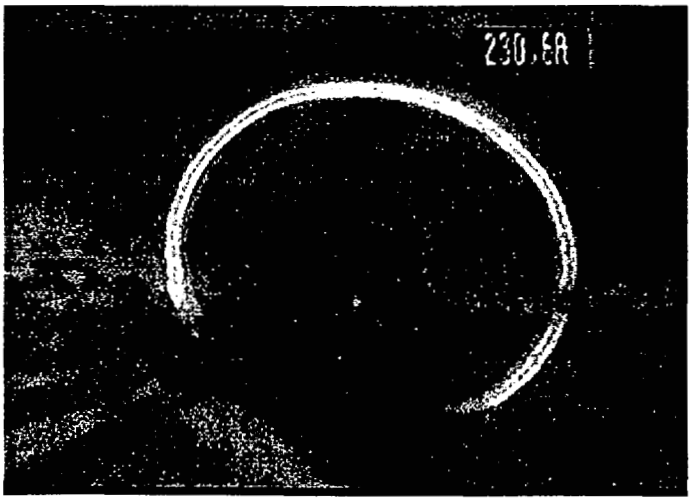


Filename: T2R6-1233,4	
Major Diameter	46
Minor Diameter	41
Ovality	0.89
% Deflection	6%
Station #	2683.4

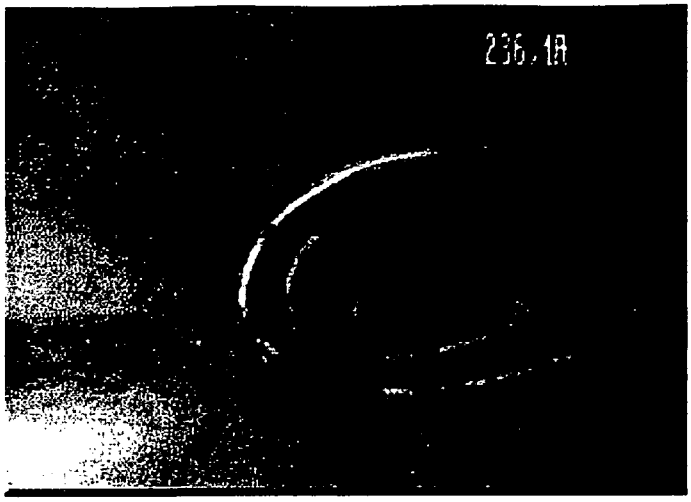
2195



Filename: T2R6-1228,0	
Major Diameter	72
Minor Diameter	37
Ovality	0.51
% Deflection	36%
Station #	2678

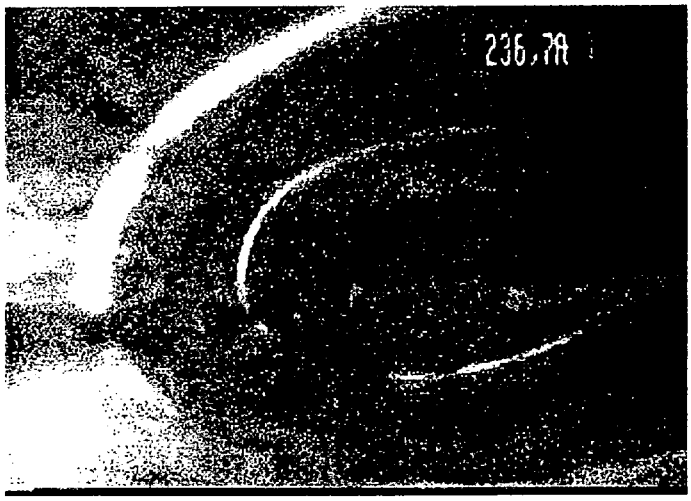


Filename: T2R6-1230,6	
Major Diameter	58
Minor Diameter	46
Ovality	0.79
% Deflection	12%
Station #	2680.6

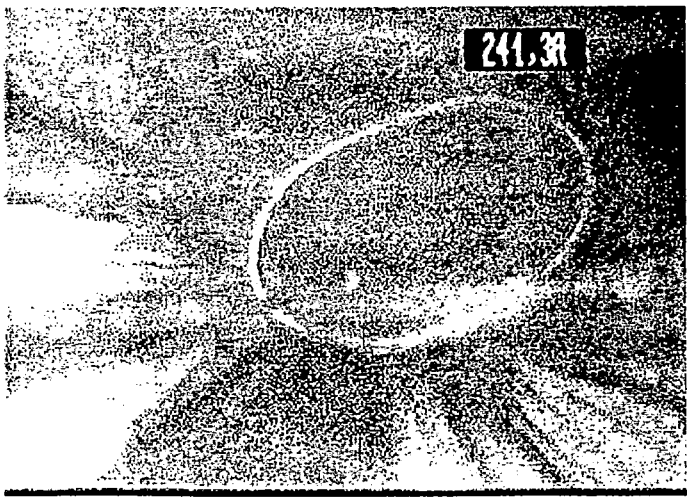


Filename: T2R6-1236,1	
Major Diameter	63
Minor Diameter	36
Ovality	0.57
% Deflection	30%
Station #	2686.1

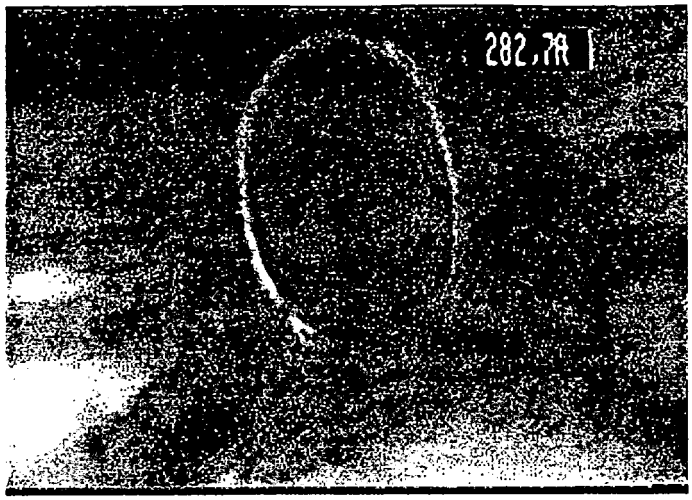
2195



Filename: T2R6-1236,7	
Major Diameter	63
Minor Diameter	35
Ovality	0.56
% Deflection	31%
Station #	2686.7

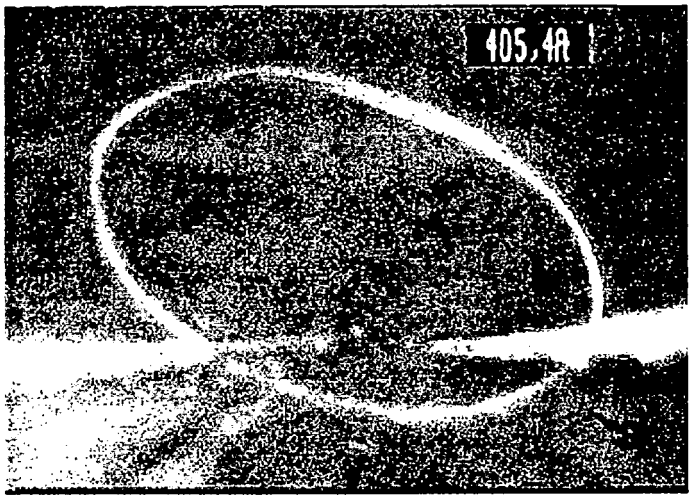


Filename: T2R6-241,3	
Major Diameter	53
Minor Diameter	32
Ovality	0.60
% Deflection	27%
Station #	2691.3

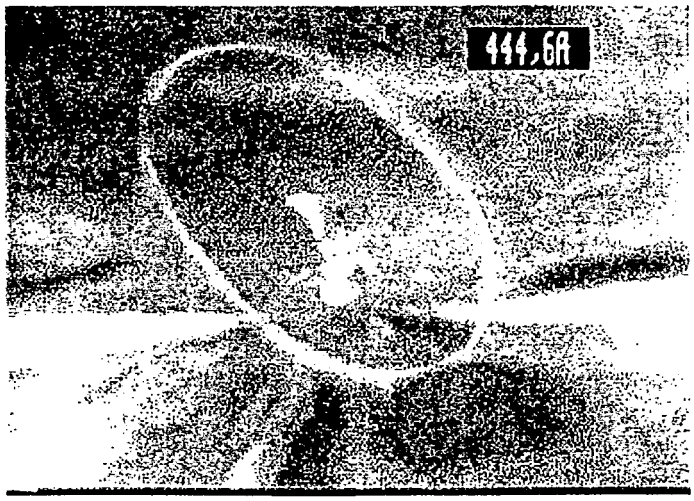


Filename: T2R6-1282,7	
Major Diameter	48
Minor Diameter	31
Ovality	0.65
% Deflection	23%
Station #	2732.7

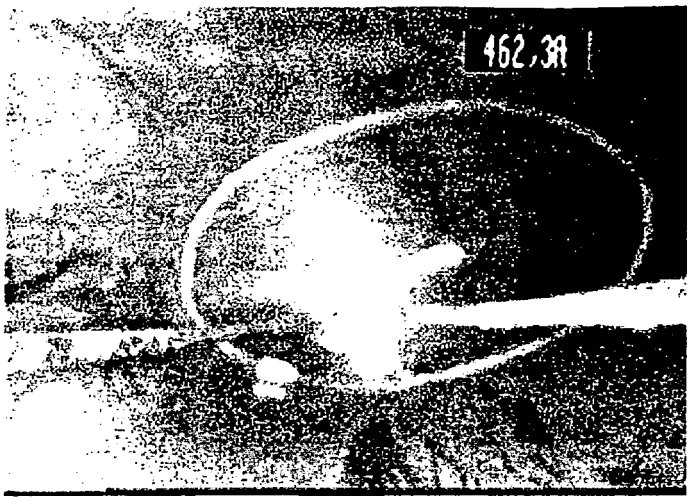
2195



Filename: T2R6-1405,4	
Major Diameter	79
Minor Diameter	46
Ovality	0.58
% Deflection	29%
Station #	2855.4



Filename: T2R6-1444,6	
Major Diameter	61
Minor Diameter	35
Ovality	0.57
% Deflection	30%
Station #	2894.6



Filename: T2R6-1462,3	
Major Diameter	70
Minor Diameter	40
Ovality	0.57
% Deflection	30%
Station #	2912.3

2195

2195

Tape #3, Run #7

401

PLS INTERNATIONAL CCTV
INSPECTION TAPE FOR:
FLUOR DANIEL 3/02/99

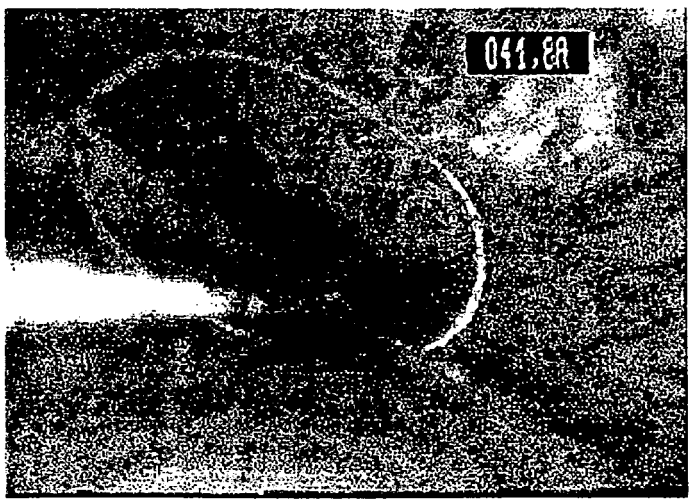
INSPECT: 6" LEACHATE
CONVEYANCE SYSTEM
ENTER: EXCAVATION #4
NORTH TOWARDS LIFT
STATION.
TAPE#3
RUN#7

Filename: T3R7-

2195

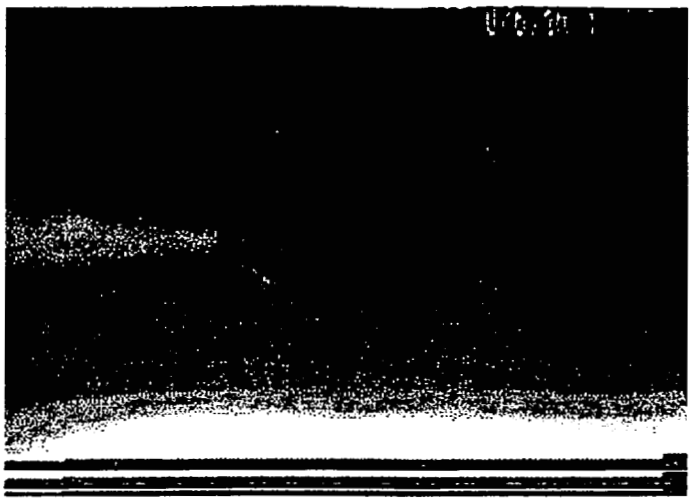
Filename: T3R7-003,0

Major Diameter	57
Minor Diameter	35
Ovality	0.61
% Deflection	26%
Station #	3063



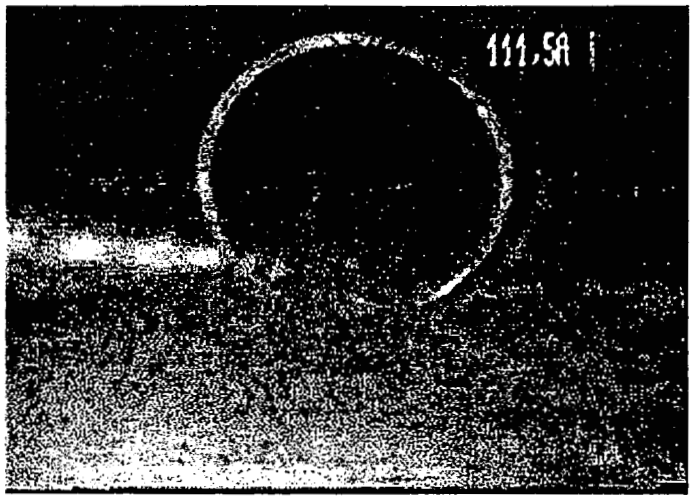
Filename: T3R7-041,8

Major Diameter	64
Minor Diameter	40
Ovality	0.63
% Deflection	25%
Station #	3101.8

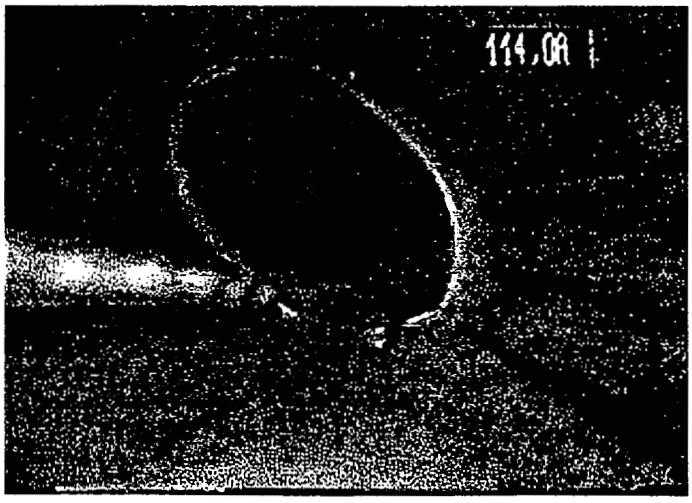


Filename: T3R7-076,1	
Major Diameter	65
Minor Diameter	40
Ovality	0.62
% Deflection	27%
Station #	3136.1

2195



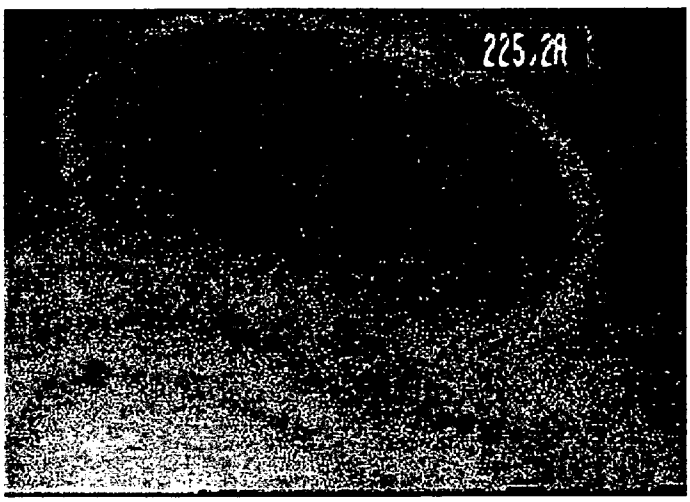
Filename: T3R7-111,5	
Major Diameter	45
Minor Diameter	40
Ovality	0.89
% Deflection	6%
Station #	3171.5



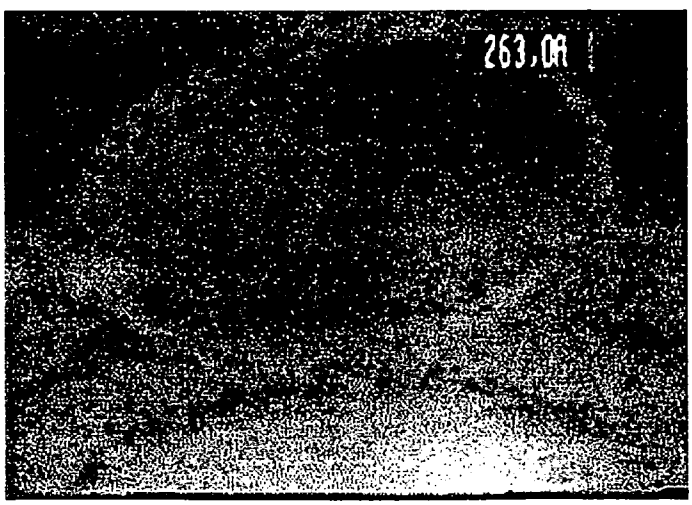
Filename: T3R7-114,0	
Major Diameter	50
Minor Diameter	30
Ovality	0.60
% Deflection	27%
Station #	3174

Filename: T3R7-186,6	
Major Diameter	88
Minor Diameter	45
Ovality	0.51
% Deflection	36%
Station #	3246.6

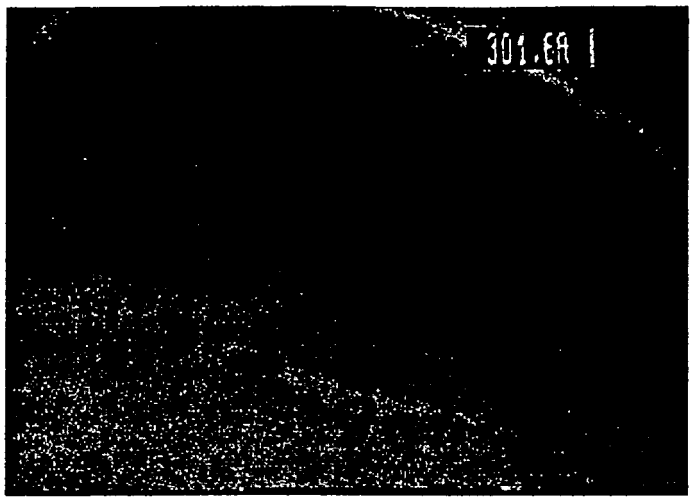
2195



Filename: T3R7-225,2	
Major Diameter	83
Minor Diameter	46
Ovality	0.55
% Deflection	32%
Station #	3285.2

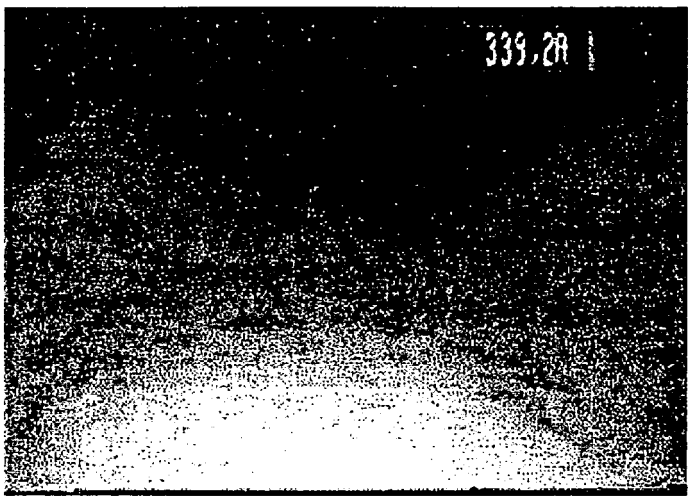


Filename: T3R7-263,0	
Major Diameter	79
Minor Diameter	45
Ovality	0.57
% Deflection	30%
Station #	3323

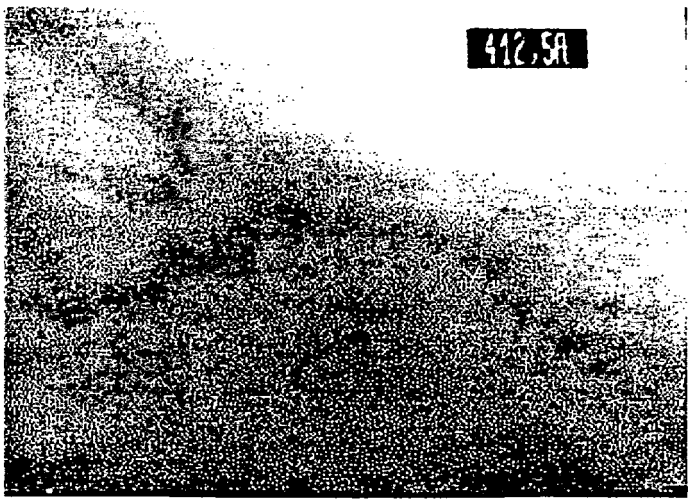


Filename: T3R7-301,6	
Major Diameter	111
Minor Diameter	56
Ovality	0.50
% Deflection	37%
Station #	3361.6

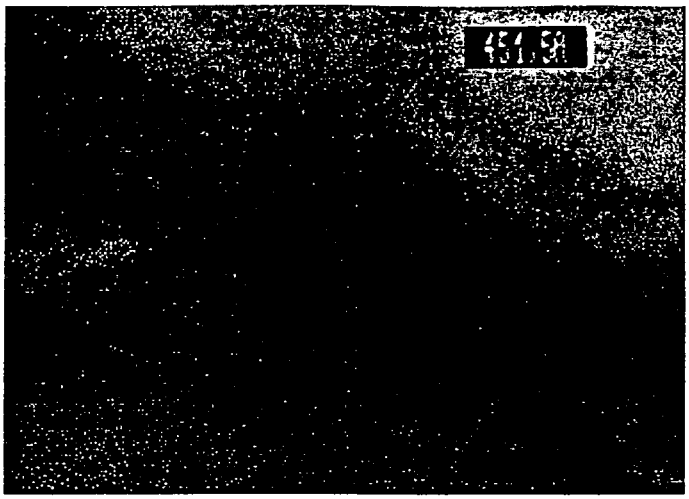
2195



Filename: T3R7-339,2	
Major Diameter	24
Minor Diameter	15
Ovality	0.63
% Deflection	25%
Station #	3399.2



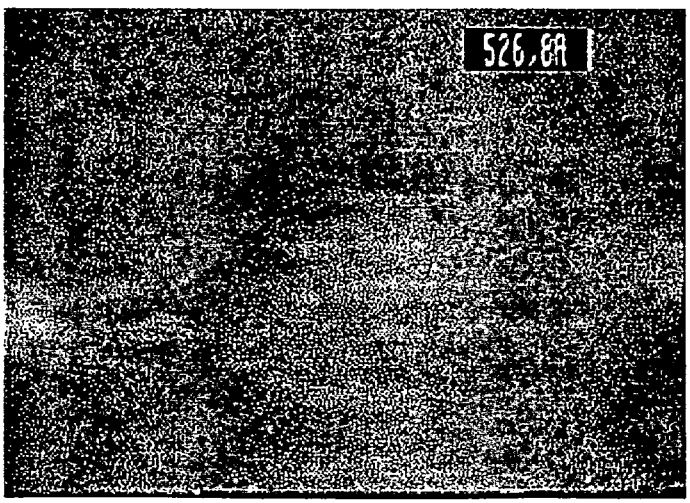
Filename: T3R7-412,5	
Major Diameter	47
Minor Diameter	37
Ovality	0.79
% Deflection	12%
Station #	3472.5



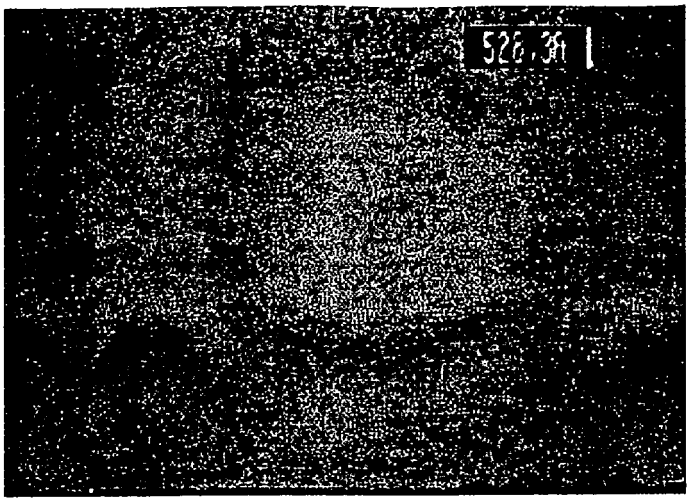
Filename: T3R7-451,5	
Major Diameter	51
Minor Diameter	33
Ovality	0.65
% Deflection	23%
Station #	3511.5

2195

Filename: T3R7-491,0	
Major Diameter	56
Minor Diameter	32
Ovality	0.57
% Deflection	30%
Station #	3551



Filename: T3R7-526,8	
Major Diameter	47
Minor Diameter	43
Ovality	0.91
% Deflection	5%
Station #	3586.8



Filename: T3R7-528,3	
Major Diameter	unclear data
Minor Diameter	
Ovality	
% Deflection	
Station #	

2195

Tape #3, Run #9

Missing
Title
Block

Filename: T3R9-0

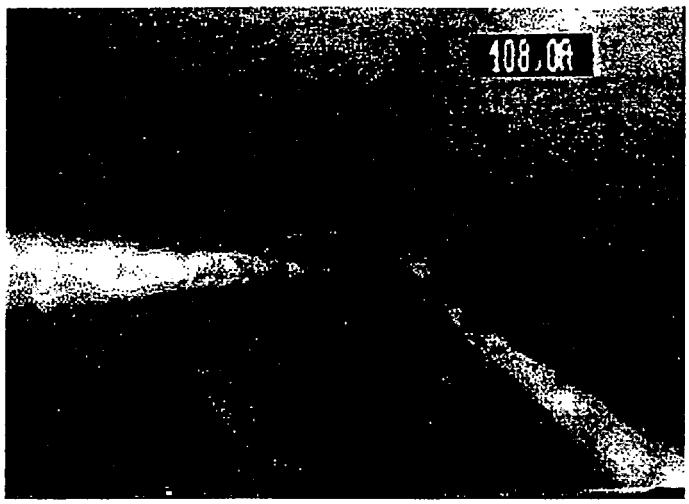
2195

Filename: T3R9-030,1

Major Diameter	40
Minor Diameter	32
Ovality	0.80
% Deflection	12%
Station #	1569.9

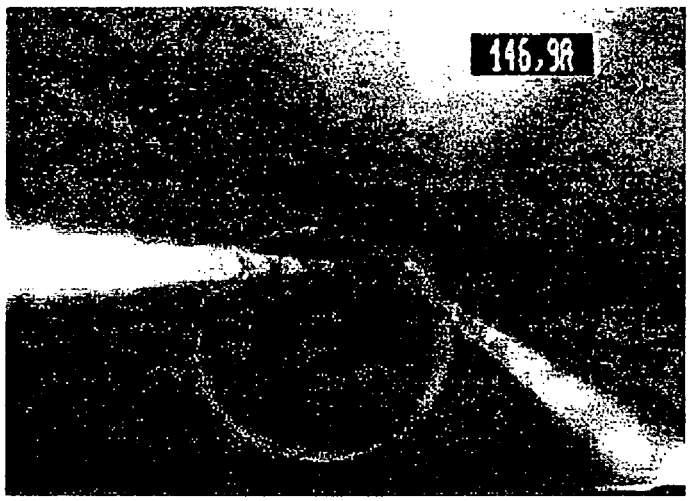
Filename: T3R9-068,9

Major Diameter	36
Minor Diameter	35
Ovality	0.97
% Deflection	2%
Station #	1531.1



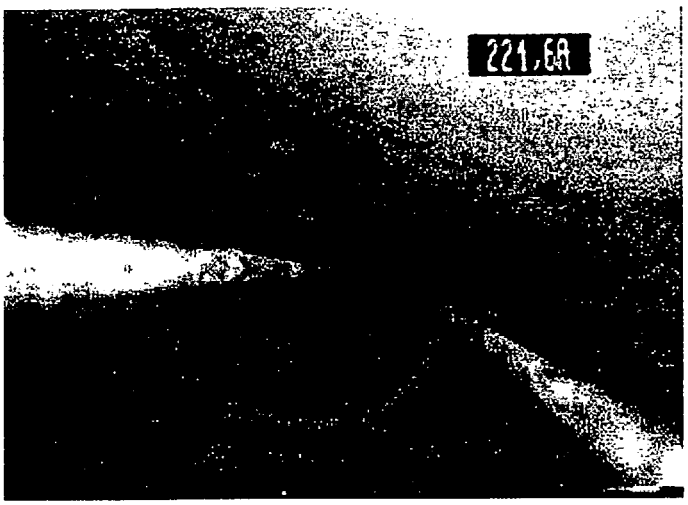
Filename: T3R9-108,0	
Major Diameter	37
Minor Diameter	37
Ovality	1.00
% Deflection	0%
Station #	1492

2195



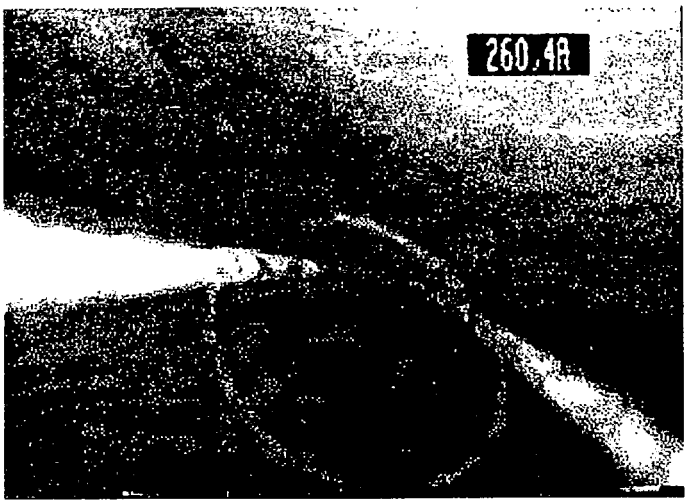
Filename: T3R9-146,9	
Major Diameter	35
Minor Diameter	34
Ovality	0.97
% Deflection	2%
Station #	1453.1

Filename: T3R9-182,1	
Major Diameter	15
Minor Diameter	15
Ovality	1.00
% Deflection	0%
Station #	1417.9

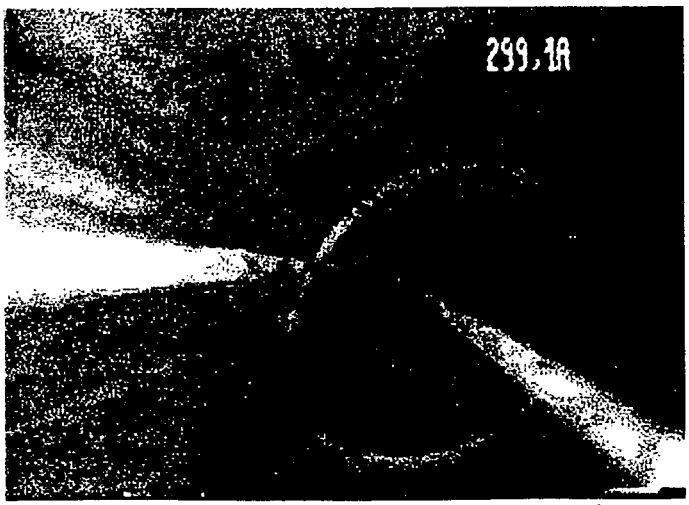


Filename: T3R9-221,6	
Major Diameter	40
Minor Diameter	30
Ovality	0.75
% Deflection	15%
Station #	1378.4

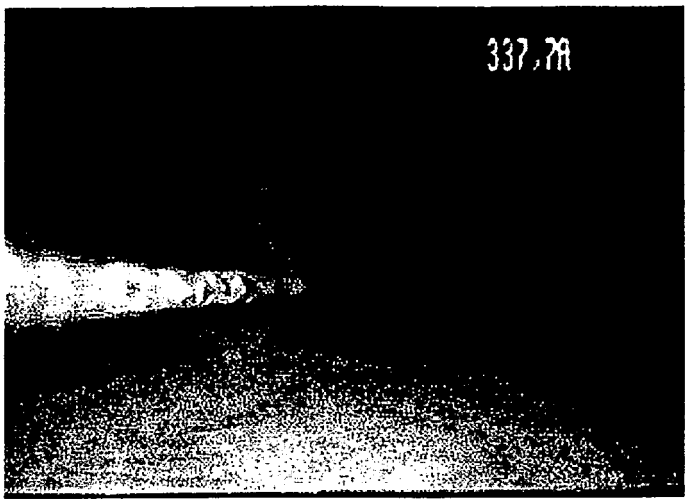
2195



Filename: T3R9-260,4	
Major Diameter	48
Minor Diameter	35
Ovality	0.73
% Deflection	17%
Station #	1339.6

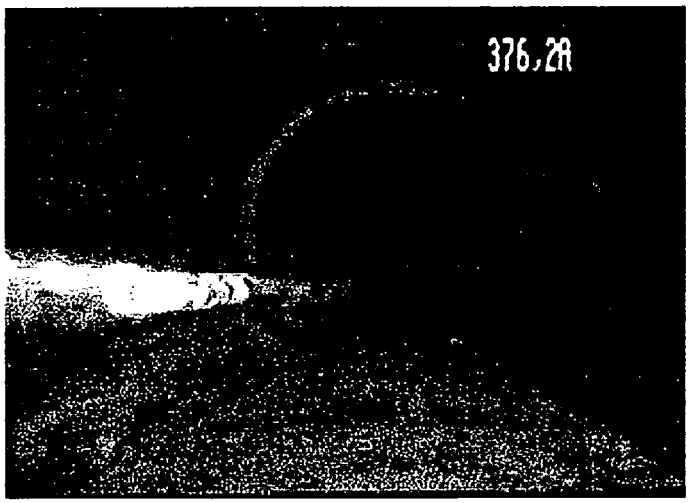


Filename: T3R9-299,1	
Major Diameter	50
Minor Diameter	38
Ovality	0.76
% Deflection	15%
Station #	1300.9



Filename: T3R9-337,7	
Major Diameter	45
Minor Diameter	35
Ovality	0.78
% Deflection	13%
Station #	1262.3

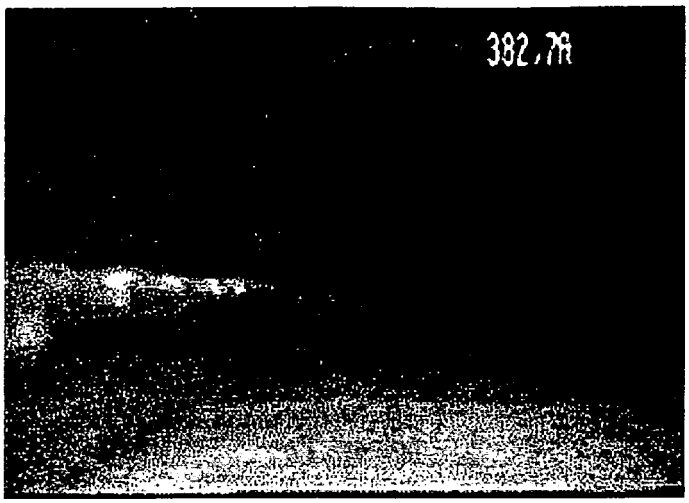
2195



Filename: T3R9-376,2	
Major Diameter	42
Minor Diameter	36
Ovality	0.86
% Deflection	8%
Station #	1223.8

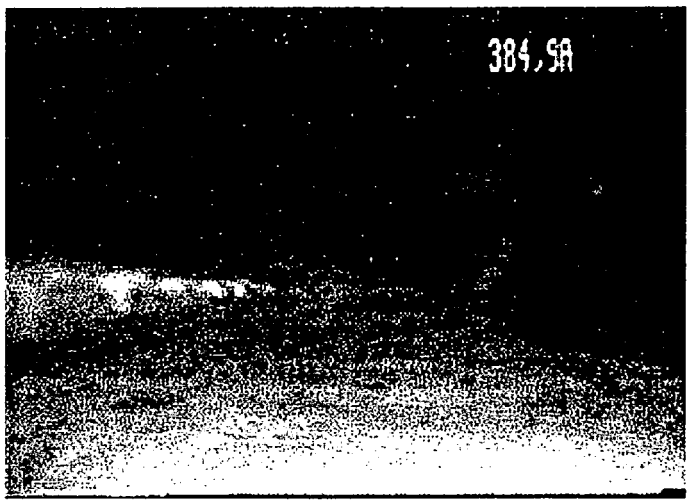
Filename: T3R9-379,7	
Major Diameter	41
Minor Diameter	39
Ovality	0.95
% Deflection	3%
Station #	1220.3

412

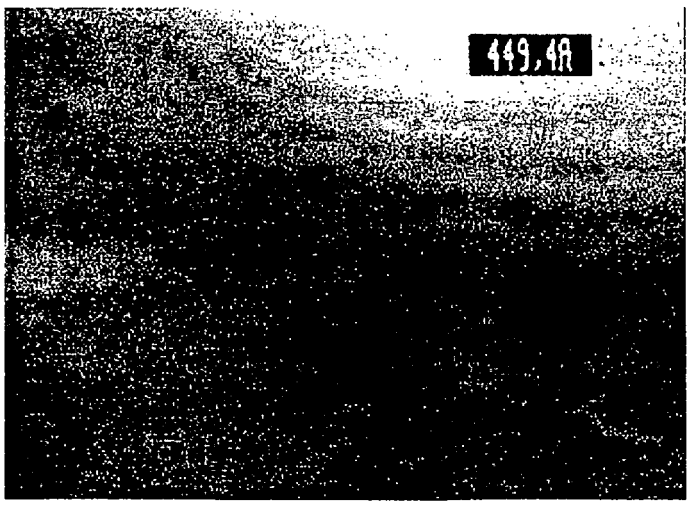


Filename: T3R9-382,7	
Major Diameter	48
Minor Diameter	45
Ovality	0.94
% Deflection	3%
Station #	1215.1

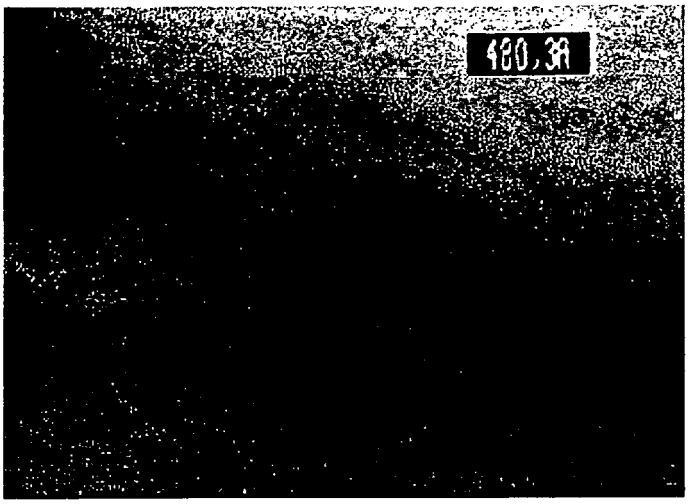
2195



Filename: T3R9-384,9	
Major Diameter	34
Minor Diameter	34
Ovality	1.00
% Deflection	0%
Station #	1215.1

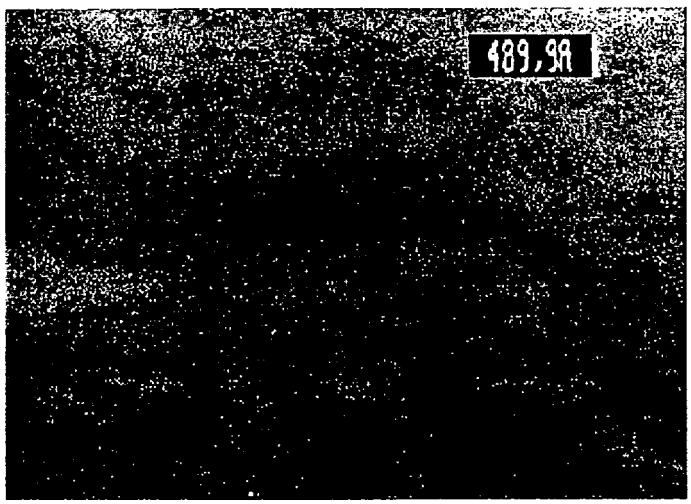


Filename: T3R9-449,4	
Major Diameter	unclear data
Minor Diameter	
Ovality	
% Deflection	
Station #	

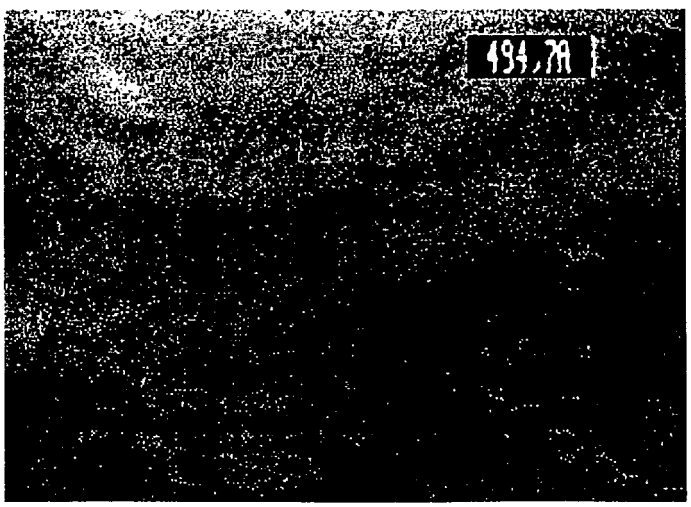


Filename: T3R9-480,3	
Major Diameter	54
Minor Diameter	38
Ovality	0.70
% Deflection	19%
Station #	1119.7

2195



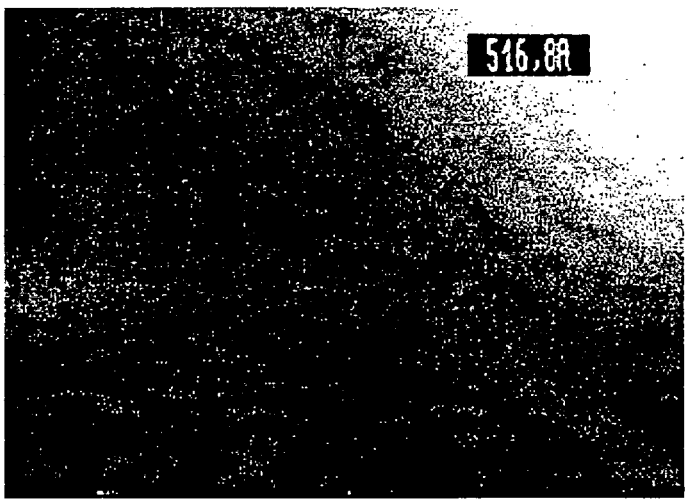
Filename: T3R9-489,9	
Major Diameter	unclear data
Minor Diameter	
Ovality	
% Deflection	
Station #	



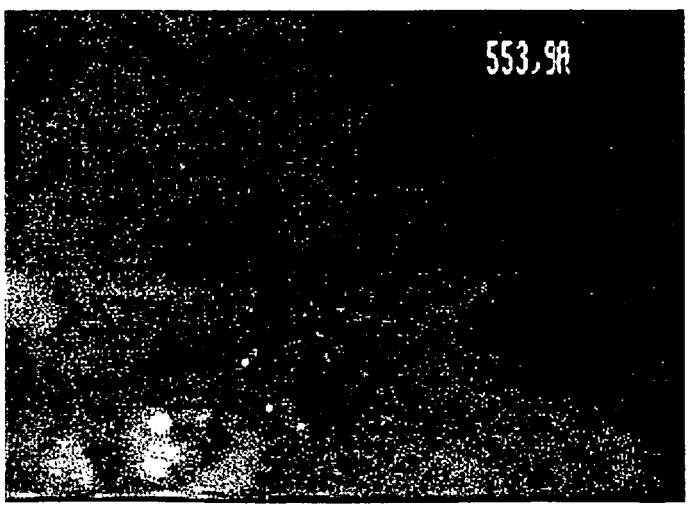
Filename: T3R9-494,7	
Major Diameter	unclear data
Minor Diameter	
Ovality	
% Deflection	
Station #	

Filename: T3R9-500,0	
Major Diameter	37
Minor Diameter	36
Ovality	0.97
% Deflection	2%
Station #	1100

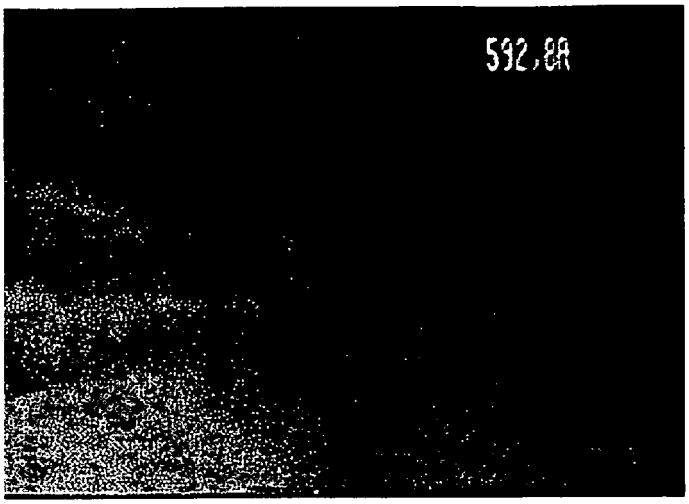
2195



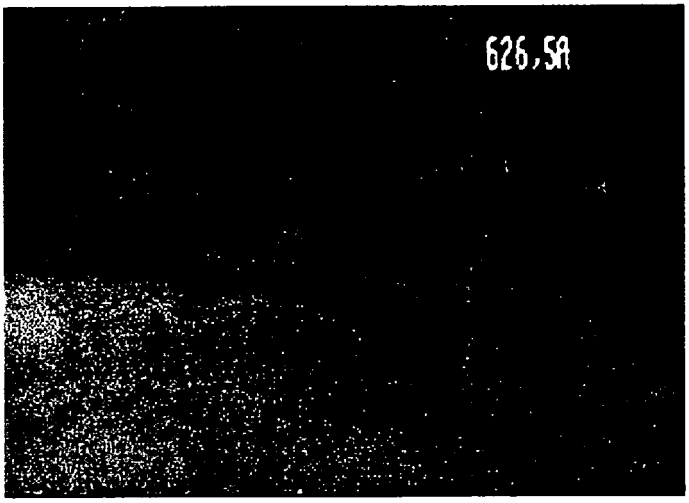
Filename: T3R9-516,8	
Major Diameter	44
Minor Diameter	40
Ovality	0.91
% Deflection	5%
Station #	1083.2



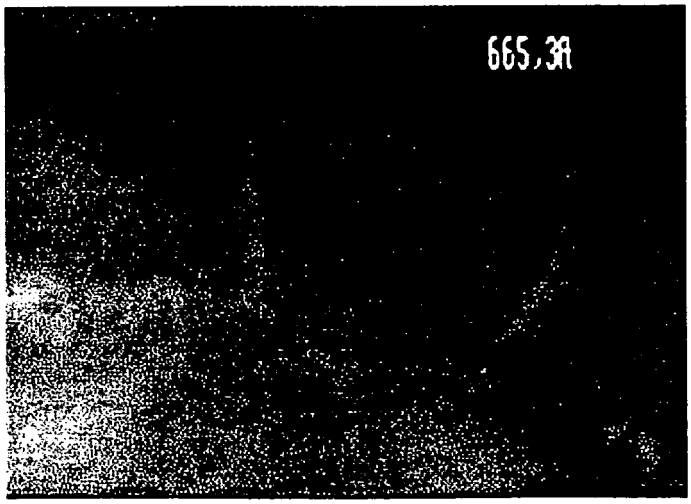
Filename: T3R9-553,9	
Major Diameter	47
Minor Diameter	32
Ovality	0.68
% Deflection	21%
Station #	1046.1



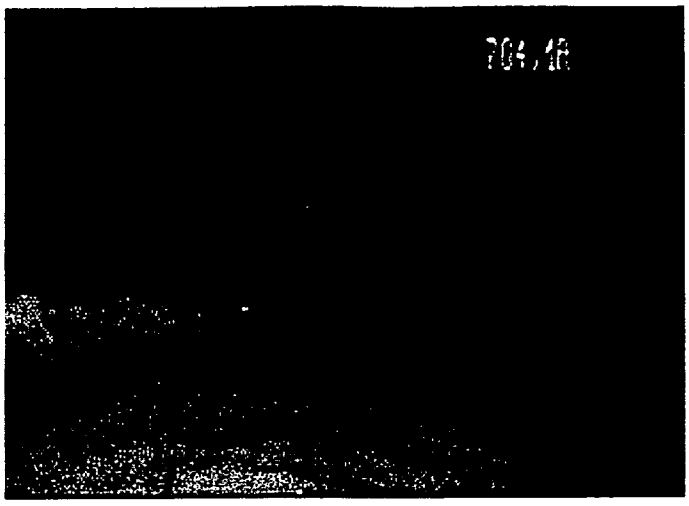
Filename: T3R9-592,8	
Major Diameter	50
Minor Diameter	38
Ovality	0.76
% Deflection	15%
Station #	1007.2



Filename: T3R9-626,5	
Major Diameter	33
Minor Diameter	23
Ovality	0.70
% Deflection	19%
Station #	973.5

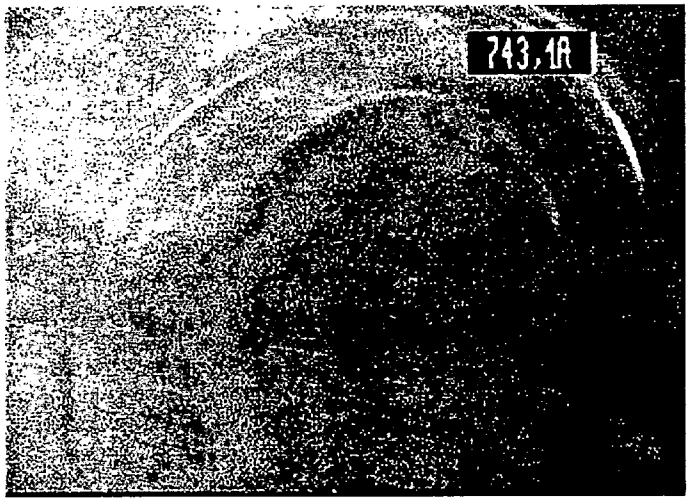


Filename: T3R9-665,3	
Major Diameter	61
Minor Diameter	45
Ovality	0.74
% Deflection	16%
Station #	934.7



Filename: T3R9-704,1	
Major Diameter	55
Minor Diameter	34
Ovality	0.62
% Deflection	26%
Station #	895.9

2195



Filename: T3R9-743,1	
Major Diameter	60
Minor Diameter	48
Ovality	0.80
% Deflection	12%
Station #	865.9

Filename: T3R9-745,9	
Major Diameter	51
Minor Diameter	51
Ovality	1.00
% Deflection	0%
Station #	854.1

Filename: T3R9-749,1	
Major Diameter	64
Minor Diameter	62
Ovality	0.97
% Deflection	2%
Station #	850.9

2195

Tape #3, Run #10

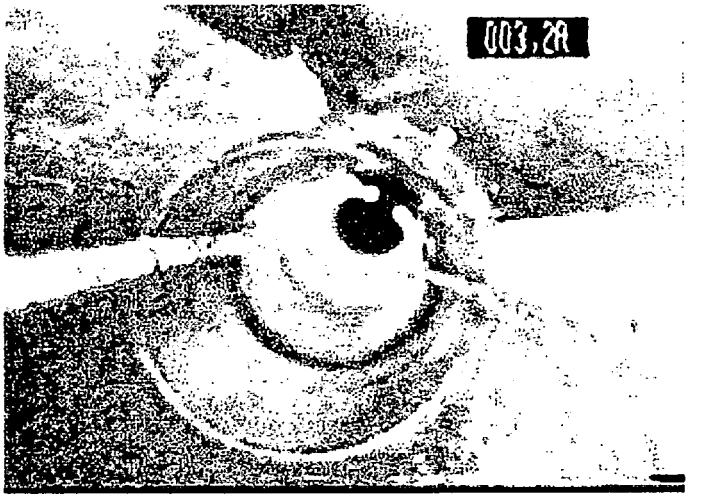
419

PLS INTERNATIONAL CCTV
INSPECTION TAPE FOR:
FLUOR DANIEL 3/03/99

INSPECT: 6" LEACHATE
CONVEYANCE SYSTEM
ENTER: EXCAVATION #2 BACK
TO MANHOLE #3. SAME
RUN AS #9.
RUN #10
TAPE#3

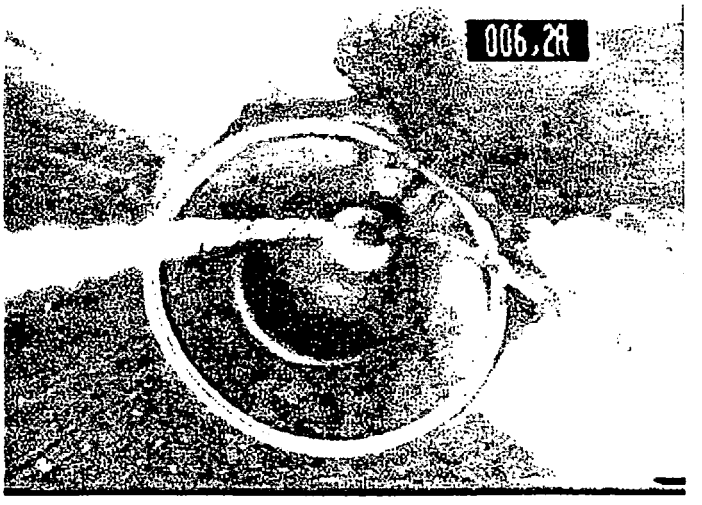
Filename: T3R10-

2195



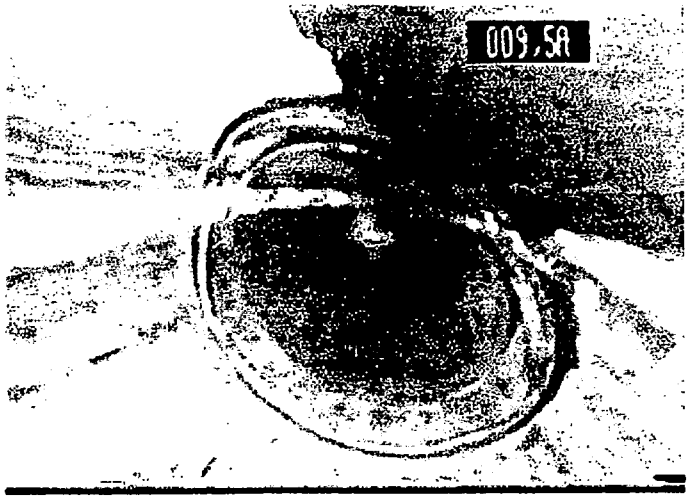
Filename: T3R10-003,2

Major Diameter	117
Minor Diameter	112
Ovality	0.96
% Deflection	2%
Station #	1596.8



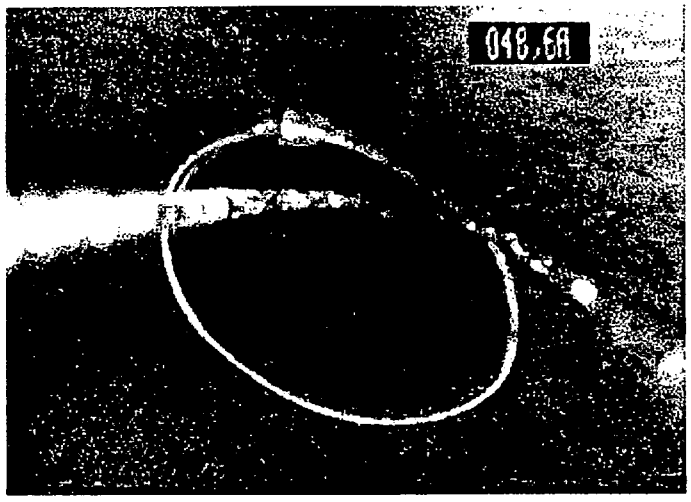
Filename: T3R10-006,2

Major Diameter	49
Minor Diameter	45
Ovality	0.92
% Deflection	4%
Station #	1593.8

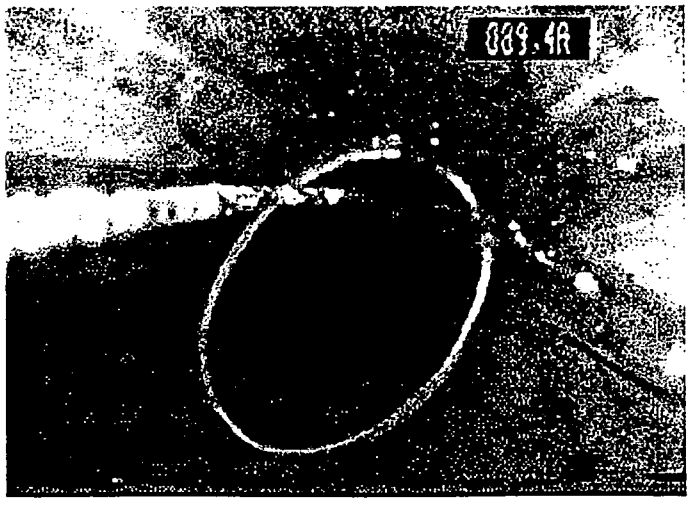


Filename: T3R10-009,5	
Major Diameter	57
Minor Diameter	40
Ovality	0.70
% Deflection	19%
Station #	1590.5

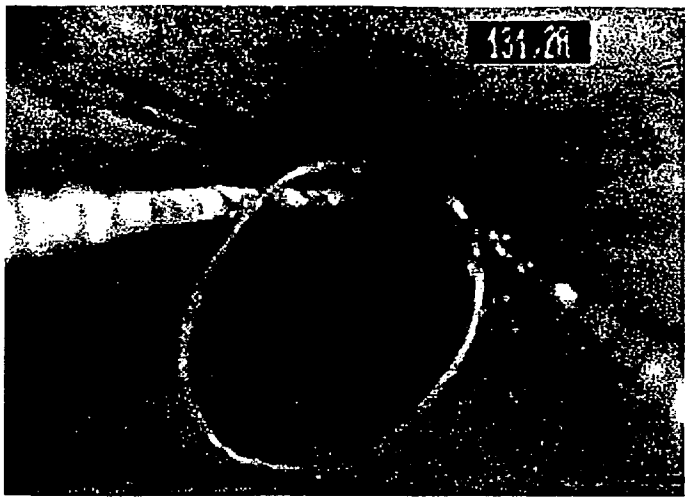
2195



Filename: T3R10-048,6	
Major Diameter	55
Minor Diameter	36
Ovality	0.65
% Deflection	23%
Station #	1551.4

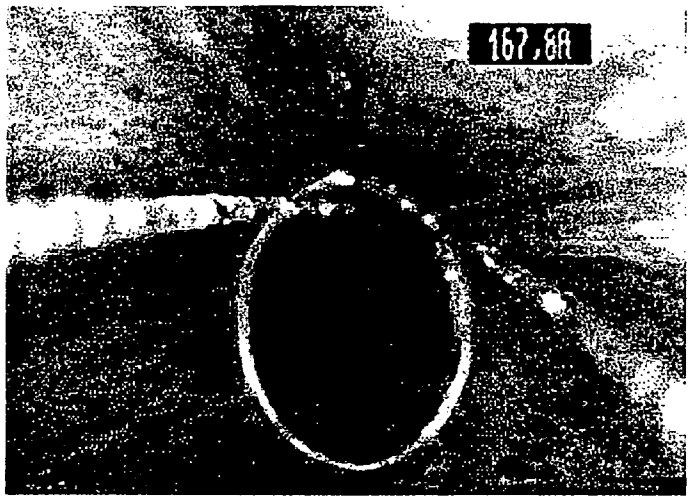


Filename: T3R10-089,4	
Major Diameter	49
Minor Diameter	33
Ovality	0.67
% Deflection	21%
Station #	1510.6

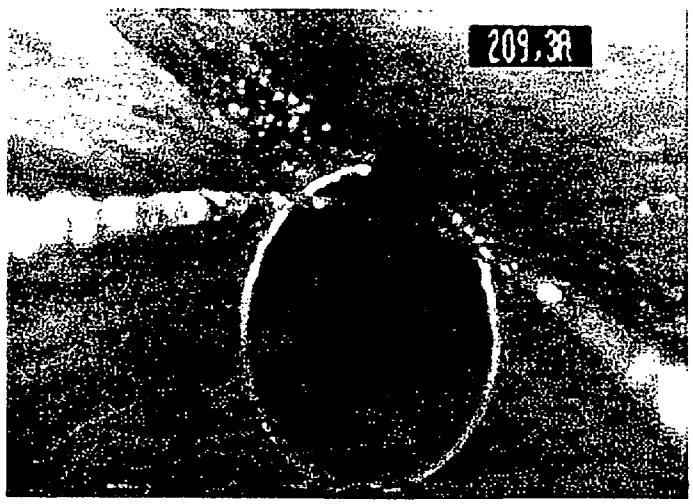


Filename: T3R10-131,2	
Major Diameter	49
Minor Diameter	37
Ovality	0.76
% Deflection	15%
Station #	1468.8

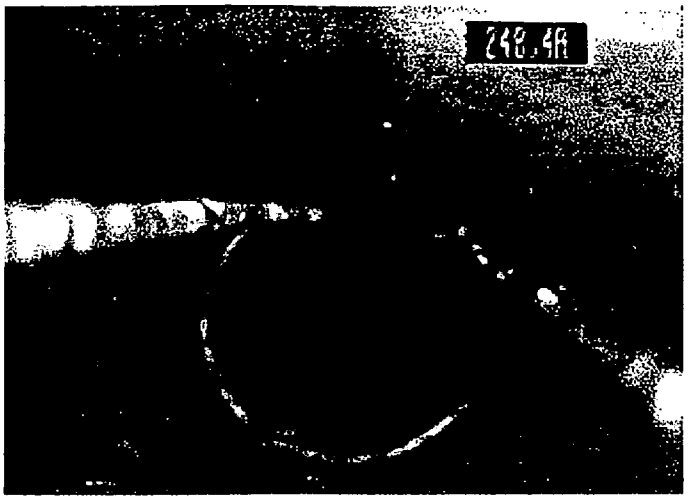
2195



Filename: T3R10-167,8	
Major Diameter	42
Minor Diameter	30
Ovality	0.71
% Deflection	18%
Station #	1432.2

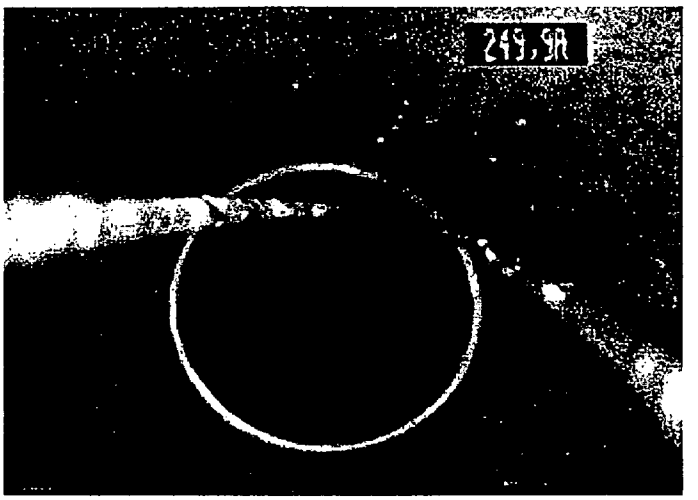


Filename: T3R10-209,3	
Major Diameter	47
Minor Diameter	35
Ovality	0.74
% Deflection	16%
Station #	1390.7

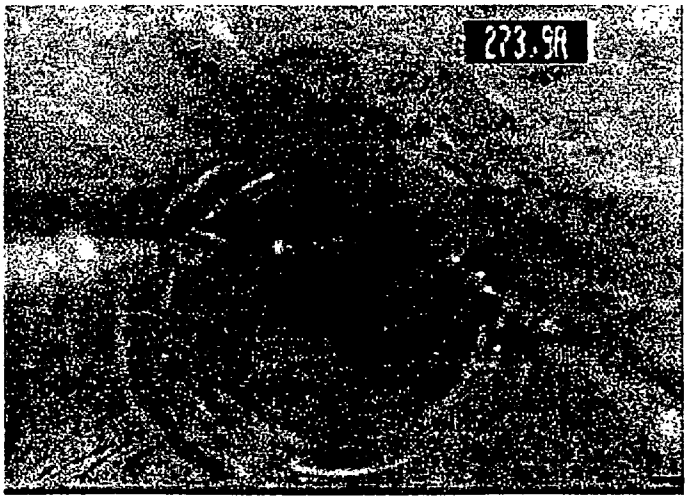


Filename: T3R10-248,4	
Major Diameter	66
Minor Diameter	36
Ovality	0.55
% Deflection	32%
Station #	1351.6

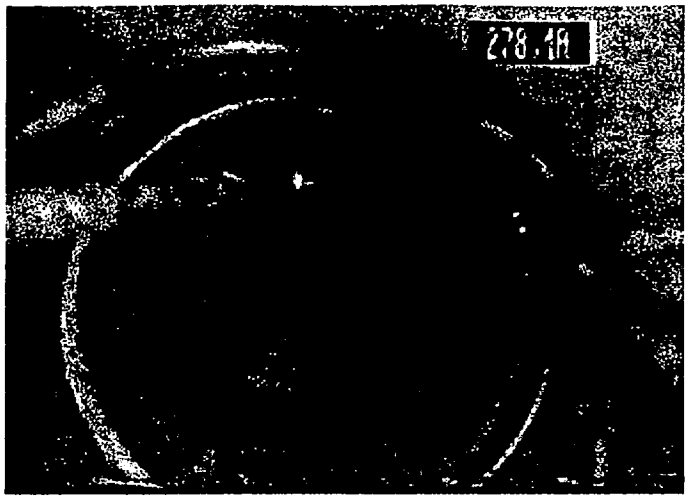
2195



Filename: T3R10-249,9	
Major Diameter	35
Minor Diameter	22
Ovality	0.63
% Deflection	25%
Station #	1350.1

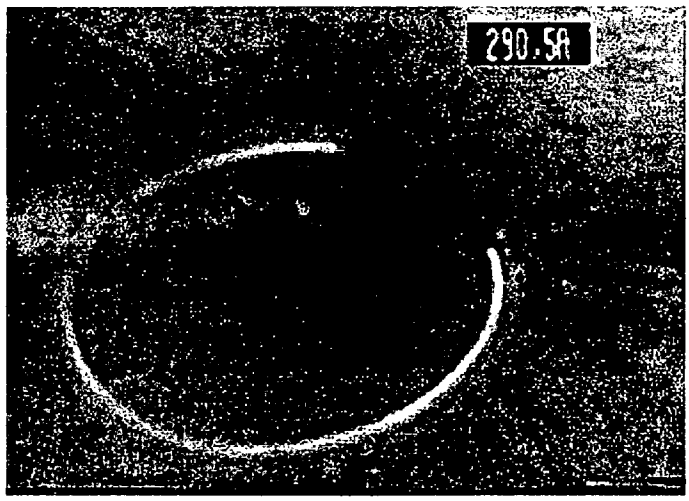


Filename: T3R10-273,9	
Major Diameter	76
Minor Diameter	49
Ovality	0.64
% Deflection	24%
Station #	1326.1

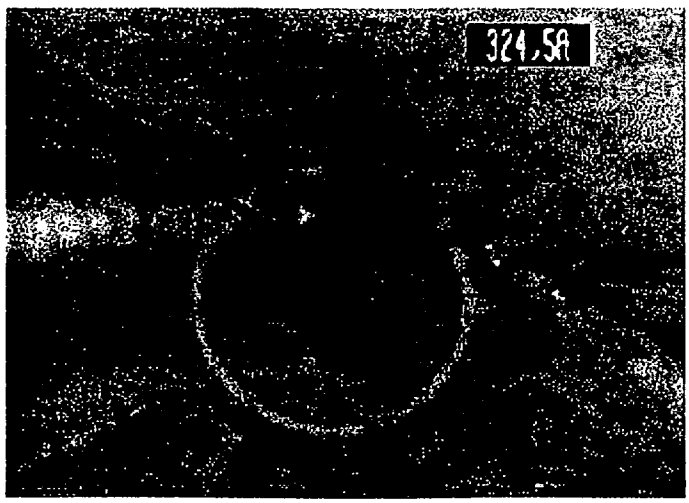


Filename: T3R10-278,1	
Major Diameter	68
Minor Diameter	65
Ovality	0.96
% Deflection	2%
Station #	1321.9

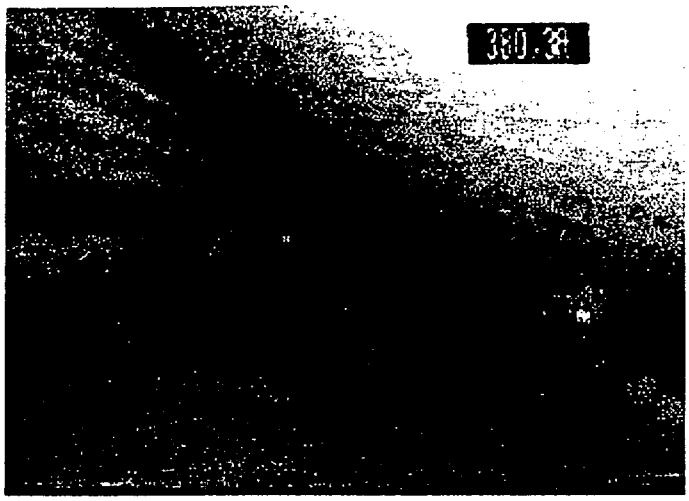
2195



Filename: T3R10-290,5	
Major Diameter	61
Minor Diameter	43
Ovality	0.70
% Deflection	19%
Station #	1309.5

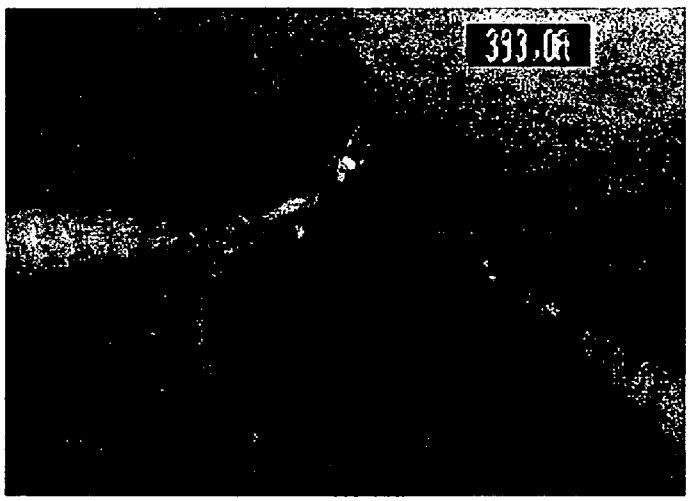


Filename: T3R10-324,5	
Major Diameter	37
Minor Diameter	37
Ovality	1.00
% Deflection	0%
Station #	1275.5

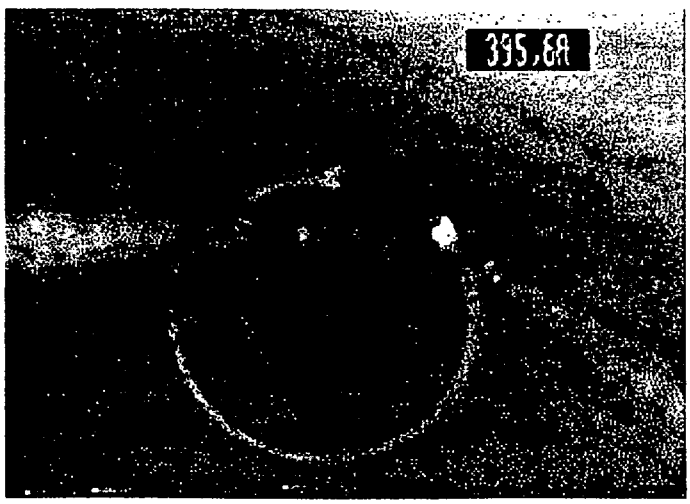


Filename: T3R10-380,3	
Major Diameter	14
Minor Diameter	11
Ovality	0.79
% Deflection	12%
Station #	1219.7

2195



Filename: T3R10-393,0	
Major Diameter	40
Minor Diameter	39
Ovality	0.98
% Deflection	1%
Station #	1207

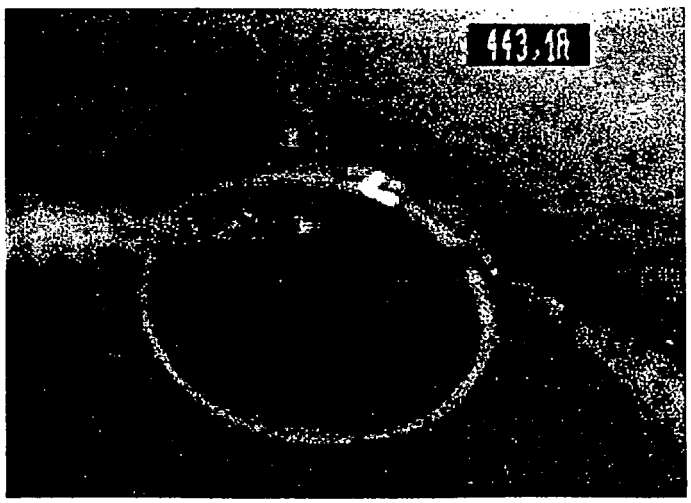


Filename: T3R10-395,6	
Major Diameter	42
Minor Diameter	40
Ovality	0.95
% Deflection	3%
Station #	1204.4

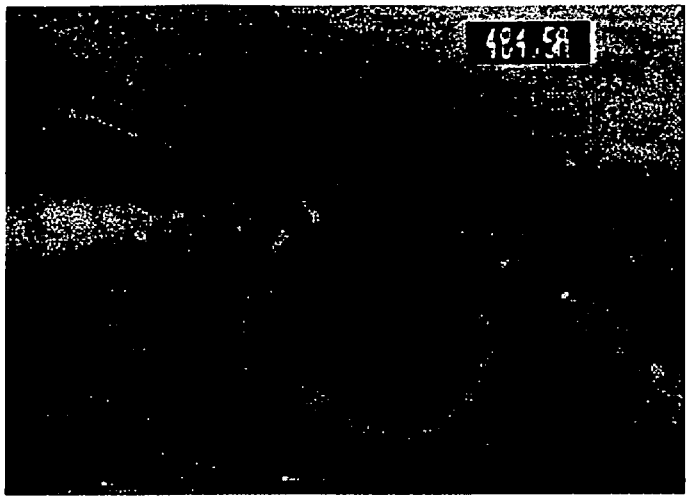
Filename: T3R10-398,7	
Major Diameter	41
Minor Diameter	38
Ovality	0.93
% Deflection	4%
Station #	1201.3

2195

Filename: T3R10-401,1	
Major Diameter	41
Minor Diameter	32
Ovality	0.78
% Deflection	13%
Station #	1198.9

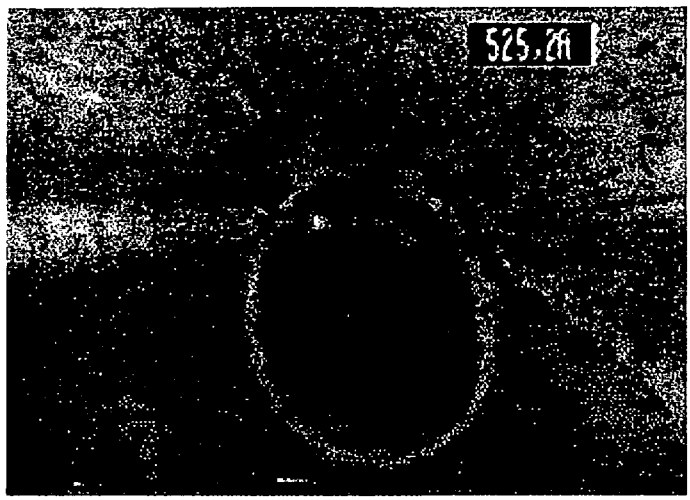


Filename: T3R10-443,1	
Major Diameter	50
Minor Diameter	37
Ovality	0.74
% Deflection	16%
Station #	1156.9

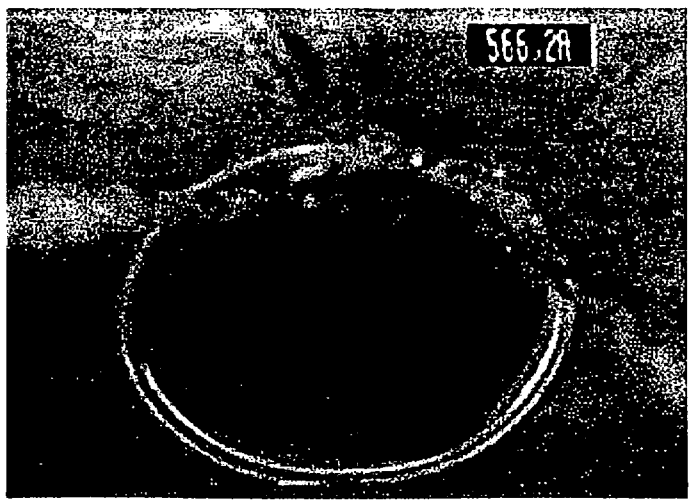


Filename: T3R10-484,5	
Major Diameter	37
Minor Diameter	28
Ovality	0.76
% Deflection	15%
Station #	1115.5

2195



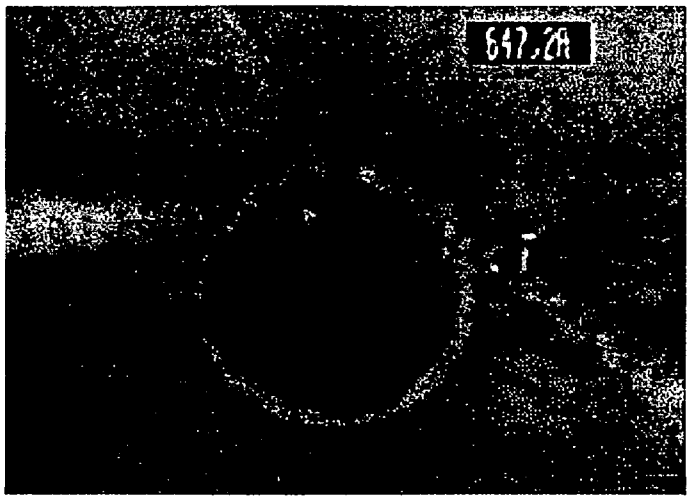
Filename: T3R10-525,2	
Major Diameter	42
Minor Diameter	32
Ovality	0.76
% Deflection	15%
Station #	1074.8



Filename: T3R10-566,2	
Major Diameter	65
Minor Diameter	50
Ovality	0.77
% Deflection	14%
Station #	1033.8

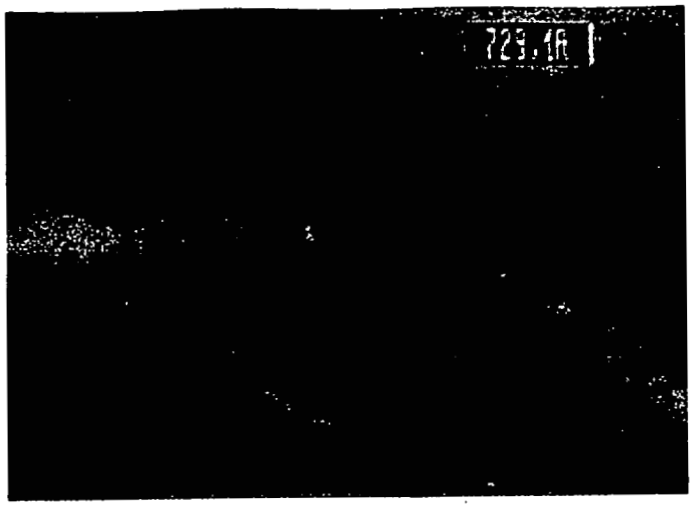
Filename: T3R10-606,7	
Major Diameter	38
Minor Diameter	33
Ovality	0.87
% Deflection	7%
Station #	993.3

2195



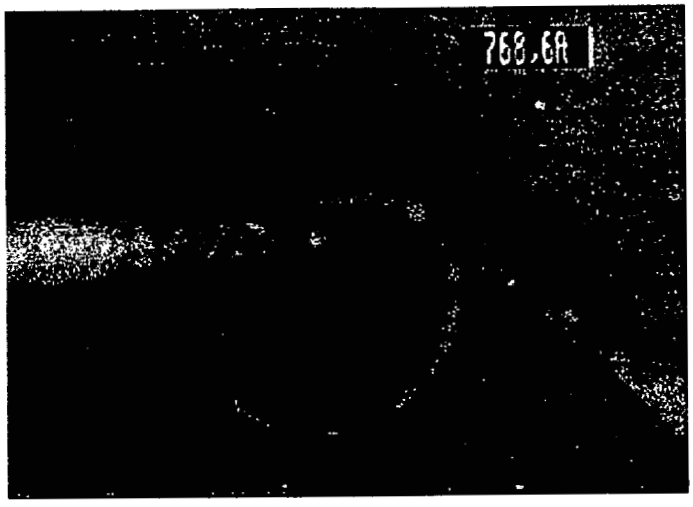
Filename: T3R10-647,2	
Major Diameter	38
Minor Diameter	36
Ovality	0.95
% Deflection	3%
Station #	952.8

Filename: T3R10-688,1	
Major Diameter	41
Minor Diameter	41
Ovality	1.00
% Deflection	0%
Station #	911.9



Filename: T3R10-729,1	
Major Diameter	34
Minor Diameter	32
Ovality	0.94
% Deflection	3%
Station #	870.9

2195

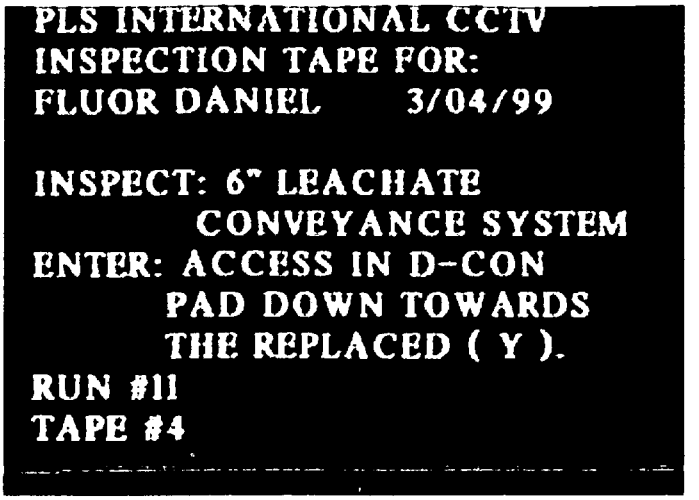


Filename: T3R10-768,6	
Major Diameter	38
Minor Diameter	30
Ovality	0.79
% Deflection	12%
Station #	831.4

2195

Tape #4, Run #11

430



Filename: T4R11-0

2195

Filename: T4R11-000,2

Major Diameter	unclear data
Minor Diameter	
Ovality	
% Deflection	

Filename: T4R11-009,7

Major Diameter	unclear data
Minor Diameter	
Ovality	
% Deflection	

END OF RUN #11

TOTAL FOOTAGE 023.3FT

UNABLE TO PUSH FARTHER WITHOUT RISKING GETTING CAMERA STUCK IN LINE.

Filename: T4R11-end	
Major Diameter	
Minor Diameter	
Ovality	
% Deflection	

2195

Tape #4, Run #12

PLS INTERNATIONAL CCTV
INSPECTION TAPE FOR:
FLUOR DANIEL 3/04/99

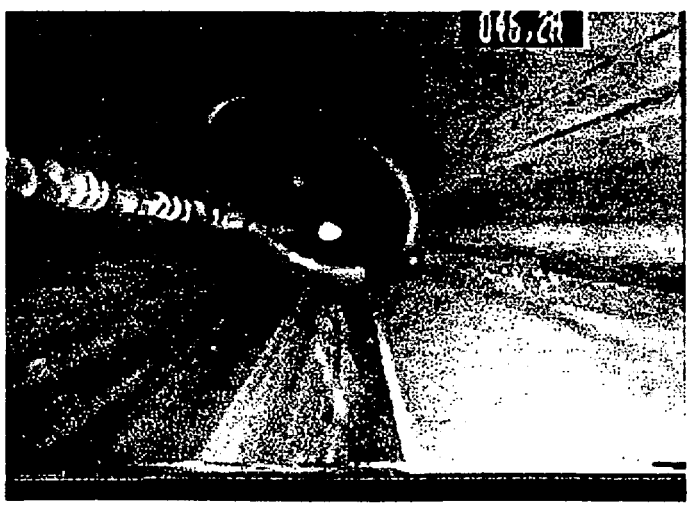
INSPECT: 6" LEACHATE
CONVEYANCE SYSTEM
ENTER: EXCAVATION #4 BACK
TO EXCAVATION #2.
FILMING BACKWARDS.
RUN #12
TAPE #4

Filename: T4R12

2195

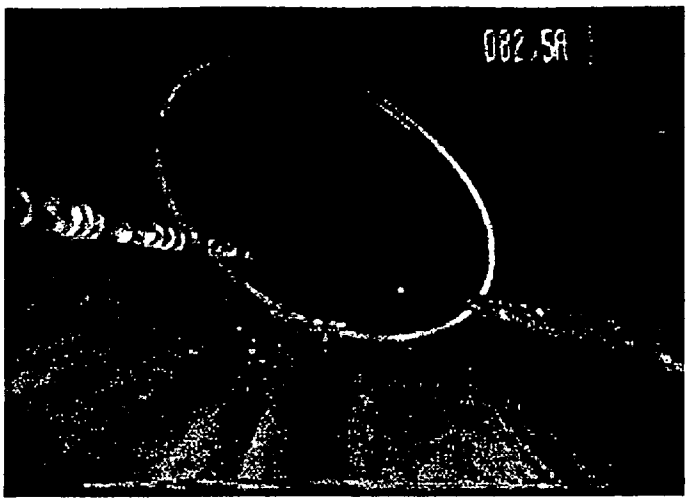
Filename: T4R12-006,1

Major Diameter	29
Minor Diameter	29
Ovality	1.00
% Deflection	0%
Station #	3053.9

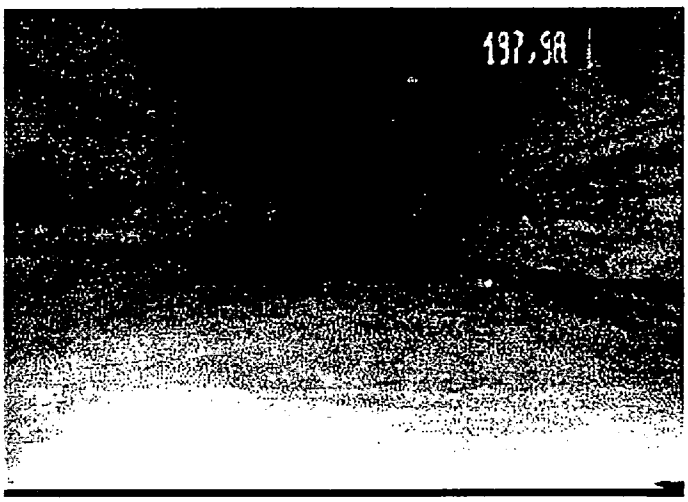


Filename: T4R12-046,2

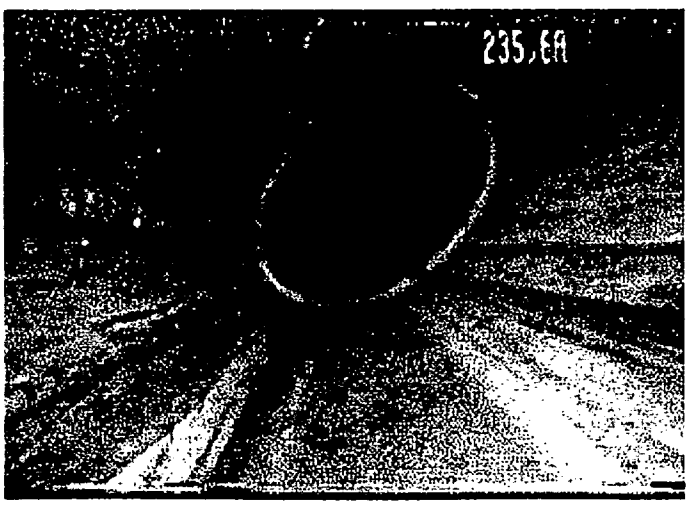
Major Diameter	35
Minor Diameter	20
Ovality	0.57
% Deflection	30%
Station #	3013.8



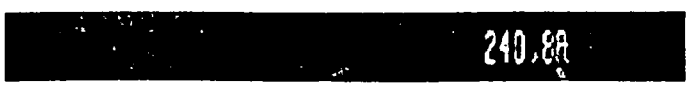
Filename: T4R12-082,5	
Major Diameter	56
Minor Diameter	35
Ovality	0.63
% Deflection	25%
Station #	2977.5



Filename: T4R12-197,9	
Major Diameter	32
Minor Diameter	22
Ovality	0.69
% Deflection	20%
Station #	2862.1

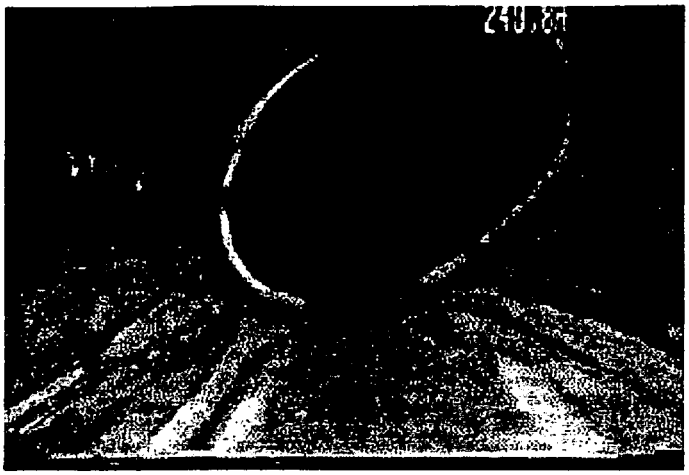


Filename: T4R12-235,6	
Major Diameter	41
Minor Diameter	27
Ovality	0.66
% Deflection	22%
Station #	2824.4

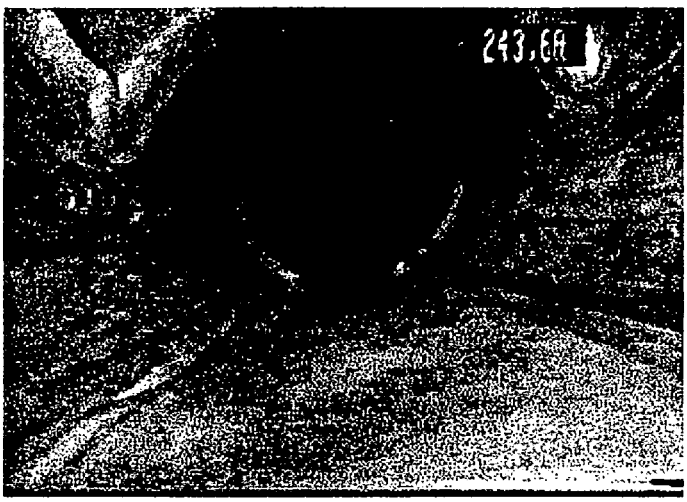


Filename: T4R12-240,8

2195

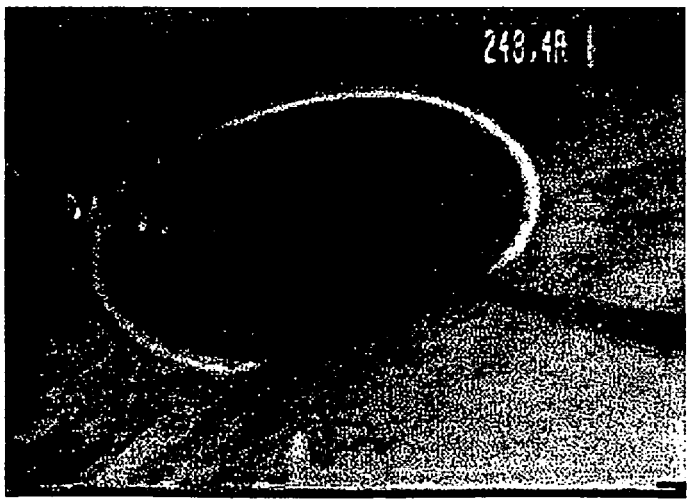


Major Diameter	59
Minor Diameter	37
Ovality	0.63
% Deflection	25%
Station #	2819.2



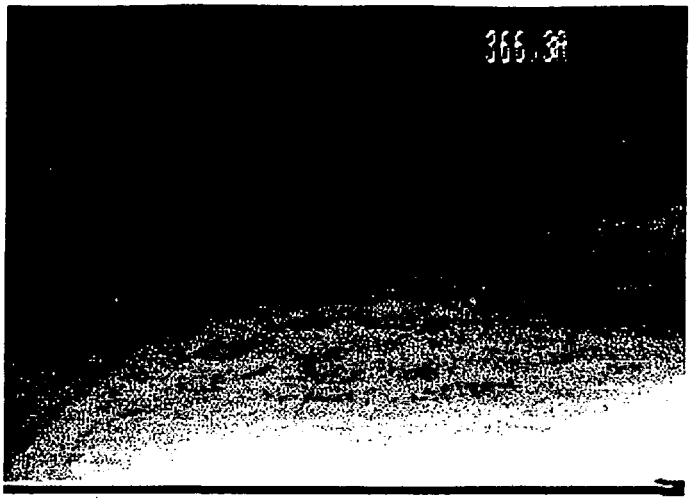
Filename: T4R12-243,6

Major Diameter	33
Minor Diameter	29
Ovality	0.88
% Deflection	7%
Station #	2816.4



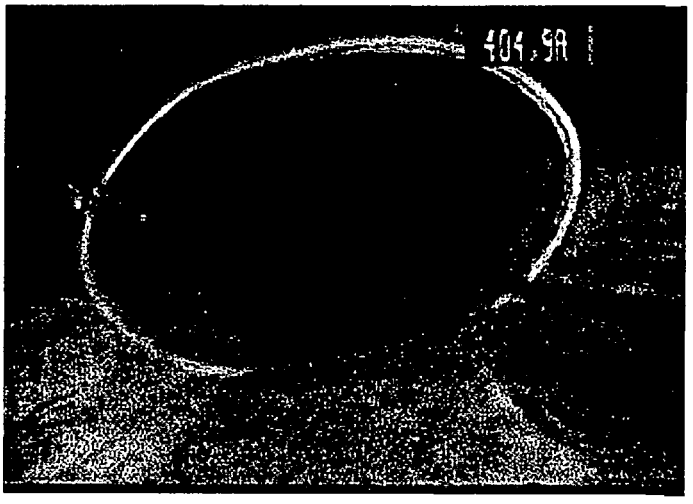
Filename: T4R12-248,4

Major Diameter	66
Minor Diameter	36
Ovality	0.55
% Deflection	32%
Station #	2811.6



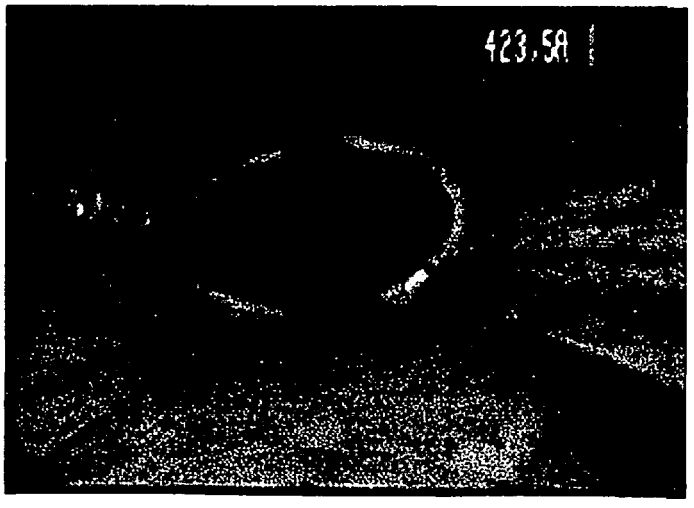
Filename: T4R12-366,3

Major Diameter	35
Minor Diameter	22
Ovality	0.63
% Deflection	25%
Station #	2637.7



Filename: T4R12-404,9

Major Diameter	76
Minor Diameter	49
Ovality	0.64
% Deflection	24%
Station #	2655.1

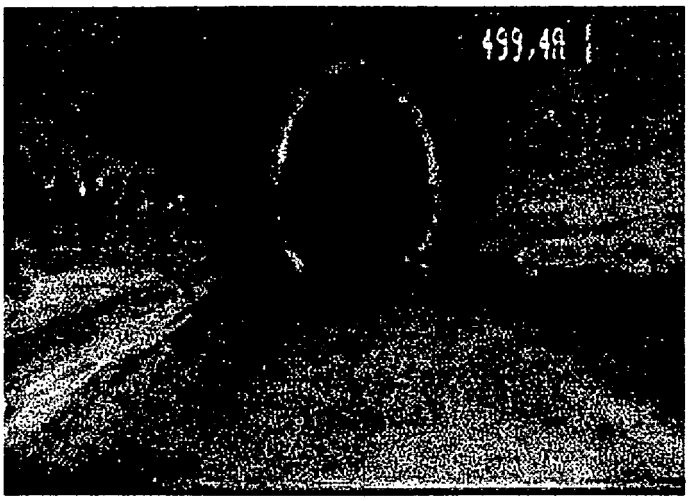


Filename: T4R12-423,5

Major Diameter	43
Minor Diameter	23
Ovality	0.53
% Deflection	34%
Station #	2636.5

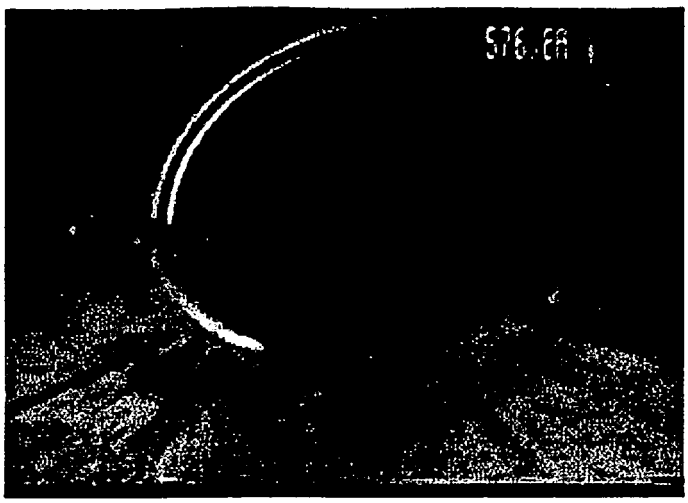
corrupted picture file

Filename: T4R12-460,	
Major Diameter	
Minor Diameter	
Ovality	
% Deflection	
Station #	



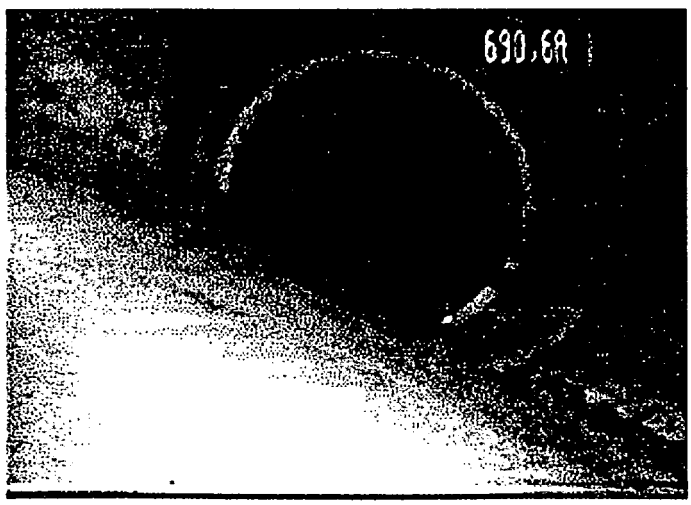
Filename: T4R12-499,4	
Major Diameter	34
Minor Diameter	22
Ovality	0.65
% Deflection	23%
Station #	2560.6

Filename: T4R12-538,2	
Major Diameter	38
Minor Diameter	26
Ovality	0.68
% Deflection	20%
Station #	2521.8

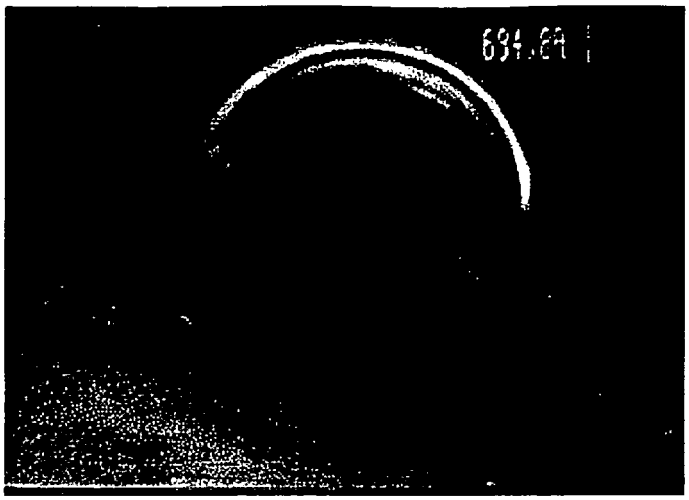


Filename: T4R12-576,8	
Major Diameter	77
Minor Diameter	51
Ovality	0.66
% Deflection	22%
Station #	2483.2

Filename: T4R12-616,6	
Major Diameter	47
Minor Diameter	31
Ovality	0.66
% Deflection	22%
Station #	2443.4

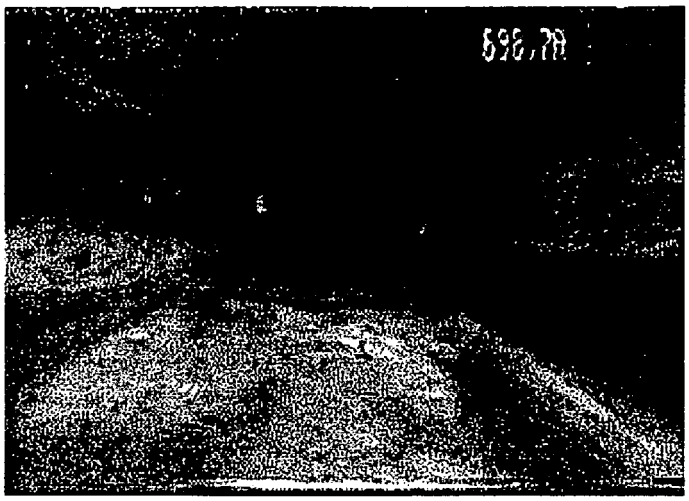


Filename: T4R12-690,6	
Major Diameter	44
Minor Diameter	43
Ovality	0.98
% Deflection	1%
Station #	2369.4



Filename:	T4R12-694,8

Major Diameter	49
Minor Diameter	47
Ovality	0.96
% Deflection	2%
Station #	2365.2

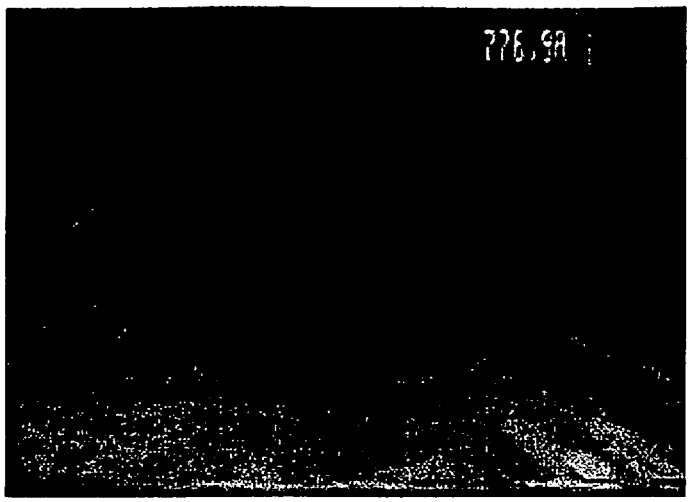


Filename:	T4R12-698,7

Major Diameter	35
Minor Diameter	25
Ovality	0.71
% Deflection	18%
Station #	2361.3

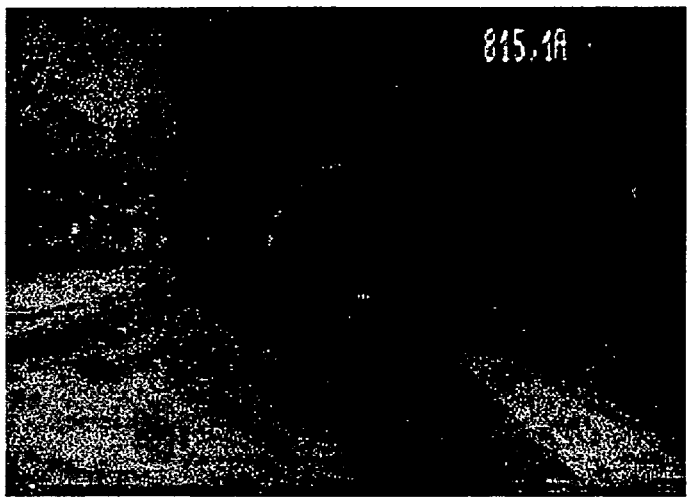
Filename:	T4R12-737,8

Major Diameter	35
Minor Diameter	26
Ovality	0.74
% Deflection	16%
Station #	2322.2



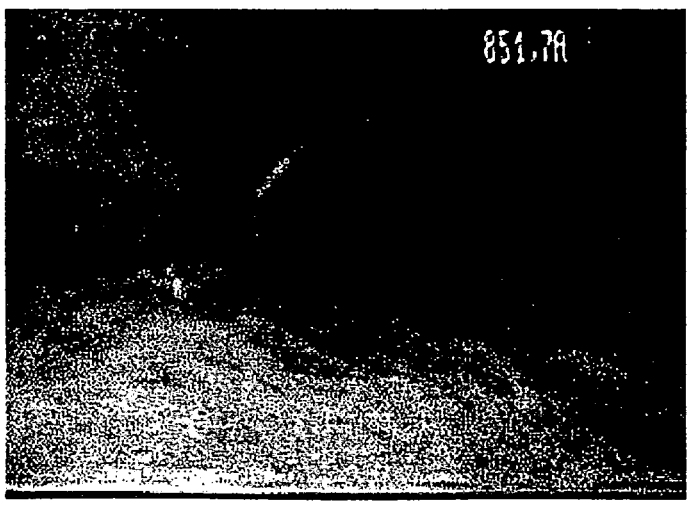
Filename:	T4R12-776,9

Major Diameter	30
Minor Diameter	19
Ovality	0.63
% Deflection	25%
Station #	2283.1



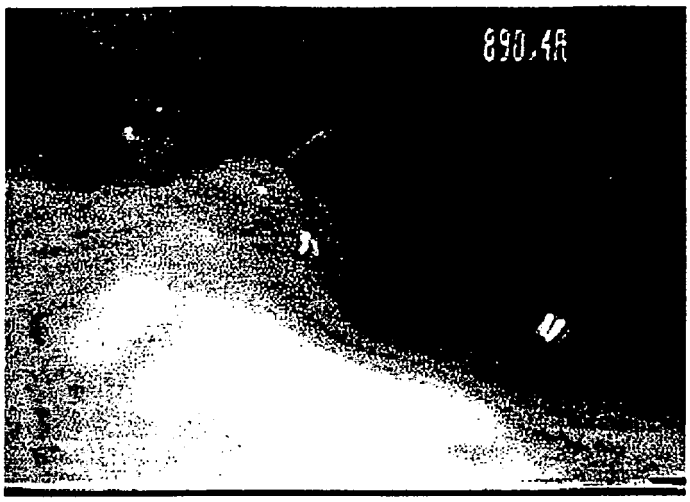
Filename:	T4R12-815,1

Major Diameter	30
Minor Diameter	20
Ovality	0.67
% Deflection	21%
Station #	2244.9



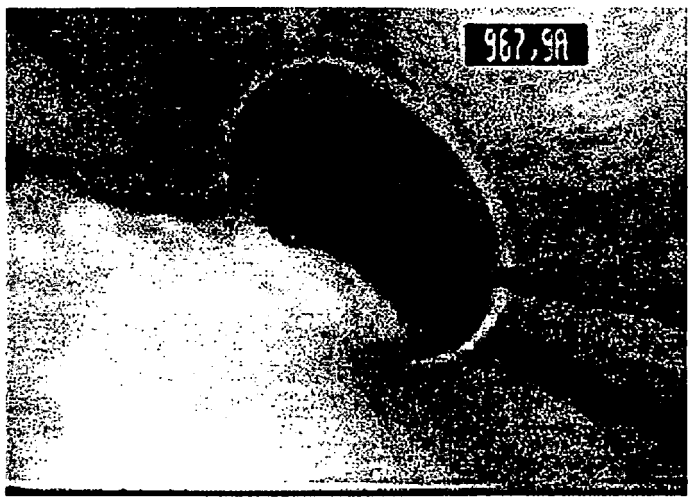
Filename:	T4R12-851,7

Major Diameter	40
Minor Diameter	30
Ovality	0.75
% Deflection	15%
Station #	2208.3



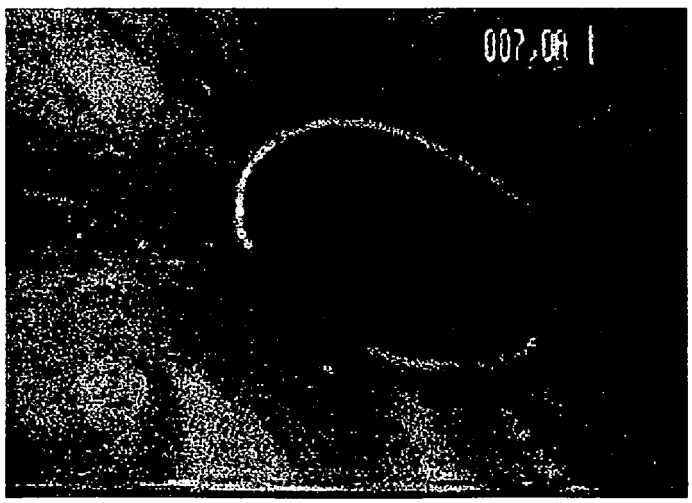
Filename:	T4R12-890,4

Major Diameter	47
Minor Diameter	31
Ovality	0.66
% Deflection	22%
Station #	2169.6



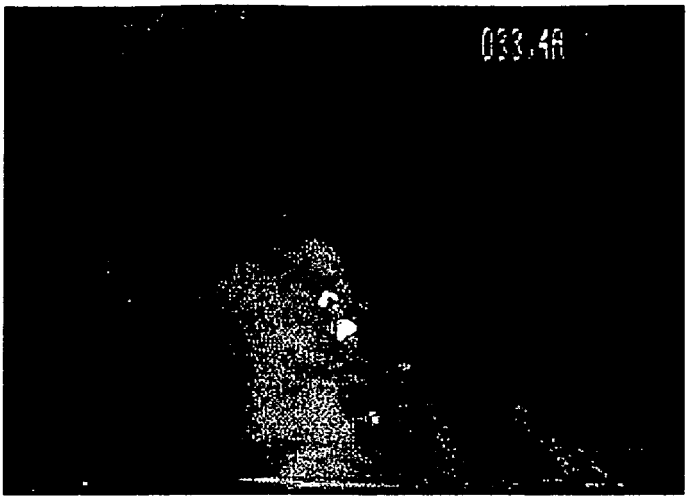
Filename:	T4R12-976,9

Major Diameter	50
Minor Diameter	30
Ovality	0.60
% Deflection	27%
Station #	2083.1



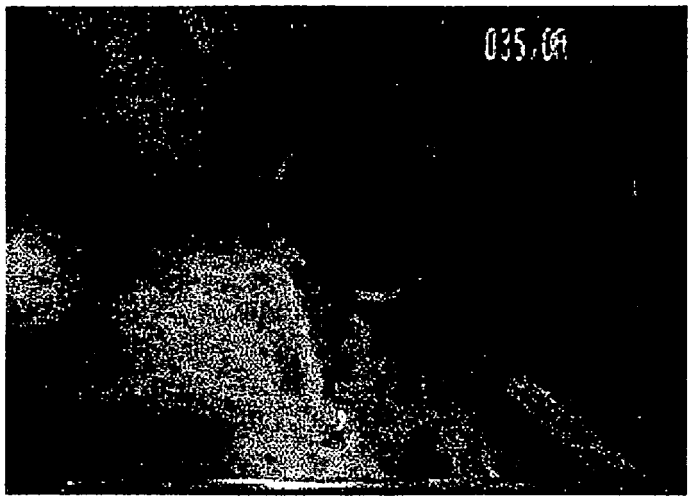
Filename:	T4R12-1007,0

Major Diameter	50
Minor Diameter	30
Ovality	0.60
% Deflection	27%
Station #	2053



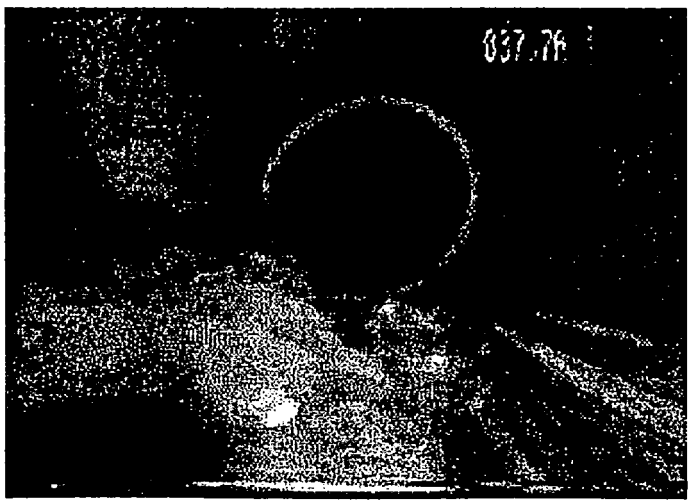
Filename:	T4R12=1033,4

Major Diameter	43
Minor Diameter	43
Ovality	1.00
% Deflection	0%
Station #	2026.6



Filename:	T4R12=1035,0

Major Diameter	27
Minor Diameter	25
Ovality	0.93
% Deflection	4%
Station #	2025

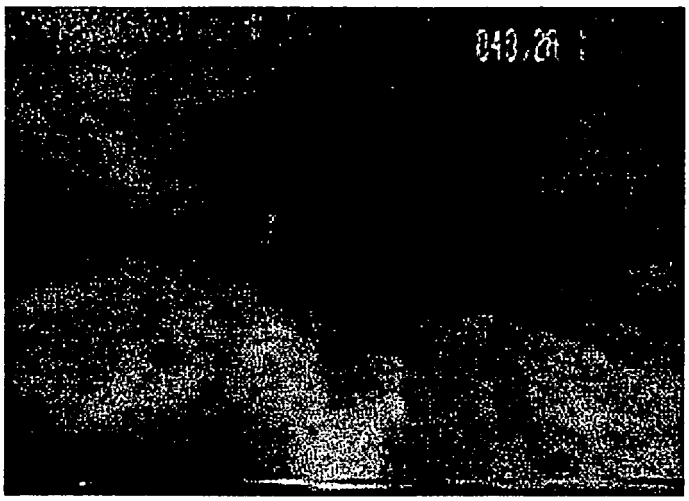


Filename:	T4R12=1037,0

Major Diameter	30
Minor Diameter	28
Ovality	0.93
% Deflection	4%
Station #	2023

Filename:	T4R12=1039,2

Major Diameter	37
Minor Diameter	22
Ovality	0.59
% Deflection	28%
Station #	2020.8



Filename:	T4R12=1040,2

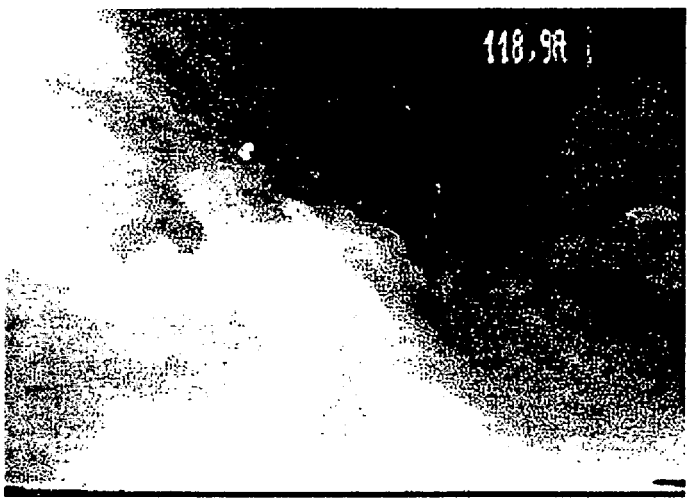
Major Diameter	37
Minor Diameter	21
Ovality	0.57
% Deflection	30%
Station #	2019.8

Filename:	T4R12=1041,3

Major Diameter	27
Minor Diameter	19
Ovality	0.70
% Deflection	19%
Station #	2018.7

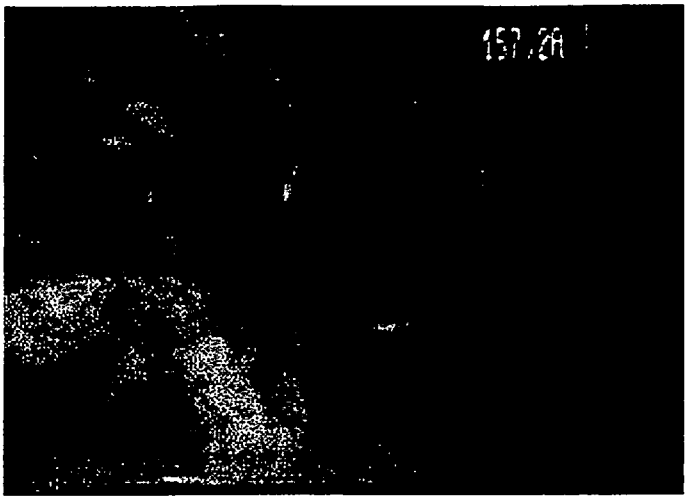
Filename:	T4R12=1079,6

Major Diameter	27
Minor Diameter	22
Ovality	0.81
% Deflection	11%
Station #	1980.4



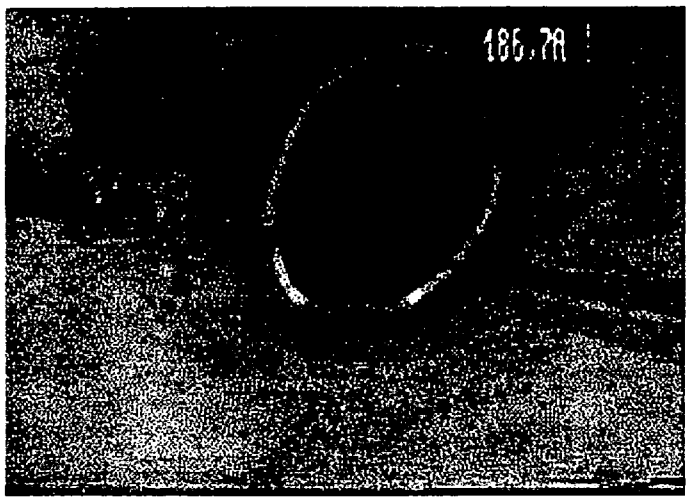
Filename:	T4R12=1118,9

Major Diameter	26
Minor Diameter	20
Ovality	0.77
% Deflection	14%
Station #	1941.1



Filename:	T4R12-1157,2

Major Diameter	32
Minor Diameter	29
Ovality	0.91
% Deflection	5.00%
Station #	1902.8



Filename:	T4R12-1186,7

Major Diameter	44
Minor Diameter	31
Ovality	0.70
% Deflection	19%
Station #	1873.3

Filename:	T4R12-1226,2

Major Diameter	36
Minor Diameter	24
Ovality	0.67
% Deflection	21%
Station #	1833.8

Filename:	T4R12-1265,1

Major Diameter	40
Minor Diameter	27
Ovality	0.68
% Deflection	21%
Station #	1794.9

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Filename:	T4R12-1304

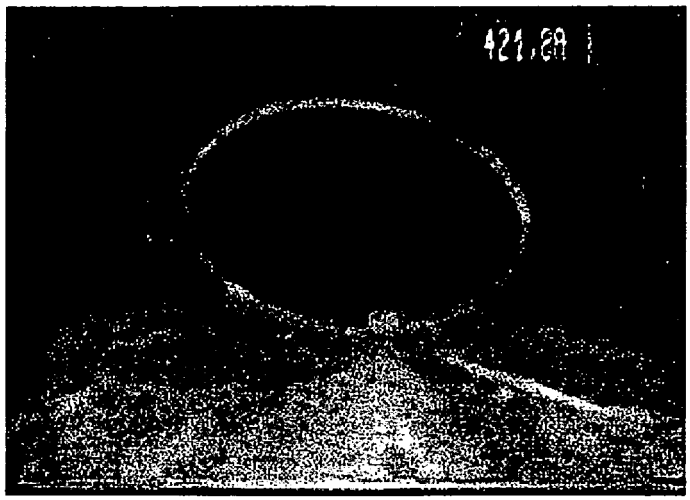
Major Diameter	
Minor Diameter	
Ovality	
% Deflection	
Station #	

Filename:	T4R12=1343,5

Major Diameter	34
Minor Diameter	24
Ovality	0.71
% Deflection	18%
Station #	1716.5

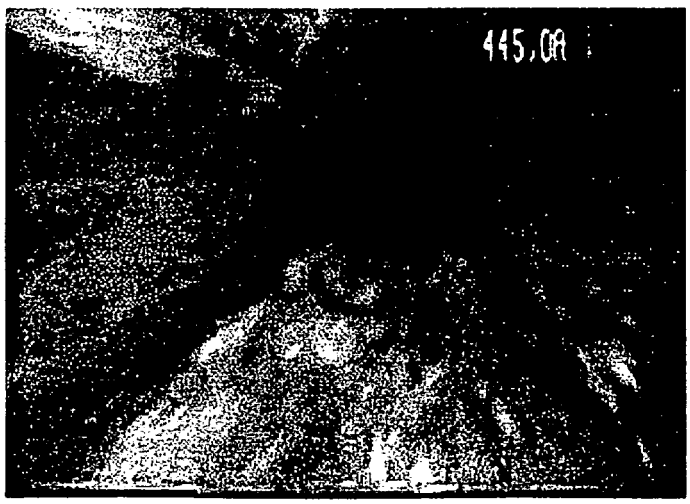
Filename:	T4R12=1382,6

Major Diameter	35
Minor Diameter	26
Ovality	0.74
% Deflection	16%
Station #	1677.4



Filename:	T4R12=1421,8

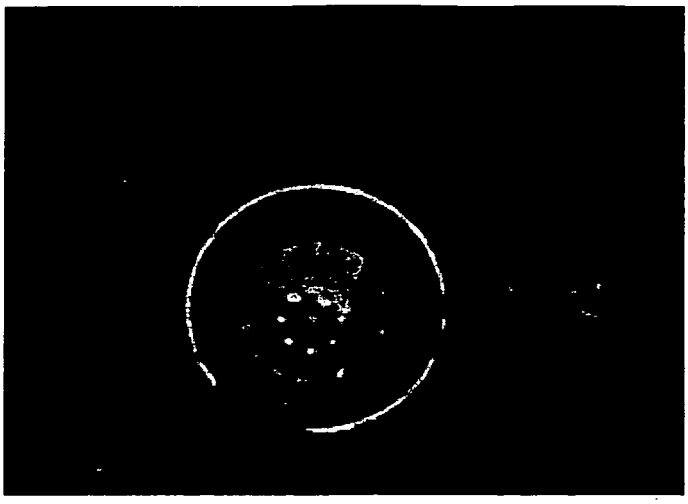
Major Diameter	50
Minor Diameter	34
Ovality	0.68
% Deflection	21%
Station #	1638.2



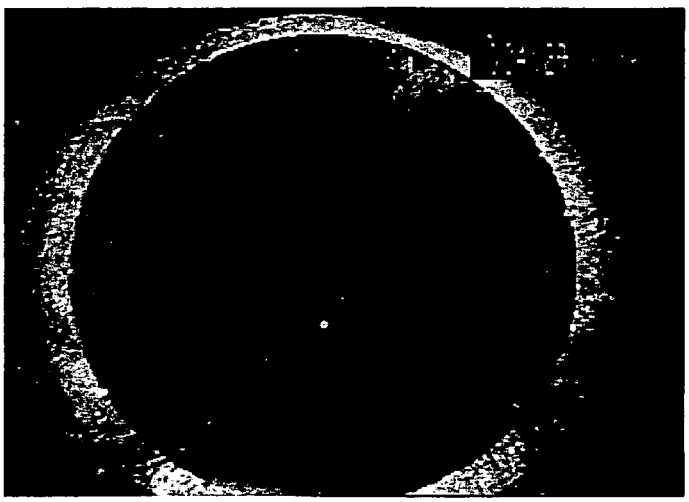
Filename:	T4R12=1445,0

Major Diameter	19
Minor Diameter	19
Ovality	1.00
% Deflection	0%
Station #	1615

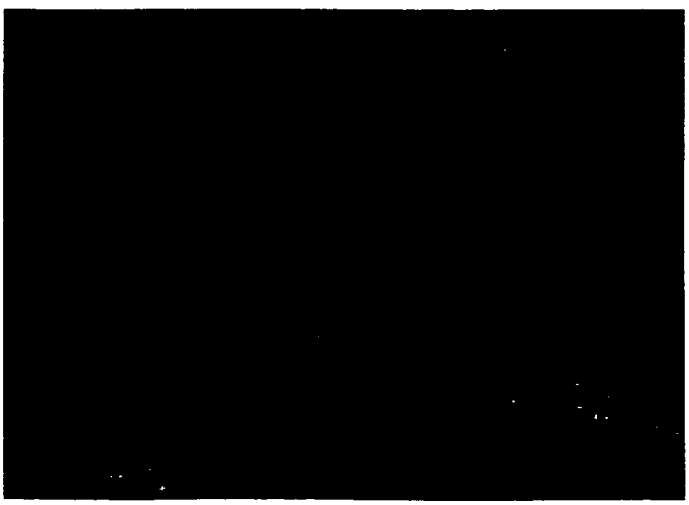
Run C



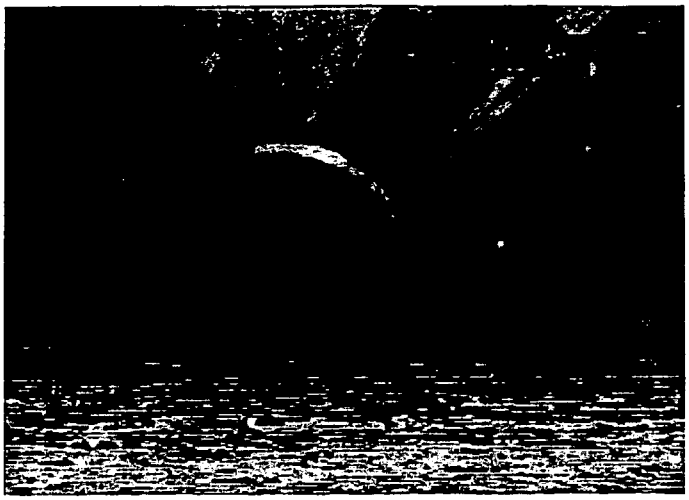
Filename: runc-1.jpg	
Major Diameter	38
Minor Diameter	38
Ovality	1.00
% Deflection	0%
Footage	3,1
Station #	791.9



Filename: runc-2.jpg	
Major Diameter	78
Minor Diameter	74
Ovality	0.95
% Deflection	3%
Footage	4,2
Station #	790.8



Filename: runc-3.jpg	
Major Diameter	21
Minor Diameter	21
Ovality	1.00
% Deflection	0%
Footage	7,6
Station #	787.4



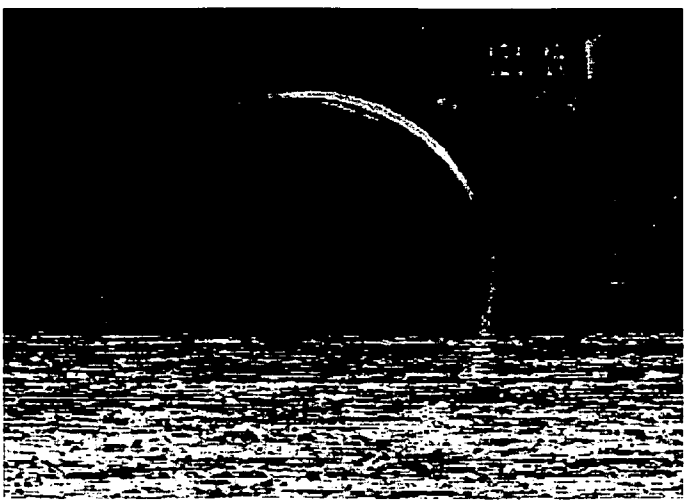
Filename: runc-4.jpg	
Major Diameter	41
Minor Diameter	40
Ovality	0.98
% Deflection	1%
Footage	12,4
Station #	782.6

Filename: runc-5.jpg	
Major Diameter	42
Minor Diameter	39
Ovality	0.93
% Deflection	4%
Footage	
Station #	795

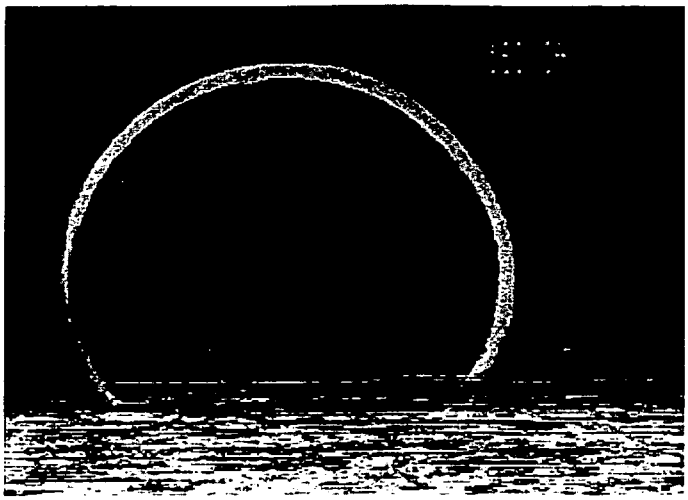
Filename: runc-6.jpg	
Major Diameter	52
Minor Diameter	47
Ovality	0.90
% Deflection	6%
Footage	42,9
Station #	752.1

Filename: runc-7.jpg	
Major Diameter	70
Minor Diameter	70
Ovality	1.00
% Deflection	0%
Footage	81,9
Station #	713.1

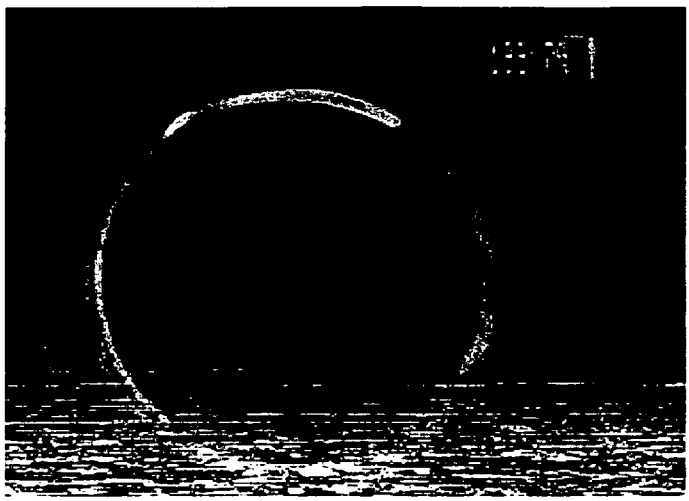
Filename: runc-8.jpg	
Major Diameter	70
Minor Diameter	70
Ovality	1.00
% Deflection	0%
Footage	81,9
Station #	713.1



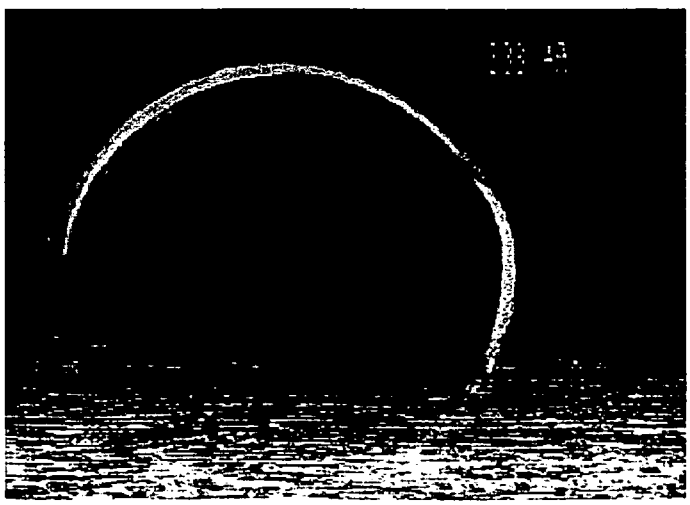
Filename: runc-9.jpg	
Major Diameter	55
Minor Diameter	52
Ovality	0.95
% Deflection	3%
Footage	121,1
Station #	673.9



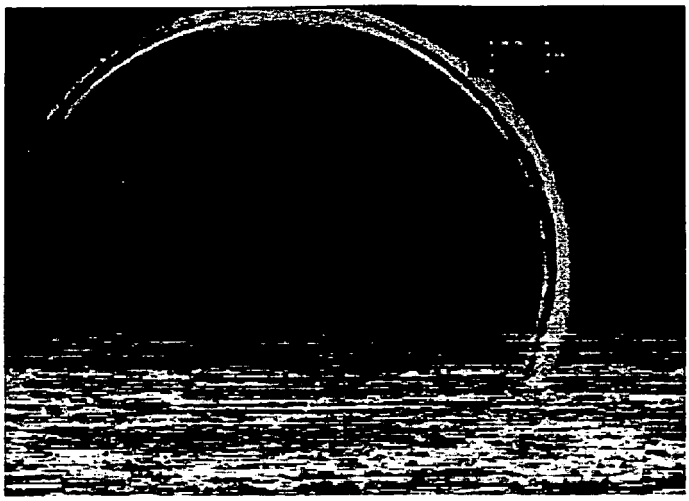
Filename: runc-10.jpg	
Major Diameter	66
Minor Diameter	62
Ovality	0.94
% Deflection	3%
Footage	160,3
Station #	634.7



Filename: runc-11.jpg	
Major Diameter	58
Minor Diameter	57
Ovality	0.98
% Deflection	1%
Footage	199,7
Station #	595.3

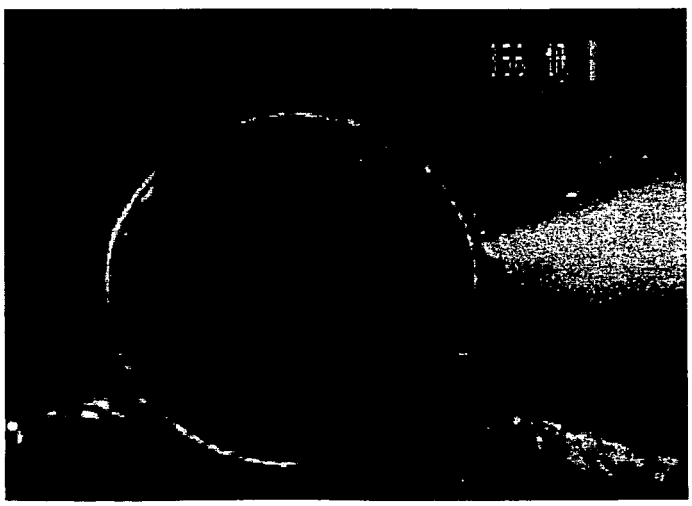


Filename: runc-12.jpg	
Major Diameter	62
Minor Diameter	62
Ovality	1.00
% Deflection	0%
Footage	238,4
Station #	556.6

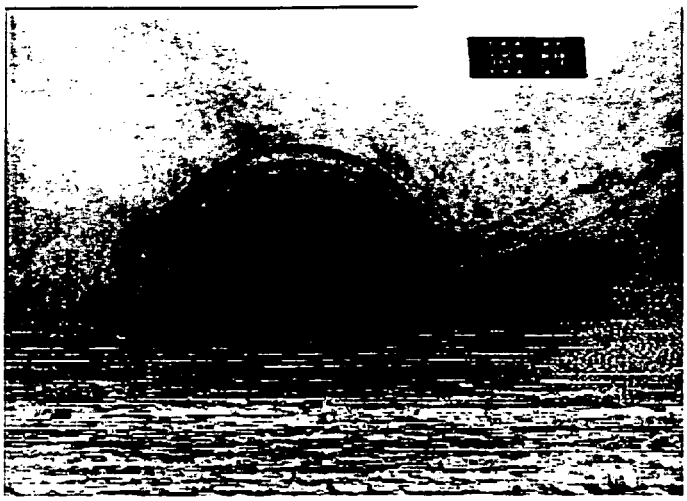


Filename: runc-13.jpg	
Major Diameter	80
Minor Diameter	70
Ovality	0.88
% Deflection	7%
Footage	277,3
Station #	517.7

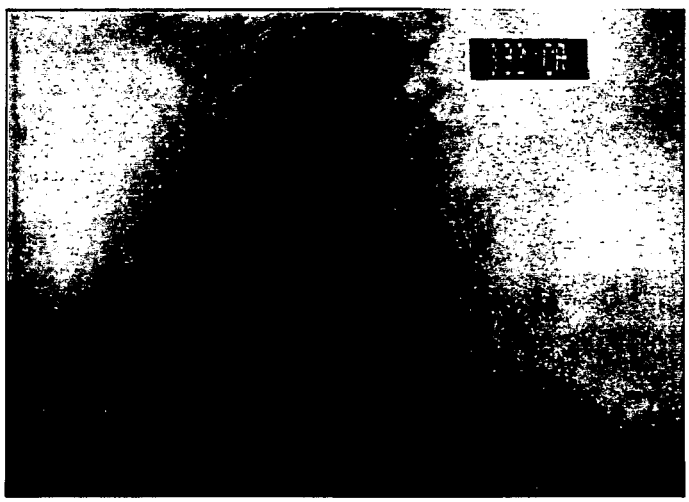
Filename: runc-14.jpg	
Major Diameter	63
Minor Diameter	57
Ovality	0.90
% Deflection	6%
Footage	316,7
Station #	478.3



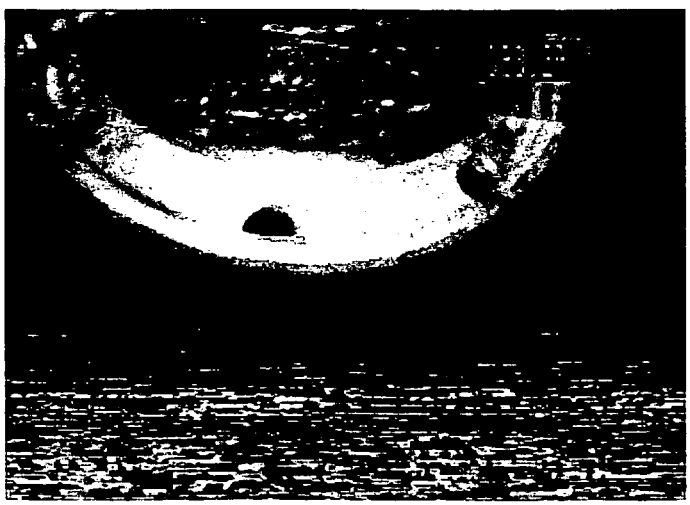
Filename: runc-15.jpg	
Major Diameter	56
Minor Diameter	54
Ovality	0.96
% Deflection	2%
Footage	356,1
Station #	438.9



Filename: runc-16.jpg	
Major Diameter	45
Minor Diameter	45
Ovality	1.00
% Deflection	0%
Footage	389,6
Station #	405.4

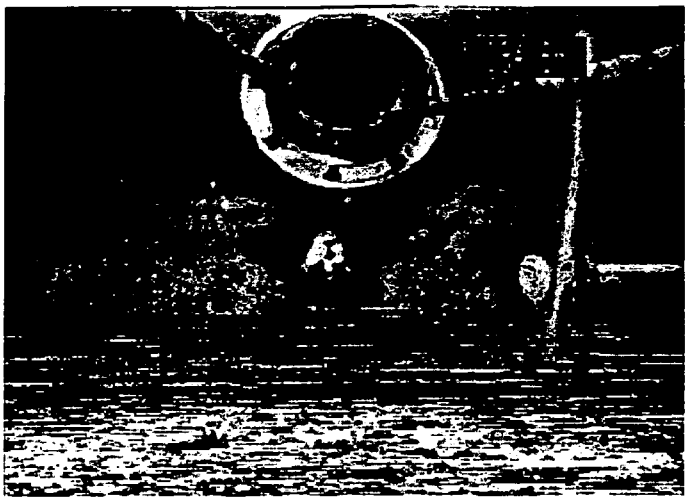


Filename: runc-17.jpg	
Major Diameter	43
Minor Diameter	40
Ovality	0.93
% Deflection	4%
Footage	393,0
Station #	402



Filename: runc-18.jpg*	
Major Diameter	N/A
Minor Diameter	N/A
Ovality	N/A
% Deflection	0%
Footage	393,2
Station #	401.8

2195



Filename: runc-19end.jpg*

Major Diameter	N/A
Minor Diameter	N/A
Ovality	N/A
% Deflection	0%
Footage	394,6
Station #	400.4

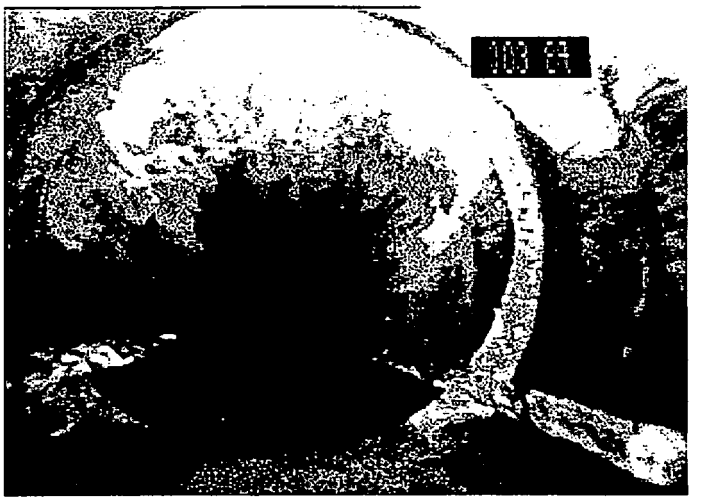
* SDR 11 Flange Adapter

456

Run D

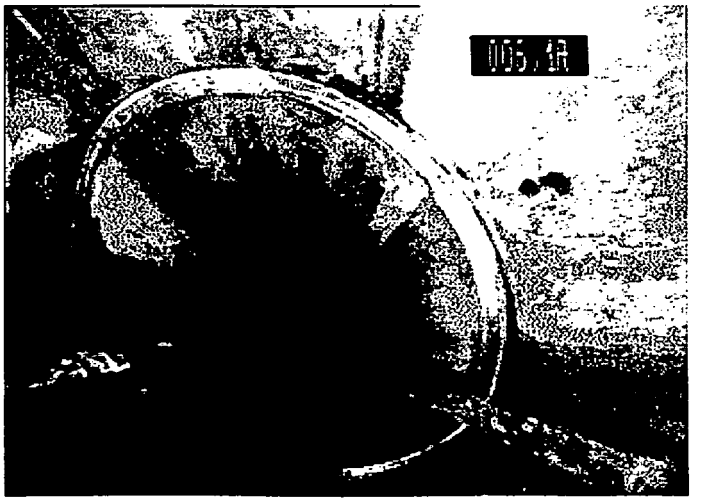
Filename: rund-1.jpg

Major Diameter	5
Minor Diameter	5
Ovality	1.00
% Deflection	0%
Footage	0,9
Station #	394.1



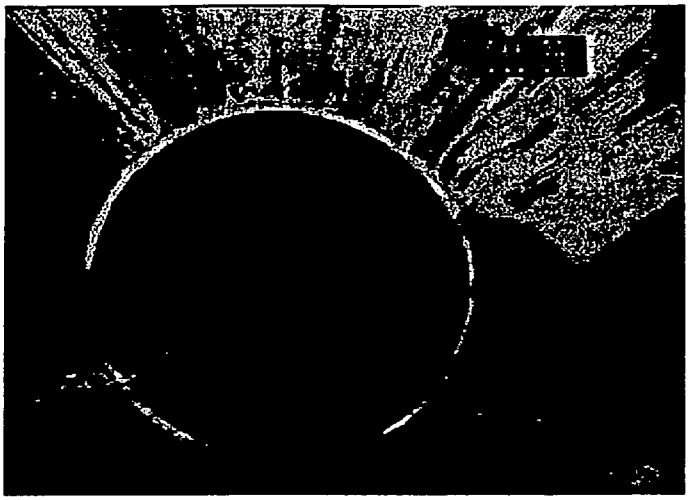
Filename: rund-2.jpg

Major Diameter	73
Minor Diameter	66
Ovality	0.90
% Deflection	6%
Footage	3,8
Station #	391.2

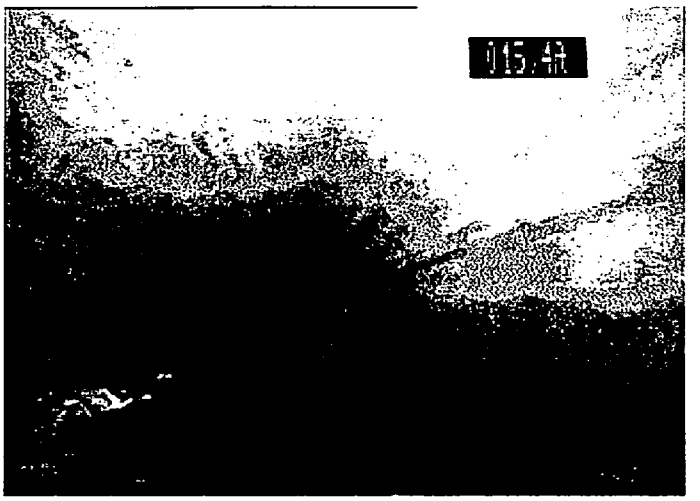


Filename: rund-3.jpg

Major Diameter	67
Minor Diameter	50
Ovality	0.75
% Deflection	15%
Footage	6,1
Station #	388.9



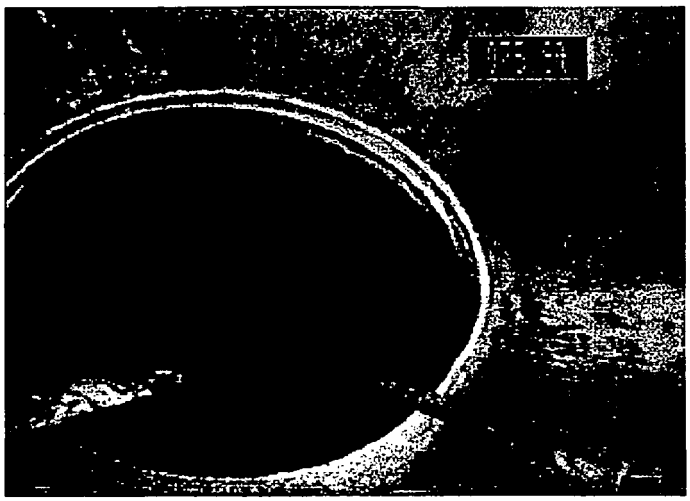
Filename: rund-4.jpg	
Major Diameter	58
Minor Diameter	54
Ovality	0.93
% Deflection	4%
Footage	11,3
Station #	383.7



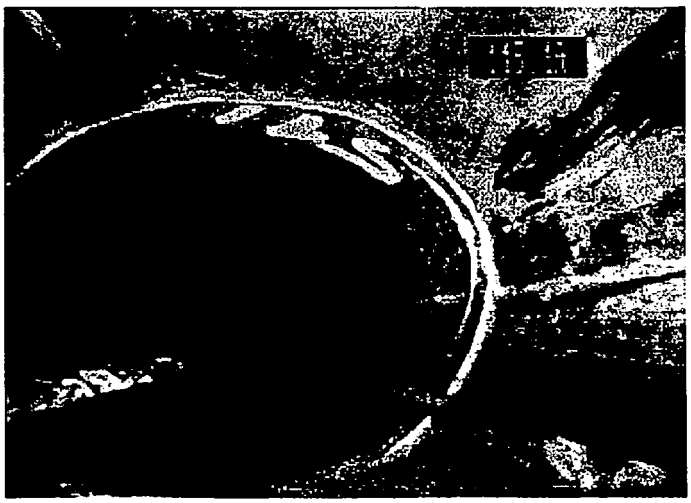
Filename: rund-5.jpg	
Major Diameter	18
Minor Diameter	17
Ovality	0.94
% Deflection	3%
Footage	15,4
Station #	379.6

Filename: rund-6.jpg	
Major Diameter	57
Minor Diameter	44
Ovality	0.77
% Deflection	14%
Footage	16,7
Station #	378.3

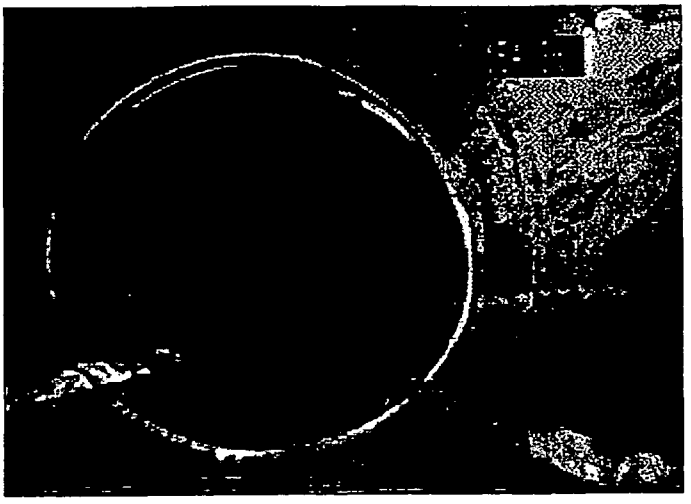
Filename: rund-7.jpg	
Major Diameter	
Minor Diameter	
Ovality	
% Deflection	
Footage	40,3
Station #	354.7



Filename: rund-8.jpg	
Major Diameter	75
Minor Diameter	57
Ovality	0.76
% Deflection	15%
Footage	75,9
Station #	319.1

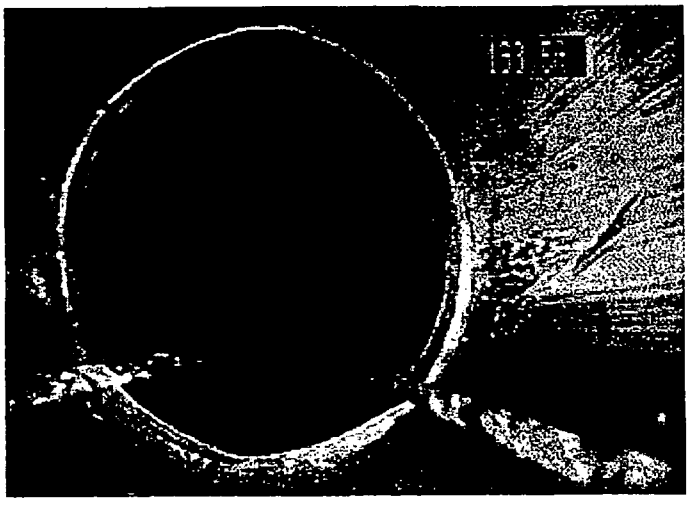


Filename: rund-9.jpg	
Major Diameter	77
Minor Diameter	59
Ovality	0.77
% Deflection	14%
Footage	115,1
Station #	279.8



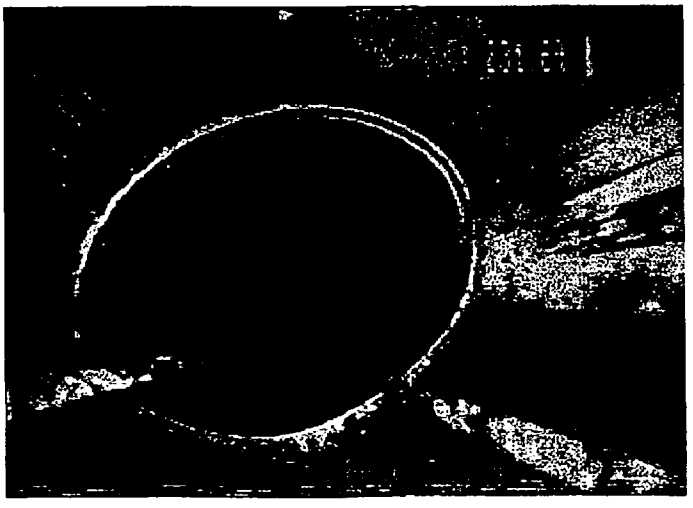
Filename: rund-10.jpg

Major Diameter	61
Minor Diameter	59
Ovality	0.97
% Deflection	2%
Footage	154,3
Station #	240.7



Filename: rund-11.jpg

Major Diameter	66
Minor Diameter	61
Ovality	0.92
% Deflection	4%
Footage	193,5
Station #	201.5



Filename: rund-12.jpg

Major Diameter	61
Minor Diameter	48
Ovality	0.79
% Deflection	13%
Footage	231,6
Station #	163.4

Filename: rund-13.jpg

Major Diameter	70
Minor Diameter	69
Ovality	0.99
% Deflection	1%
Footage	269,5
Station #	125.5

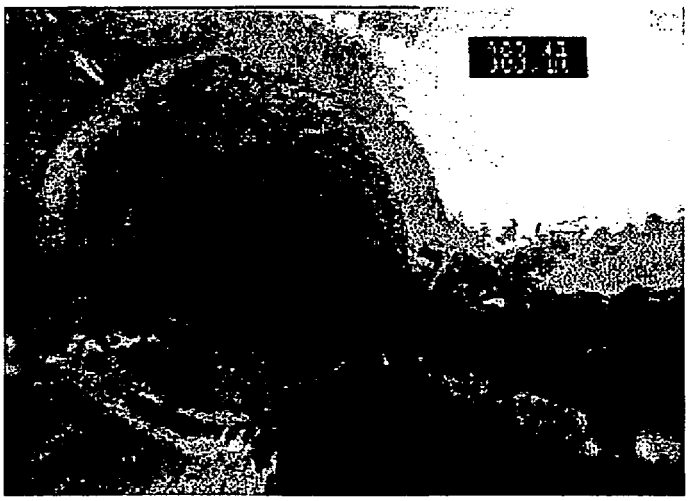
Filename: rund-14.jpg

Major Diameter	64
Minor Diameter	51
Ovality	0.80
% Deflection	12%
Footage	308,5
Station #	86.5

Filename: rund-15.jpg

Major Diameter	64
Minor Diameter	51
Ovality	0.80
% Deflection	12%
Footage	308,5
Station #	86.5

Filename: rund-16.jpg	
Major Diameter	70
Minor Diameter	53
Ovality	0.76
% Deflection	15%
Footage	347,2
Station #	47.8



Filename: rund-17.jpg	
Major Diameter	44
Minor Diameter	44
Ovality	1.00
% Deflection	0%
Footage	383,1
Station #	11.9

Filename: rund-18end.jpg	
Major Diameter	21
Minor Diameter	21
Ovality	1.00
% Deflection	0%
Footage	388,7
Station #	6.3

CCT Video Logs

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

2195 VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: #1 RUN #1 DATE OF RECORDING: 12 FEB 1999 TIME: _____

STATION: START: EXC#1(3+20) FINISH: M.H#3

FOOTAGE: START: 0.0' FINISH: 121.5'

*NOTE: STEADY FLOW OF WATER THROUGH ENTIRE CAMERA RUN

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
4.5	COUPLING	ROUND	
8.9	COUPLING	ROUND	
18.5	BUTT	O.O.R	
28.3 TO 38.0	—	—	CAMERA UNDER WATER
48.0	BUTT	ROUND	
60.0 TO 75.0	—	—	CAMERA UNDER WATER.
79.0 TO 99.0	—	—	CAMERA UNDER WATER
85.0	COUPLING	ROUND	COUPLING UNDER WATER
90.5	COUPLING	ROUND	" "
96.0	COUPLING	ROUND	" "
109.0	COUPLING	ROUND	THIS COUPLING APPEARS TO HAVE LEAK WATER COMING INTO PIPE FAST HERE.
110.0	BUTT	ROUND	
111.5	BUTT	ROUND	
112.5	CLEANOUT	—	
113.5	BUTT	ROUND	
115.0	COUPLING	ROUND	
117.0	COUPLING	ROUND	
121.5	—	—	DRY PIPE (NO WATER FLOW)

PER: Bryan York

SHEET NO. 1 OF 1

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

2195

VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: #1 RUN #2 DATE OF RECORDING: 17 FEB 1999 TIME: _____

STATION: START: EXC#2 (16+00) FINISH: EXC#1 (13+20)

FOOTAGE: START: 0.0' FINISH: 4.5'

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
2.5	CLEANOUT	—	Sta 16+00
3.5	BUTT	ROUND	
4.5	—	—	PIPE OUT OF ROUND. THE CRAWLER COULD NOT GET THROUGH PIPE

PER: Byron Cook

SHEET NO. 1 OF 1

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

2195 VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: #2 RUN #4 DATE OF RECORDING: 17 FEB 1999 TIME: _____

STATION: START: CLEANOUT #4 FINISH: EXC #2 (16+00)

FOOTAGE: START: 0.1' FINISH: 150.0

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
9.5'	—	—	DOWN THROUGH THE CLEANOUT & CAMERA VIEWING DOWN INTO WATER IN PIPE CAMERA IS UNDER SILTY WATER. UNABLE TO SEE ANYTHING.
9.5 TO 21.5	—	—	
23.5	BUTT	O.D.R	CAMERA UNDER SILTY WATER
54.5 TO 62.0	—	—	
64	BUTT	O.D.R	PIPE TOO OUT OF ROUND AND BEING PULLED IN FAST SURGES TO SEE OR RECOGNIZE ANYTHING.
64.0 TO 150.0	—	—	

PER: Byron York

SHEET NO. 1 OF 1

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FLUOR DANIEL FERNALD

VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: ~~RES #3~~ #1 (TB) RUN #3 DATE OF RECORDING: 17 FEB 1999 TIME: _____

STATION: START: EXC#1 (13+20) FINISH: EXC#2 (16+00)

FOOTAGE: START: 0.0' FINISH: 234.5

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
9.5	BUTT	O.O.R	
46.5	BUTT	O.O.R	
82.0	BUTT	O.O.R.	
114.5	BUTT	O.O.R	
152.5	BUTT	O.O.R	
190.5	BUTT	O.O.R	
229.5	BUTT	O.O.R	
230.0	BUTT	O.O.R	
232.0	BUTT	ROUND	
232.5	CLEANOUT	—	Sta 16+00
234.5	BUTT	ROUND	

PER: BYRAN YORK

SHEET NO. 1 OF 1

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

2195

VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: #2 RUN #5 DATE OF RECORDING: 19 FEB 1999 TIME: _____

STATION: START: ~~EXC~~#2 (16+00) FINISH: ~~EXC~~#4 (30+00)

FOOTAGE: START: 0.0' FINISH: 1488.0

NOTE: THIS TAPE & RUN IS MISLABELED ON THE VIDEO.

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
PLEASE REFER TO TAPE #2, RUN #6 FOR DOCUMENTATION OF THIS SECTION OF PIPE. BOTH RUNS ARE THE SAME SECTION OF PIPE BUT THE PULL BACK SEEMS TO BE CLEARER.			

PER: Byron York

SHEET NO. 1 OF 1

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

2195 VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: #2 RUN #6 DATE OF RECORDING: 19 FEB 1999 TIME: _____

STATION: START: EXC#4 (~3ϕ+ϕϕ) FINISH: EXC#2 (~16+ϕϕ)

FOOTAGE: START: 1488.ϕ FINISH: ϕ.ϕ

NOTE: THIS TAPE AND RUN IS MISLABELED ON THE VIDEO.

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS Excavation #4
1463.ϕ	BUTT	O.O.R	
1456.ϕ	—	—	APPEARS TO BE A DEFORMATION OF CARRIER PIPE DUE TO A CENTRALIZER.
1444.5	BUTT	O.O.R	
1406.5	BUTT	O.O.R	
1385.ϕ TO	1385.ϕ	—	STANDING WATER IN PIPE
1385.ϕ TO	1296.ϕ	—	CAMERA UNDER WATER UNABLE TO SEE ANYTHING.
1284.ϕ	BUTT	O.O.R	
1242.5	BUTT	O.O.R	
1238.ϕ	BUTT	O.O.R.	
1237.ϕ	BUTT	O.O.R	
1234.5	BUTT	ROUND	
1234.ϕ	CLEANOUT	—	STATION 28+ϕϕ (AS-BUILT 28+ϕϕ)
1231.5	BUTT	ROUND	
1228.5	BUTT	O.O.R	
1188.ϕ	BUTT	O.O.R	
1186.ϕ TO	115ϕ.ϕ	—	CAMERA UNDER WATER.
1147.ϕ	BUTT	ROUND	COULD BARELY SEE DUE TO WATER.
11ϕ6.ϕ	BUTT	O.O.R	
1ϕ65.ϕ	BUTT	O.O.R	

PER: Bryan York

SHEET NO. 1 OF 3

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

2195

VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: #2 RUN #6 DATE OF RECORDING: 19 FEB 1999 TIME: _____

STATION: START: EXC#4(~30+00) FINISH: EXC#2(~16+00)

FOOTAGE: START: 1488.0 FINISH: 0.0

NOTE: THIS TAPE AND RUN IS MISLABELED ON THE VIDEO.

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
1045.5	BUTT	O.O.R.	
1007.0	BUTT	ROUND	
966.0	BUTT	O.O.R	
925.0	BUTT	O.O.R	
884.0	BUTT	O.O.R	
843.0	BUTT	O.O.R	
805.0	TO 784.0		CAMERA UNDER WATER
766.5	COUPLING	ROUND	
765.0	BUTT	ROUND	
763.0	CLEANOUT		STATION 24+00 (AS-BUILT 23+55)
762.0	BUTT	O.O.R	
758.5	BUTT	O.O.R	
718.0	BUTT	O.O.R	
678.5	BUTT	O.O.R	
639.0	BUTT	O.O.R	
601.0	BUTT	O.O.R	
560.5	BUTT	O.O.R	
556.0	TO 480.0		CAMERA UNDER WATER
479.0	BUTT	O.O.R	

PER: Bryan York

SHEET NO. 2 OF 3

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2195 VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: #2 RUN #6 DATE OF RECORDING: 19 FEB 1999 TIME: _____

STATION: START: EXC#4 (~30.00) FINISH: EXC#2 (~16+00)

FOOTAGE: START: 1488.0 FINISH: 0.0

NOTE: THIS TAPE AND RUN IS MISLABELED ON THE VIDEO.

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
438.5	BUTT	O.O.R	
411.5	COUPLING	ROUND	
410.0	BUTT	ROUND	
407.5	CLEANOUT	—	STATION 20+00 (AS-BUILT 20+00)
406.5	BUTT	ROUND	
405.5	BUTT	O.O.R	
404.5	BUTT	O.O.R	
403.5	BUTT	O.O.R	
364.0	BUTT	O.O.R	
323.0	BUTT	O.O.R	
283.0	BUTT	O.O.R	
252.5	BUTT	O.O.R	
212.0	BUTT	O.O.R	
171.5	BUTT	O.O.R	
131.0	BUTT	O.O.R	
90.5	BUTT	O.O.R	
50.0	BUTT	O.O.R	
9.0	BUTT	O.O.R.	
0.0	—	—	END OF PIPE @ EXC#2 Cleanout

PER: Byron York

SHEET NO. 3 OF 3

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2195 VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: 3 (Run #7) DATE OF RECORDING: 2 March 1999 TIME: _____

STATION: START: ~30+00 (Excavation #4) FINISH: _____ (Permanent Lift Station)

FOOTAGE: START: 0.0 FINISH: 537.2

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
0.7'		Round	
4.2'	Butt	OOR	
32.0'	—	—	STANDING WATER (~1-2 in)
42.9'	Butt	OOR	
72.5'	—	—	STANDING WATER ENDS
75.5'	—	—	Back into standing water (1-2 in)
77.9	Butt	OOR	Butt may be damaged-Rightside DGB
88.2	—	—	STANDING WATER ENDS
112.7	Coupling	Round	Repair of VBS Test Plug Removal DGB
115.3	Butt	OOR	
131.9	Coupling	Round	STANDING water
136.5	Butt	Round	Sta 32+00 Cleanout @ 140 ± ft
141.1	—	—	Camera is underwater
158.8	—	—	Camera half submerged (STANDING water)
187.7	Butt	OOR	
193.0	—	—	Camera is underwater
205.0	—	—	Camera is half submerged (STANDING water)
226.5	Butt	OOR	
229.0	—	—	STANDING WATER ENDS

PER: C. Sukow

SHEET NO. 1 OF 3

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FLUOR DANIEL FERNALD

2195 VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: 3 RUN #7 DATE OF RECORDING: 2 March 1999 TIME: _____

STATION: START: Excavation #4 ~30+00 FINISH: PERMANENT LIFT STATION

FOOTAGE: START: 0.0 FINISH: 537.2

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
245	—	—	CAMERA IS SUBMERGED
251	—	—	CAMERA IS HALF SUBMERGED
264.4	Butt	OOR	PIPE IS NEAR DRY
302.7	Butt	OOR	
332	—	—	STANDING WATER
335	—	—	CAMERA IS UNDER WATER
341	Butt	OOR	
348	—	—	STANDING WATER
352.5	—	—	CAMERA UNDERWATER
368.0	Believed to be	—	STANDING WATER
379.0	Joint? Butt	—	CAMERA UNDERWATER, JOLT NOTED
393.0	—	—	STANDING WATER ENDS
408	—	—	STANDING WATER
414.5	Butt	OOR	
421	—	—	CAMERA UNDERWATER
447	—	—	STANDING WATER
453	BUTT	OOR	
492	BUTT		
528	COUPLING	ROUND	

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PER: C. Sukow

SHEET NO. 2 OF 3

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

2195 VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: 3 RUN #7 DATE OF RECORDING: 2 March 1999 TIME: _____

STATION: START: EXCAVATION #4 ~30+00 FINISH: PERMANENT LIFT STATION

FOOTAGE: START: 0.00 FINISH: 537.2

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
532	ELBOW	Round	Numerous welds
537	BUTTERFLY VALVE	Round	

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PER: C. Sokoll

SHEET NO. 3 OF 3

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

2195 VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: 3 Run #8 DATE OF RECORDING: 2 March TIME: _____

STATION: START: LIFT STATION SOUTH FINISH: BUTTERFLY VALVE

FOOTAGE: START: 0.0 FINISH: 4.5

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
4.5	—	—	STANDING WATER
			CAMERA BECOMES STUCK IN
			OUT OF ROUND PIPE.
			ONE JOINT SEEN AT APPROXIMATELY
			5.5 to 6.0

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PER: C. Schow

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

2195 VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: 7 DATE OF RECORDING: Ø3 MARCH 1999 TIME: 1245

(TAPE 3 RUN 10)

STATION: START: 16+ØØ (EXC#2) FINISH: 8+ØØ (M.H.#3)

FOOTAGE: START: 1.1' FINISH: 8Ø2.1'

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
4.Ø	CLEAN OUT		STA 16+ØØ (AS-BUILT 16+ØØ)
5.Ø	BUTT	ROUND	
8.5	BUTT	O.O.R	
9.Ø	BUTT		
48.Ø	BUTT	O.O.R	
88.Ø	BUTT	O.O.R	
13Ø.Ø	BUTT	O.O.R	
166.Ø	BUTT	O.O.R	
2Ø8.Ø	BUTT	O.O.R	
247.Ø	COUPLING	ROUND	
248.5	BUTT	ROUND	APPEARS TO BE NEWER PIPE (254'-27Ø' ⇒ CAMERA UNDER WATER)
272.Ø	COUPLING	ROUND	STEADY FLOW OF WATER OVER COUPLING
277.5	COUPLING	ROUND	APPEARS TO HAVE WATER FLOWING OVER JOINT (POSSIBLY FROM CAMERA AGITATION) STANDING(?) WATER NORTH OF JOINT
288.5	BUTT	O.O.R	
323.Ø	BUTT	ROUND	APPEARS TO HAVE WATER FLOWING OVER THE JOINT. CAMERA IS UNDER WATER
359.Ø TO 38Ø.Ø	—	—	COUPLINGS SUSPECTED FROM 1997 REPAIR COUPLINGS HAVE BEEN REMOVED
378.Ø	BUTT	ROUND	
391.5	COUPLING	ROUND	
393.Ø	COUPLING	ROUND	
394.Ø	BUTT	ROUND	

Rebed Removed

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PER: BYRAN YORK

SHEET NO. 1 OF 2

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

2195 VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: 7 DATE OF RECORDING: 03 MARCH 1999 TIME: 1245

TAPE 3 RUN 10

STATION: START: 16+00 (EXC#2) FINISH: 8+00 (M.H.#3)

FOOTAGE: START: 1.1' FINISH: 802.1'

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
397.0	CLEAN OUT		STA 12+00 (AS-BUILT 12+07)
397.5	BUTT	ROUND	
399.0	COUPLING	ROUND	
401.0	COUPLING	ROUND	
442.0	BUTT	O.D.R	
483.0	BUTT	O.D.R	
505.0 TO 518.0	—	—	STANDING WATER IN PIPE
523.5	BUTT	O.D.R	
565.0	BUTT	O.D.R	
605.0	BUTT	ROUND	
645.0	BUTT	ROUND	
686.5	BUTT	ROUND	
727.0	BUTT	ROUND	
768.0	BUTT	O.D.R	
802.1	Coupling DGB	—	END OF PIPE AT MANHOLE #3

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PER: BYRAN YORK

SHEET NO. 2 OF 2

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: _____ DATE OF RECORDING: 18 MARCH 1999 TIME: 1400

(TAPE 5 RUN C)

STATION: START: M.H. #3 FINISH: M.H. #2

FOOTAGE: START: 0.0' FINISH: 394.0

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
0.0	—	—	NORTH LCS STUB OUT IN M.H. #3
2.5	BUTT	ROUND	
4.0	COUPLING	ROUND	APPEARS TO BE THE WELDING OF TWO DIFFERENT THICKNESSES OF PIPE.
6.0	BUTT	ROUND	
12.0	BUTT	ROUND	
14.0	CLEANOUT	—	
14.8	BUTT	ROUND	
16.0	COUPLING	ROUND	
42.0	BUTT	ROUND	
81.5	BUTT	ROUND	
120.5	BUTT	ROUND	
160.0	BUTT	ROUND	
199.0	BUTT	ROUND	
238.0	BUTT	ROUND	
277.0	BUTT	ROUND	
316.0	BUTT	ROUND	
355.5	BUTT	ROUND	
388.5	COUPLING	ROUND	
392.0	BUTT	ROUND	

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PER: Bryan York

SHEET NO. 1 OF 1

NOTE: WHEN CAMERA IS INSIDE OF M.H. #2 THERE IS A LEAK AROUND THE INTERNAL PLUG ON SOUTH LCS STUB OUT

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FLUOR DANIEL FERNALD

2195 VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: _____ DATE OF RECORDING: 18 MARCH 1999 TIME: 1500

(TAPE 5 RUN D)

STATION: START: M.H. #2 FINISH: M.H. #1

FOOTAGE: START: 0.0' FINISH: 390.0'

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
1.0	BUTT	ROUND	
3.5	COUPLING	ROUND	WATER IN BOTTOM OF PIPE IS GREEN FROM DYE IN CONTAINMENT PIPE.
5.5	BUTT	O.O.R	
10.5	BUTT	ROUND	WATER NOT GREEN
13.0	CLEANOUT	TAB	
14.0	BUTT	ROUND	
16.0	BUTT	O.O.R	
39.0	COUPLING	ROUND	APPEARS THAT THERE MAY BE TWO COUPLINGS HERE?
75.0	BUTT	O.O.R	
114.5	BUTT	O.O.R	
153.5	BUTT	ROUND	
193.0	BUTT	O.O.R	
231.0	BUTT	O.O.R	
269.0	BUTT	O.O.R	
308.0	BUTT	O.O.R	JOINT APPEARS TO HAVE SLIGHT "CORNERS" → O
346.5	BUTT	O.O.R	
382.0	COUPLING	ROUND	
387.0	COUPLING	ROUND	
390.0	—	—	AT M.H. #1

480

PER: Bryan York

SHEET NO. 1 OF 1

APPENDIX G

APPENDIX G
CALCULATIONS PACKAGES

2195

Original Design Calculations

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10.1 LTS Gravity Line Design

- LTS Gravity Line Flow Capacity
- LTS Gravity Line Structural Stability
- LTS Gravity Line Frost Protection

2195

COMPUTATION COVER SHEET

NON-CONTROLLED DOCUMENT

SUBJECT OF CALCULATION: LTS GRAVITY LINE DESIGN

Computations By: (Cognizant Engineer)
Signature: Majdi Ahmed Othman — Date: 96/6/24
Printed Name and Title: MAJDI A. OTHMAN, PROJECT ENGINEER

Assumptions and Procedures Checked by: (Checker)
Signature: Robert A. Morgan III — Date: 24 JUNE 96
Printed Name and Title: ROBERT A. MORGAN III, SENIOR STAFF ENGINEER

Computations Checked by:
Signature: Robert A. Morgan III — Date: 24 JUNE 96
Printed Name and Title: ROBERT A. MORGAN III, SENIOR STAFF ENGINEER

Computations Backchecked by: (Cognizant Engineer)
Signature: Majdi Ahmed Othman — Date: 96/6/25
Printed Name and Title: Majdi A. Othman, Project Engineer

Approved by: (PDP)
Signature: Majdi Ahmed Othman — Date: 96/6/25
Printed Name and Title: Majdi A. Othman, Project Engineer

Approved by: (DTL and TETL)
Signature: Rudolph Bonaparte — Date: 24 June 96
Printed Name and Title: Rudolph Bonaparte, Principal

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
F	Pre-Final Submittal to EPA	96/6/24	MAO	RAM	RB 25 Jun 96
G	Final Design Package	4 Oct 96	—	—	—
C	Response to Final Design Comments	1 May 97	—	—	—

Written By: MAO Date: 96/6/24 Reviewed by: RAM Date: 24 JUNE 96

Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE2000 Task No.: 03.2

factor of safety, $Q_g/Q_{ao} = 8.9 > 3$ (OK) ✓

- Baseline design flow rate during post closure, $Q_{pc} = 9.7 \times 10^{-4}$ gpm;
  factor of safety, $Q_g/Q_{pc} = 1.44 \times 10^5 >> 10$ (OK) ✓
- LTS gravity line flow capacity under pressure flow conditions, $Q_p = 334$ gpm ✓
  Storm design flow rate during active operations, $Q_s = 200$ gpm; $Q_p > Q_s$ (flow should be regulated with valves in the LCS gravity line to obtain maximum storm design flow rate of 200 gpm)
- factor of safety against hydraulic rupture, pressure rating of pipe / pressure in pipe during storm event = 33 (OK) ✓

Structural Stability

- factor of safety against LTS gravity line wall crushing, $FS_{wc} = 37$ (OK) ✓
- factor of safety against LTS gravity line wall buckling, $FS_{wb} = 31$ (OK) ✓
- factor of safety against LTS gravity line excessive ring deflection, $FS_{rd} = 10$ (OK) ✓

Frost Protection

- Thickness of silty or clayey cover recommended to protect the LTS gravity line from frost = 2 ft ✓
- Thickness of gravel recommended to protect the LTS gravity line from frost = 3 ft

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THIS PAGE IS INSERTED ONLY FOR CLARITY AND DOES NOT AFFECT THE NUMBERING SYSTEM OF THE REST OF THE PACKAGE

Written By: MAS Date: 96/6/24 Reviewed

Client: FERMCO Project: FERNALD OSDF P

LTS GRAVITY LINE DESIGN

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Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE3900 Task No.: 05.5

RB 24 June 96

LEACHATE TRANSMISSION SYSTEM (LTS) GRAVITY LINE DESIGN

CALCULATION PROCEDURES

INTRODUCTION

The purpose of this package is to present the calculation procedures for the LTS gravity line design. The LTS gravity line extends between the leachate collection system (LCS) manholes along the western boundary of the On-site Disposal Facility (OSDF) and terminates into the permanent lift station as shown in Figure 1. During the active life of the OSDF, the LTS gravity line transfers leachate and liquids collected from the OSDF cells to a temporary gravity line. The temporary gravity line transfers liquids from the LTS gravity line to a permanent lift station located south-west of the OSDF. During later stages of the OSDF development (e.g., during Cell 6 construction) and after closure, the LTS gravity line will transfer flows directly to the permanent lift station. A forcemain will transfer flows from the permanent lift station to the Biosurge Lagoon located at the FERNALD site.

The LTS gravity line should have adequate capacity to convey design flow rates, should have adequate structural resistance to withstand stresses applied on it from overburden materials and from equipment traffic, and should be protected from frost with a soil cover of adequate thickness and thermal properties. Methods to perform these evaluations are described below.

LTS GRAVITY LINE FLOW CAPACITY

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Design Flow Rates

As discussed in the "Leachate Generation Rates" Calculation Package (LGRCP) and the Design Criteria Package (DCP), The LTS gravity line must have adequate capacity to convey: (i) the baseline

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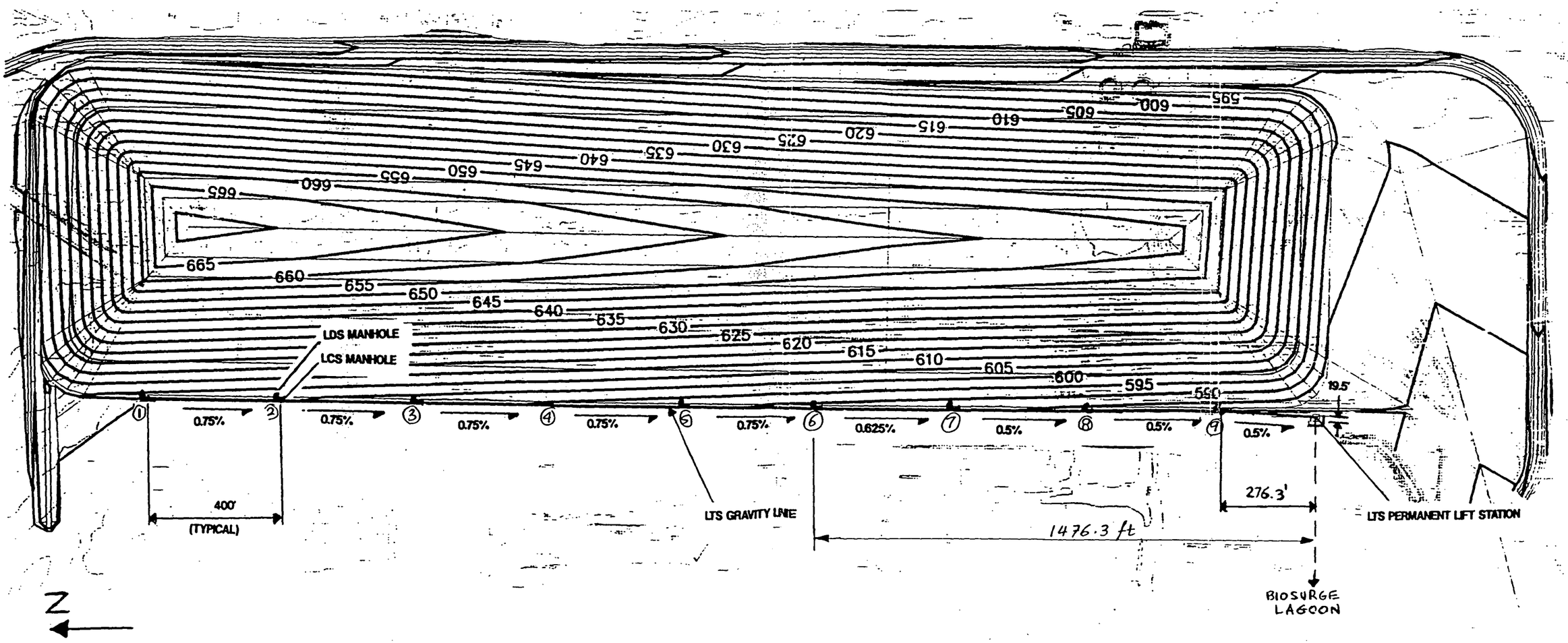
Written by: MAO Date: 96 / 6 / 17 (YY MM DD) Reviewed by: RAM Date: 96 / 6 / 24 (YY MM DD)

Client: FFCO Project: FERNALD OSDF Project/Proposal No.: GE3900 Task No.:

BB 24 Jun 96

FIGURE 1. LEACHATE TRANSMISSION SYSTEM(LTS)



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design flow rate during active operations with a factor of safety no less than three; (ii) the baseline design flow rate after cell closure with a factor of safety no less than ten; and (iii) the storm design flow rate during active cell operations with a factor of safety no less than one. The baseline design flow rates are solely a function of the leachate generation rates calculated for the OSDF. Accordingly, baseline design flow rates for active-operation and post-closure conditions calculated in the LGRCP (i.e., 15.8 gpm and 9.7×10^{-4} gpm, respectively) will be used in this calculation package

The storm design flow rate is a function of: (i) the rate of direct infiltration of storm water runoff from active portions of the OSDF into the LCS of the cell containing the runoff; (ii) the mechanical flow control systems on the LTS gravity line; (iii) the storage capacity of the permanent lift station; and (iv) the maximum acceptable leachate discharge rate from the permanent lift station. Analyses performed in the "Required Cell Leachate Storage" Calculation Package indicate that storm water runoff from active portions of the OSDF are substantial and therefore infiltration of this runoff into the LCS pipe and thereafter into the LTS gravity line must be regulated through mechanical controls imposed on the LTS gravity line. The rate of flow of the impacted runoff into the LCS pipe, which will be defined as the storm design flow rate, will be the lesser of: (i) flow rate in the LTS gravity line at capacity under pressure flow conditions; and (ii) maximum acceptable leachate discharge rate from the permanent lift station of 200 gpm. The flow capacity of the LTS gravity line under pressure flow conditions is larger than the maximum acceptable leachate discharge rate of 200 gpm (as illustrated in this calculation package). Therefore, the storm design flow rate for he LTS gravity line is 200 gpm.

Gravity Flow Condition

The LTS gravity line flow capacity will be calculated using Manning's equation for pipes as follows:

$$Q_g = \frac{R_h^{0.66} i_p^{0.5} A_p}{n} \qquad (1)$$

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where: Q_g = pipe flow capacity; R_h = hydraulic radius (defined as the ratio of the flow area to the perimeter of the wetted area; for a pipe with a circular cross section flowing full under atmospheric pressure, $R_h = B_i/4$, where B_i is pipe inner diameter); i_p = hydraulic gradient (slope of the pipe); A_p =

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cross-sectional area of the pipe (= $\pi B_i^2/4$); and n = Manning's roughness coefficient. The Manning's equation assumes steady uniform fully turbulent flow conditions. ✓

Pressure Flow Condition

The LTS gravity line will flow under pressure if the flow rate in the line exceeds its capacity under gravity flow conditions. The capacity of the line under pressure-flow condition will be calculated using the following procedure:

$$Q = VA_p \qquad (2)$$ ✓

where: Q = flow rate; V = average velocity of the liquid = Q/A_p; A_p = area of pipe = $\frac{\pi}{4}(D)^2$; and D = inside diameter of pipe.

The Darcy-Weisbach equation, typically presented as follows:

$$h_f = f\frac{L}{D}\frac{V^2}{2g} \qquad (3)$$ ✓

is rearranged to solve for velocity as follows:

$$V = \sqrt{\frac{2gh_f D}{fL}} \qquad (4)$$ ✓

where: h_f = friction head in pipe = $z_1 - z_2$ (i.e., liquid elevation at pipe inlet - liquid elevation at pipe outlet); g = gravitational acceleration; f = friction factor; and L = length of pipe.

The friction factor is obtained from the Moody diagram [Roberson/Crow, 1990] shown in Figure 2. Two terms are required to determine the friction factor: (i) a combination of the Darcy-Weisbach and Reynolds equations as presented below, and (ii) the relative roughness of the pipe. The first term is as follows:

$$\mathrm{Re}\, f^{1/2} = \frac{D^{3/2}}{\nu}\left(\frac{2gh_f}{L}\right)^{1/2} \qquad (5)$$ ✓

where: Re = Reynolds number = DV/ν; and ν = kinematic viscosity of water.

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Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE3000 Task No.: [illegible]

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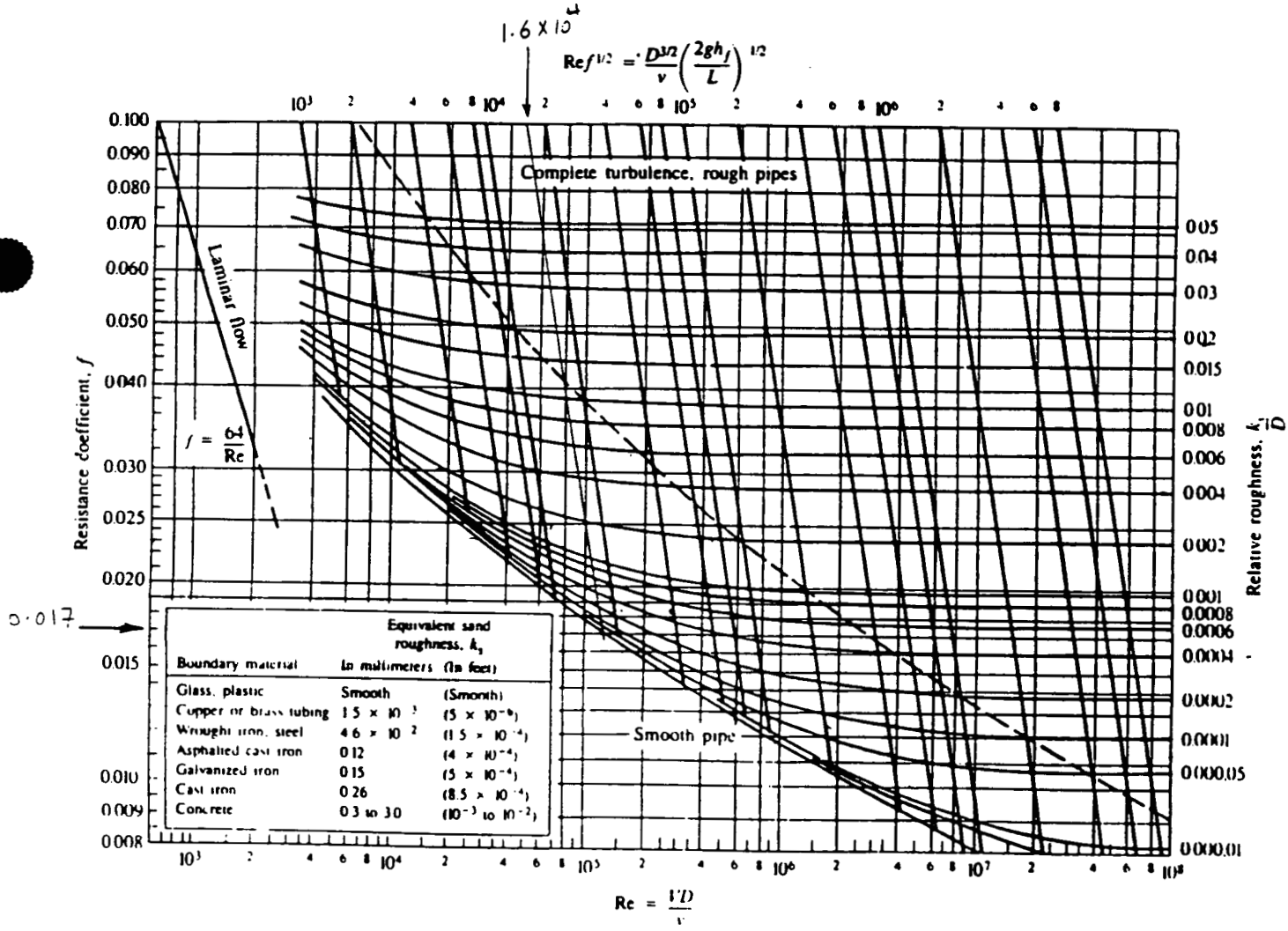
Figure 2. The Moody Diagram [Roberson/Crow, 1990]



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Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE 3900 Task No.: 3.6

RB 24 June 96

The relative roughness curve to be used on the Moody Diagram is the smooth pipe curve.

It is anticipated that the LTS gravity line will be connected to the permanent lift station during construction of Cell 6. The pressure flow condition to be analyzed relates to flow of leachate contained in the Cell 6 impacted runoff catchment area through the LTS gravity line to the permanent lift station. It is anticipated that this flow rate will exceed the gravity flow rate capacity of the line and therefore the pipe will be under pressure. As presented in Figure 3, the friction loss in the fittings will be calculated using the equivalent pipe lengths method. The friction head loss in the fittings between Cell 6 and the permanent lift station is caused by: (i) one 6" butterfly valve; (ii) one 6" check valve; (iii) one 6" tee (branch); (iv) seven 6" tee (line); and (v) three 6" 90° ell.

As presented in Figure 1, the friction head loss due to the pipe is caused by 1476.3 ft of 6" pipe.

Hydraulic Pressure

The LTS gravity line resistance to hydraulic rupture will be evaluated using the following equation:

$$FS_{hr} = \frac{2P_{rating}}{P_h} \quad (6)$$

where: FS_{hr} = factor of safety against hydraulic rupture; P_{rating} = pressure rating of the pipe material (which includes an integral factor of safety of 2); and P_h = hydraulic pressure in the pipe (taken as the hydraulic head multiplied by the unit weight of leachate; i.e., $(z1-z2)\,\gamma_w$).

LTS GRAVITY LINE STRUCTURAL STABILITY

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Overview

Calculations will be performed to ensure the LTS gravity line is able to withstand the loads applied on it with an adequate factor of safety. Failure mechanisms that will be checked are: (i) wall crushing; (ii) wall buckling; and (iii) excessive ring deflection. Stresses applied on the LTS gravity line

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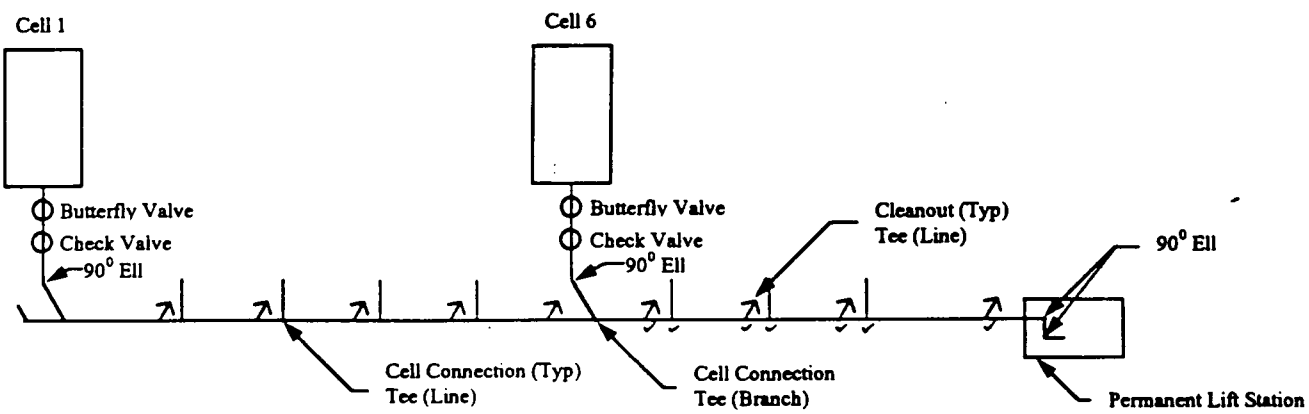
RJ 24 Jun 96

FIGURE 3.
SCHEMATIC DIAGRAM
LOCATION OF FITTINGS



Note: It is anticipated that the LTS gravity line will be extended to the permanent lift station when cell 6 undergoes construction.

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include stresses due to traffic and stresses due to overburden materials. Plastic pipe can be designed to resist failure by the above mechanisms using design methods presented in the technical literature [Uni-Bell, 1991; Phillips 66, 1988, 1991; and Chevron, 1992].

The stresses due to traffic are assumed to be applied by a truck with a capacity of 35 tons and a wheel load of 20,000 lb when full. The total stress on the pipe is then the sum of the stresses applied by the soil layers and the stresses applied by the loaded truck, which can be calculated as described by ASCE [1979] as follows:

$$\sigma_{ic} = \gamma_p D_p + C_s \frac{PF_{ic}}{L_{ic} B_c} \checkmark \tag{7}$$

where: σ_{ic} = stress on the pipe; γ_p = average unit weight of the overburden materials; D_p = thickness of the overburden materials; B_c = outer pipe diameter; C_s = load coefficient (Table 1), which is a function of $B_c/(2D_p)$ and $L_{ic}/(2D_p)$; P = concentrated load; F_{ic} = impact factor accounting for dynamic loads; and L_{ic} = effective length of pipe, which is arbitrarily defined as follows by ASCE [1979]: L_{ic} = 3 ft if pipe is longer than 3 ft, and L_{ic} = actual pipe length if pipe is shorter than 3 ft.

Wall Crushing

Wall crushing can occur when the stress in the pipe wall, due to external vertical pressure, exceeds the compressive strength of the pipe material. The factor of safety against pipe wall crushing may be calculated using the following equation:

$$FS_{wc} = \frac{2\sigma_y}{(SDR-1)\sigma_{max}} \checkmark \tag{8}$$

where: FS_{wc} = factor of safety against pipe wall crushing; σ_y = compressive yield strength of the pipe; SDR = standard dimension ratio of the pipe; and σ_{max} = maximum stress applied to the pipe.

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Wall Buckling

Wall buckling, a longitudinal wrinkling in the pipe wall, can occur when the external vertical pressure exceeds the critical buckling pressure of the pipe/bedding aggregate system. The factor of safety against pipe wall buckling may be calculated using the following equation:

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Table 1. Load Coefficient C_s.

$\frac{B_c}{2D_p}$	$\frac{L_{1c}}{2D_p}$													
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.5	2.0	5.0
0.1	0.019	0.037	0.053	0.067	0.079	0.089	0.097	0.103	0.108	0.112	0.117	0.121	0.124	0.128
0.2	0.037	0.072	0.103	0.131	0.155	0.174	0.189	0.202	0.211	0.219	0.229	0.238	0.244	0.248
0.3	0.053	0.103	0.149	0.190	0.224	0.252	0.274	0.292	0.306	0.318	0.333	0.345	0.355	0.360
0.4	0.067	0.131	0.190	0.241	0.281	0.320	0.349	0.373	0.391	0.405	0.425	0.440	0.454	0.460
0.5	0.079	0.155	0.224	0.284	0.336	0.379	0.414	0.441	0.463	0.481	0.505	0.525	0.540	0.548
0.6	0.089	0.174	0.252	0.320	0.379	0.428	0.467	0.499	0.524	0.544	0.572	0.596	0.613	0.624
0.7	0.097	0.189	0.274	0.349	0.414	0.467	0.511	0.546	0.584	0.597	0.628	0.650	0.674	0.688
0.8	0.103	0.202	0.292	0.373	0.441	0.499	0.546	0.584	0.615	0.620	0.674	0.703	0.725	0.740
0.9	0.108	0.211	0.306	0.391	0.463	0.524	0.574	0.615	0.647	0.673	0.711	0.742	0.766	0.784
1.0	0.112	0.219	0.318	0.405	0.481	0.544	0.597	0.639	0.673	0.701	0.740	0.774	0.800	0.816
1.2	0.117	0.229	0.333	0.425	0.505	0.572	0.628	0.674	0.711	0.740	0.783	0.820	0.849	0.868
1.5	0.121	0.238	0.345	0.440	0.525	0.596	0.650	0.703	0.742	0.774	0.820	0.861	0.894	0.916
2.0	0.124	0.244	0.355	0.454	0.540	0.613	0.674	0.725	0.766	0.800	0.849	0.894	0.930	0.956

Note: This dimensionless coefficient has been obtained by elastic theory [ASCE, 1979].

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Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE2900 Task No.: 5.6

R3 24 June 94

NOTE: PHILLIPS 66 (1991) APPLIES AN ADDITIONAL FACTOR OF $\sqrt{2.32}$ TO RIGHT HAND SIDE OF EQN. MAO 30 Oct 96

$$FS_{wb} = \frac{1.2}{\sigma_{max}}\left[\frac{E'E}{(SDR)^3}\right]^{1/2} \quad (9)$$

where: FS_{wb} = factor of safety against pipe wall buckling; σ_{max} = maximum stress applied to the pipe; E' = modulus of soil reaction for pipe bedding; E = modulus of elasticity of the pipe material; and SDR = standard dimension ratio of the pipe.

Excessive Ring Deflection

Ring deflection is the change in vertical diameter of the pipe as the pipe/bedding aggregate system deforms under the external vertical pressure. The actual ring deflection of the pipe must be less than the allowable ring deflection of the pipe. The factor of safety against excessive ring deflection may be calculated using the following equation:

$$FS_{RD} = \frac{\Delta_R E'}{100\sigma_{max}} \quad (10)$$

$\frac{\text{VERTICAL DIA. CHANGE}}{\text{ORIG. DIA.}} \times 100$

where: Δ_R = allowable ring deflection in percent; E' = modulus of soil reaction for pipe bedding; and σ_{max} = maximum stress applied to the pipe. The allowable ring deflection of the pipe will be obtained from the manufacturers and technical literature.

LTS GRAVITY LINE FROST PROTECTION

Analyses included in the "Liner System Frost Protection" Calculations Package are applicable to the LTS gravity line. In that package, estimates were made of the minimum thickness of protective soil needed to provide frost protection of the clay liner. Recommendations were made that a 2-ft thick layer of a clayey or silty material or a 3-ft thick layer of gravel is adequate to provide frost protection. These recommendations will also be used for the LTS gravity line. Because the LTS gravity line will be more than 3 ft below the ground surface, the line is adequately protected from frost. Therefore, no additional calculations will be performed in this package.

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Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE3900 Task No.: 05.0

RB 24 June 96

REFERENCES

✓ ASCE, "*Design and Construction of Sanitary and Storm Sewers*", Manual and Report on Engineering Practice No. 37, American Society of Civil Engineers, New York, NY, Printed 1969, Reprinted 1979.

✓ Chevron Chemical Company, "*Plexco/Spirolite Engineering Manual, 2. System Design*", Chevron Chemical Company, Bensenville, IL, Aug 1992, 76 p.

✓ Phillips 66, "*Driscopipe System Design*", Manufacturers' literature, No. 1160-88 A17, Phillips 66, 1988.

✓ Phillips 66, "*Driscopipe System Design*", Manufacturers' literature, No. 1089-91 A17, Phillips 66, 1991.

✓ Roberson/Crow, Engineering Fluid Mechanics, Fourth ed., Houghton Miffin Co., Boston, Mass., 1990

✓ Uni-Bell PVC Pipe Association, "*Handbook of PVC Pipe, Design and Construction*", Uni-Bell Plastic Pipe Association, 1991.

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Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE3900 Task No.: 02

BB 24 June 96

LEACHATE TRANSMISSION SYSTEM (LTS)
GRAVITY LINE DESIGN

DATA VERIFICATION

The LTS gravity line is a dual containment pipe with the inner pipe being a 6-in. diameter HDPE SDR-11 pipe and the outer pipe being a 10-in. diameter HDPE SDR-11 pipe. The flow capacity of the inner pipe will be calculated in accordance with the methods described in the Calculation Procedures section of this package.

The characteristics of the 6-in. diameter inner pipe required to calculate its capacity under gravity conditions are as follows:

- inner diameter, B_i = 5.421 in.; ✓
- hydraulic radius, $R_h = B_i / 4$ = 1.36 in. (0.0345 m); ✓
- cross-sectional area, $A_p = \pi B_i^2 / 4$ = 23.1 in^2 (1.5x10^{-2} m^2); ✓
- hydraulic gradient, i_p = 0.286° (0.5%) ✓ (taken as the minimum slope along the entire length of the gravity line as shown in Figure 1 of the Calculation Procedures section of this package which is conservative);
- Manning's roughness coefficient, n = 0.013 s/m$^{0.33}$ ✓ (conservative for smooth HDPE pipe; a value of 0.009 is often used);
- Baseline design flow rate during active operations, Q_{ao} = 22,803 gpd =15.8 gpm (from "Leachate Generation Rates" Calculation Package); and
- Baseline design flow rate during post closure, Q_{pc} = 1.4 gpd = 9.7x 10^{-4} gpm (from "Leachate Generation Rates" Calculation Package). ✓

In addition to the above, the following data are required to estimate the flow capacity of the gravity line under pressure flow conditions and to calculate the factor of safety against pressure rupture of the pipe (for these analyses, it is assumed that the LTS gravity line will be extended to the permanent lift station when Cell 6 undergoes construction):

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- Length of pipe between cell 6 and the permanent lift station, L = 1476.3 ft

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Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE7900 Task No.: 5.2.6

B3 24 June 96

- Storm design flow rate during active operations, Q_s = 200 gpm ✓
- Maximum elevation of impacted runoff in catchment area of Cell 6, Z_1 = 596 ft elevation;
- Maximum elevation of liquid in permanent lift station, Z_2 = 575 ft elevation; ✓
- Kinematic viscosity of water at a temperature of 40° F (reasonable for a pipe buried well below the frost penetration depth), ν = 1.66E-5 ft^2/s; ✓
- Equivalent sand roughness, ks = smooth (from table on Moody Diagram); and ✓
- Head losses from fittings, $h_{L,\ fittings}$ in terms of the pipe diameter, D[Phillips 66, 1991]:
  - 6" butterfly valve = 40D ✓
  - 6" check valve = 100D ✓
  - 6" tee (branch) = 50D ✓
  - 6" tee (line) = 20D ✓
  - 6" 90° elbow = 30D ✓
- Pressure Rating of Pipe = P_{rating} = 150 psi (includes a factor of safety of 2) ✓

The characteristics of the 10-in. diameter outer pipe and other parameters to be used in the structural stability calculations are as follows:

- outer diameter, B_c = 10.75 in. (0.896 ft) ✓
- wall thickness, t = 0.977 in. ✓
- effective length of pipe, L_{ic} = 3 ft (1 m) ✓
- average unit weight of overburden materials, γ_p = 125 pcf (conservative assumption for compacted backfill material) ✓
- maximum thickness of overburden materials, D_p = 8 ft (from the Prefinal Design Drawings, June 1996) ✓
- load coefficient C_s = 0.015 (from Table 1 of Procedures section for L_{ic} / (2 D_p) = 3 ft / (2 x 8 ft) = 0.1875 ✓ and B_c / (2 D_p) = 0.896 ft / (2 x 8 ft) = 0.056 ✓)
- concentrated load, P = 20,000 lb (90 kN) (assumed based on truck with a capacity of 35 tons and a wheel load of 20,000 lb when full)
- impact factor accounting for dynamic loads, F_{ic} = 1.5 ✓ [ASCE, 1979; see Calculations Procedures section of this package for reference]
- modulus of elasticity of pipe, E = 2.74 x 10^6 psf (1.31x10^5 kPa) as estimated from a manufacturer's literature [Phillips 66, 1988, 1991] ✓
- compressive yield strength of pipe, σ_y = 216,000 psf ✓ (10,346 kPa) as estimated from a manufacturer's literature [Phillips 66, 1988, 1991]

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Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE3020 Task No.: 28.0

RB 24 June 96

- allowable ring deflection of SDR-11 pipe used for gravity flow, Δ_R = 2.7 percent as estimated from a manufacturer's literature [Phillips 66, 1988, 1991]
- modulus of soil reaction for pipe bedding, E' = 432,000 psf (20,560 kPa)

501

Written By: MAO Date: 96/6/24 Reviewed by: RAM Date: 24 JUNE 96

Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE 3900 Task No.: 08.6

LEACHATE TRANSMISSION SYSTEM (LTS)
GRAVITY LINE DESIGN

CALCULATION RESULTS

LTS GRAVITY LINE FLOW CAPACITY

GRAVITY FLOW CONDITION

- $Q_g = \dfrac{R_h^{0.66} \; i_p^{0.5} \; A_p}{n}$

$= \dfrac{(0.0345\,m)^{0.66} \, (0.005)^{0.5} \, (1.5 \times 10^{-2}\,m^2)}{0.013 \;\; s/m^{0.33}} = 0.0088\ m^3/s$ ✓

$= 140$ gpm. ✓

- Q_{ao} = baseline design flow rate during active operations

$= 15.8$ gpm ✓

$F.S. = \dfrac{140 \text{ gpm}}{15.8 \text{ gpm}} = 8.9 > 3$ (o.k.) ✓

- Q_{pc} = baseline design flow rate for post closure

$= 9.7 \times 10^{-4}$ gpm ✓

$F.S. = \dfrac{140 \text{ gpm}}{9.7 \times 10^{-4} \text{ gpm}} = 1.44 \times 10^5$ ✓ $\gg 10$ (o.k.)

502

Written by: MAO Date: 96/6/24 (YY/MM/DD) Reviewed by: RAM Date: 96/6/24 (YY/MM/DD)

Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE 3900 Task No.: 03.6

PRESSURE FLOW CONDITION

Equivalent length of fittings = 1 x 40D + 1 x 100D + 1 x 50D + 7 x 20D + 3 x 30D = 420 D ✓

$$= 420 \left(\frac{5.421 \text{ in.}}{12 \text{ in/ft}} \right) = 189.7 \text{ ft} \checkmark$$

Equivalent Length of Pipe = 1476.3 ft + 189.7 ft = 1,666 ft ✓

$$R_e f^{1/2} = \frac{D^{3/2}}{\nu} \left[\frac{2g\, h_f}{L} \right]^{1/2}$$

$$= \frac{\left(5.421/12 \text{ ft}\right)^{3/2}}{1.66 \times 10^{-5} \frac{ft^2}{s}} \left[\frac{2 \times \left(32.2 \frac{ft}{s^2}\right)\left(596 ft - 575 ft\right)}{1{,}666 \text{ ft}} \right]^{1/2}$$

$$= 16{,}480 \checkmark$$

From the Moody Chart and using $R_e f^{1/2} = 16{,}480$ and $\frac{k_s}{D}$ curve relating to smooth pipe $\Rightarrow$

$f = 0.017$ ✓

$$V = \sqrt{\frac{2g\, h_f\, D}{f L}} = \sqrt{\frac{2 \times \left(32.2 \frac{ft}{s^2}\right)\left(596 ft - 575 ft\right)\left(\frac{5.421}{12} ft\right)}{(0.017)(1{,}666 \text{ ft})}}$$

$$= 4.64 \text{ ft/s} \checkmark$$

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Written by: MAO Date: 96/6/24 Reviewed by: DAK Date: 96/6/24

Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE 3900 Task No.: [illegible]

$$Q_p = VA = (4.64\ ft/s)\left(\frac{23.1\ in^2}{144\ in^2/ft^2}\right) = 0.744\ ft^3/s$$

$$= 334\ gpm$$

Q_s = storm design basis flow rate = 200 gpm

$$F.S. = \frac{334}{200} = 1.67 \quad (o.k.)$$

Flow will have to be throttled at butterfly valve to not exceed 200 gpm.

Factor of Safety against hydraulic rupture

$$= \frac{2 \times P_{rating}}{(z_1 - z_2)\gamma_w} = \frac{2 \times 150\ psi \times 144\ \frac{in^2}{ft^2}}{(596\ ft - 575\ ft) \times 62.4\ pcf}$$

$$= 33 \quad (o.k.)$$

LTS GRAVITY LINE STRUCTURAL STABILITY

- $$\sigma_{max} = \gamma_p D_p + \frac{C_s\ P\ F_{ic}}{L_{ic}\ B_c}$$

$$= (125\ pcf)(8\ ft) + \frac{(0.015)(20{,}000\ lb)(1.5)}{(3\ ft)(0.896\ ft)}$$

$$= 1{,}167\ psf$$

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- Factor of Safety against wall crushing, FS_{wc}

$$= \frac{2\ \sigma_y}{(SDR-1)\ \sigma_{max}} = \frac{2\ (216{,}000\ psf)}{(11-1)\ (1{,}167\ psf)} = \underline{37} \quad (o.k.)$$

Written by: MAO Date: 96 / 6 / 24 Reviewed by: [illegible] Date: 96 / 6 / 24

Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE3900 Task No.: [illegible]

- Factor of Safety against wall buckling, FS_{wb}

$$= \frac{1.2}{\sigma_{max}} \left[\frac{E'E}{(SDR)^3} \right]^{1/2} = \frac{1.2}{1{,}167 \text{ psf}} \left[\frac{432{,}000 \text{ psf} \times 2.74 \times 10^6 \text{ psf}}{(11)^3} \right]^{1/2}$$

$$= \underline{31} \quad (\text{o.k.}) \checkmark$$

- Factor of Safety against ring deflection, FS_{RD}

$$= \frac{\Delta R \; E'}{100 \; \sigma_{max}} = \frac{(2.7)\,(432{,}000 \text{ psf})}{(100)\,(1{,}167 \text{ psf})} = \underline{10} \checkmark (\text{o.k.})$$

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10.2 LTS Temporary Gravity Line Design

- LTS Temporary Gravity Line Hydraulic Pressure
- LTS Temporary Gravity Line Structural Stability
- LTS Temporary Gravity Line Frost Protection

2195

COMPUTATION COVER SHEET

NON-CONTROLLED DOCUMENT

SUBJECT OF CALCULATION: TEMPORARY GRAVITY LINE

Computations By: (Cognizant Engineer)
Signature [signature] Date 21 June 96
Printed Name BRIAN D. JACOBSON
and Title SENIOR STAFF ENGINEER

Assumptions and Procedures Checked by: (Checker)
Signature [signature] Date 24 JUNE 96
Printed Name ROBERT A. MORGAN III
and Title SENIOR STAFF ENGINEER

Computations Checked by:
Signature [signature] Date 24 JUNE 96
Printed Name ROBERT A. MORGAN III
and Title SENIOR STAFF ENGINEER

Computations Backchecked by: (Cognizant Engineer)
Signature [signature] Date 24 June 96
Printed Name BRIAN D. JACOBSON
and Title SENIOR STAFF ENGINEER

pproved by: (PDP)
Signature [signature] Date 24 June 96
Printed Name MAJDI A. OTHMAN
and Title PROJECT ENGINEER

Approved by: (DTL and TETL)
Signature [signature] Date 25 June 96
Printed Name Rudolph Bonaparte
and Title Principal

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
F	change forcemain to temporary gravity line - EPA Prefinal submittal	24 June 96	[illegible]	RAM	B 25 Jun 96
G	Final Design Package	4 Oct 96	—	—	[illegible]
C	Response to Final Design Cmts	1 May 97	—	—	[illegible]

Written By : BRIAN D. JACOBSON Date: 24 June 96 Reviewed by: RAM Date: 24 JUNE 96

Client: FERMCO Project: Fernald OSDF Project/Proposal No.: GE3900 Task No.: 8.6

LEACHATE TRANSMISSION SYSTEM (LTS) TEMPORARY GRAVITY LINE DESIGN

EXECUTIVE SUMMARY

PURPOSE OF ANALYSIS

The purpose of this analysis is to evaluate the performance of the temporary gravity line. The temporary gravity line transfers leachate and liquids from the LTS gravity line to the permanent lift station during early stages of the OSDF development.

METHODS OF ANALYSIS

- The temporary gravity line flow capacity was estimated to verify it can carry the design flow rates with adequate factors of safety. Manning's and the Darcy-Weisbach equations were used to calculate the flow capacities of the line under gravity and pressure flow conditions, respectively. These capacities were compared to baseline design flow rate for active-operations and the storm design basis flow rate. Additionally, the factor of safety against hydraulic rupture of the temporary gravity line (under pressure flow conditions) was compared to the pressure rating of the pipe.
- Structural stability (i.e., resistance to wall crushing, wall buckling, and excessive ring deflection) of the LTS temporary gravity line was not evaluated because the conditions (i.e., pipe diameters and wall thickness) are similar to the LTS gravity line and the equivalent calculation was performed in the LTS Gravity Line Design Calculation Package.
- Soil cover thickness required to protect the LTS gravity line from frost was not evaluated because the conditions (i.e., burial depth and soil type) are similar to the LTS gravity line and the equivalent calculation was performed in LTS Gravity Line Design Calculation Package.

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Written By : BRIAN D. JACOBSON Date: 24 JUNE 96 Reviewed by: RAM Date: 24 JUNE 96

Client: FERMCO Project: Fernald OSDF Project/Proposal No.: GE3900 Task No.: 8.6

CONCLUSIONS

Flow Capacity:

- Temporary gravity line flow capacity under gravity flow conditions, $Q_g = 97.5$ gpm ✓
- Baseline design flow rate during active operations, $Q_{ao} = 15.8$ gpm; ✓
  factor of safety, $Q_g / Q_{ao} = 6.2 > 3$ (OK) ✓
- Temporary gravity line flow capacity under pressure flow conditions, $Q_p = 273$ gpm
  Storm design flow rate during active operations, $Q_s = 200$ gpm; factor of safety, $Q_p/Q_s = 1.4$; ✓
  $Q_p > Q_s$ (flow should be regulated with valves in the LCS gravity line to obtain maximum storm design flow rate of 200 gpm)
- factor of safety against hydraulic rupture, pressure rating of pipe / pressure in pipe during storm event = 19.7 (OK) ✓

509

Written By : BRIAN D. JACOBSON Date: Reviewed by: RAM Date: 24 JUNE 96

Client: FERMCO Project: Fernald OSDF Project/Proposal No.: GE3900 Task No.: 8.6

LEACHATE TRANSMISSION SYSTEM (LTS)
TEMPORARY GRAVITY LINE DESIGN

TABLE OF CONTENTS

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ANALYSIS RESULTS	1 of ~~2~~ 3
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MAO 96/6/12

Written By : BRIAN D. JACOBSON Date: 12 June 96 Reviewed by: RAM Date: 24 JUNE 96

Client: FERMCO Project: Fernald OSDF Project/Proposal No.: GE3900 Task No.: 8.6

RB (DTL) 20 June 96

LEACHATE TRANSMISSION SYSTEM (LTS) GRAVITY LINE DESIGN

CALCULATION PROCEDURES

INTRODUCTION

The purpose of this package is to present the calculation procedures for the temporary gravity line design. As presented in Figure 1, the temporary gravity line extends between selected leachate collection system (LCS) manholes along the western boundary of the On-site Disposal Facility (OSDF) and terminates into the permanent lift station located south-west of the OSDF. During the early phases of construction of the OSDF, the temporary gravity line transfers leachate and liquids from the LTS gravity line to the permanent lift station. The transition from the LTS gravity line to the temporary gravity line is made in a LCS manhole which is outfitted to include valves, controls, and other fittings as appropriate. The initial connection will be made at LCS manhole number 3. The locations of later connections of the LTS gravity line to the temporary gravity line will be selected based on the OSDF development needs and schedule. During later stages of the OSDF development and after closure, the LTS gravity line will be connected and will transfer flows directly to the permanent lift station. A forcemain will transfer flows from the permanent lift station to the Biosurge Lagoon located at the FERNALD site.

As discussed in the "Leachate Generation Rates" Calculation Package (LGRCP) and the Design Criteria Package (DCP), The temporary gravity line must have adequate capacity to convey: (i) the baseline design flow rate during active operations with a factor of safety no less than three based on gravity flow conditions; and (ii) the storm design flow rate during active cell operations with factors of safety no less than one based on both the flow capacity and the pressure rating of the pipe. The baseline design flow rate is solely a function of the leachate generation rate calculated for the OSDF. Accordingly, the baseline design flow rate for the active-operation condition calculated in the LGRCP (i.e., 15.8 gpm) will be used in this calculation package. The storm design flow rate during active cell operations is 200 gpm as discussed in the "LTS Gravity Line" Calculation Package.

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NPO 96/6/12

Written By: BRIAN JACOBSON Date: 12 June 96 Reviewed by: RAM Date: 24 JUNE 96

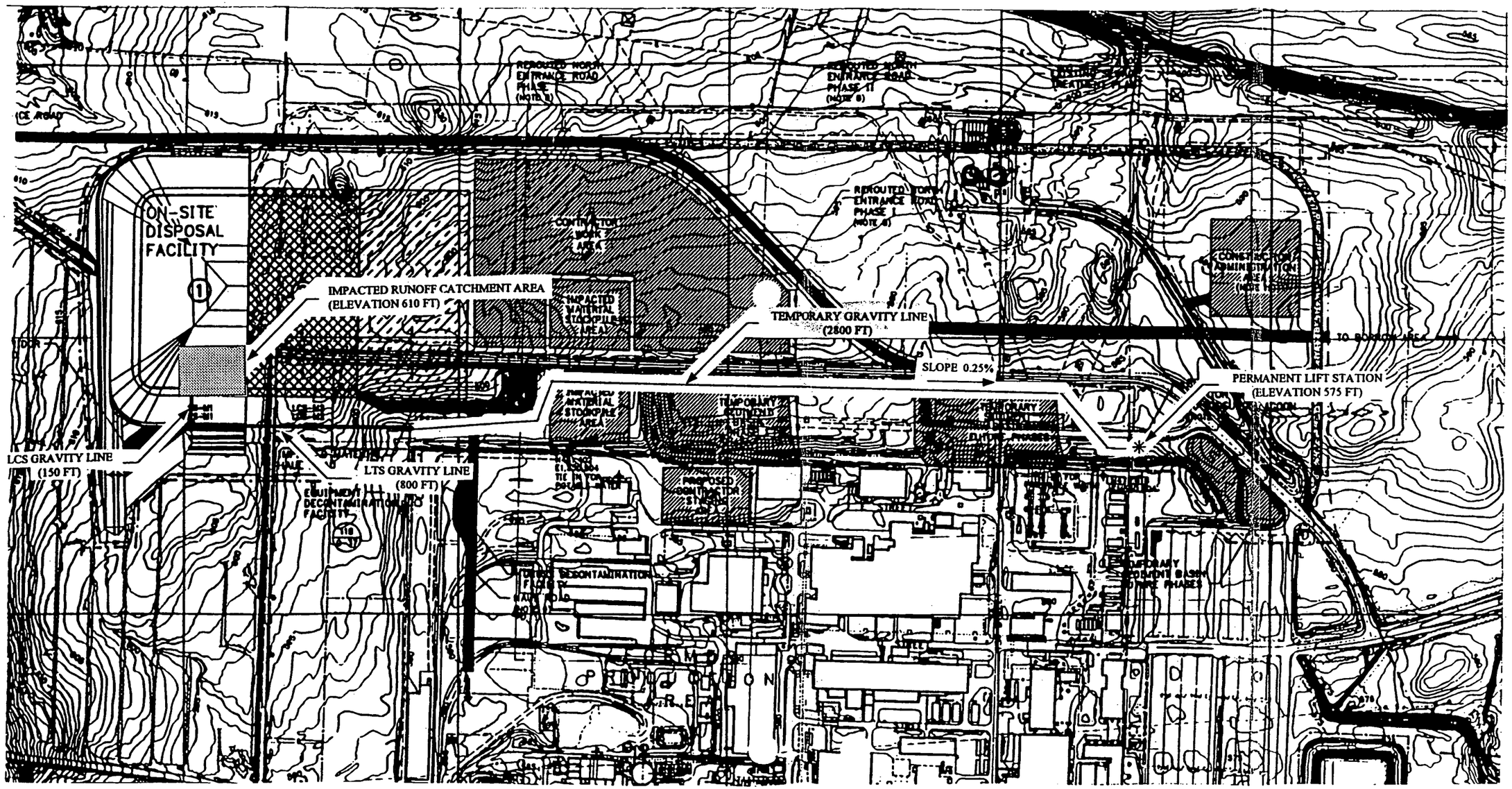
Client: FERINCO Project: Fernald OSDF Project/Proposal No.: GE3900 Task No.: 8.6

RB(DR) 20 June 96

2 of 8

FIGURE 1

TEMPORARY GRAVITY LINE



Scale: N.T.S.

512

MAO 96/6/12

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Client: FERMCO Project: Fernald OSDF Project/Proposal No.: GE3900 Task No.: 8.6

RB (DTL) 20 June 96

The temporary gravity line should have adequate capacity to convey the design flow rates, should have adequate structural resistance to withstand stresses applied on it from overburden materials and from equipment traffic, and should be protected from frost with a soil cover of adequate thickness and thermal properties. Whereas the temporary gravity line is constructed of similar materials and will be installed in a similar manner as the LTS gravity line, the calculations for structural stability and frost protection are not repeated in this calculation package. The methods to be used to perform the flow capacity evaluations are described below.

METHODS OF ANALYSIS

Temporary Gravity Line Flow Capacity:

Gravity Flow Condition

The temporary gravity line flow capacity under the gravity flow condition will be calculated using Manning's equation for pipes as follows:

$$Q_g = \frac{1.49 R_h^{0.66} i_p^{0.5} A_p}{n} \qquad (1)$$

where:

1.49	=	standard conversion factor for traditional (english) units;
Q_g	=	pipe gravity flow capacity;
R_h	=	hydraulic radius (defined as the ratio of the flow area to the perimeter of the wetted area; for a pipe with a circular cross section flowing full under atmospheric pressure; $R_h = D/4$, where D is pipe inner diameter);
i_p	=	hydraulic gradient (slope of the pipe);
A_p	=	cross-sectional area of the pipe ($= \pi D^2/4$); and
n	=	Manning's roughness coefficient.

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The Manning's equation assumes steady uniform fully turbulent flow conditions.

NAO 96/6/12

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Pressure Flow Condition

The temporary gravity line flow capacity under the pressure flow condition will be calculated using the following procedure.

$$Q = VA_p \tag{2}$$

where:

Q	=	flow rate;
V	=	average velocity of the liquid = Q/A_p;
A_p	=	area of pipe = $\frac{\pi}{4}(D)^2$; and
D	=	inside diameter of pipe.

Darcy-Weisbach equation, typically presented as follows:

$$h_f = f\frac{L}{D}\frac{V^2}{2g} \tag{3}$$

is rearranged to solve for velocity;

$$V = \sqrt{\frac{2gh_f D}{fL}} \tag{4}$$

where:

h_f	=	friction head in pipe = $z_1 - z_2$ (i.e., initial elevation - final elevation);
g	=	gravitational acceleration;
f	=	friction factor; and
L	=	length of pipe.

The friction factor is obtained from the Moody diagram [Roberson/Crow, 1990] shown in Figure 2. Two terms are required to determine the friction factor (i) a combination of the Darcy-Weisbach and Reynolds equations as presented below, and (ii) the relative roughness of the pipe.

$$\mathrm{Re}\, f^{1/2} = \frac{D^{3/2}}{\nu}\left(\frac{2gh_f}{L}\right)^{1/2} \tag{5}$$

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NMO 96/6/12

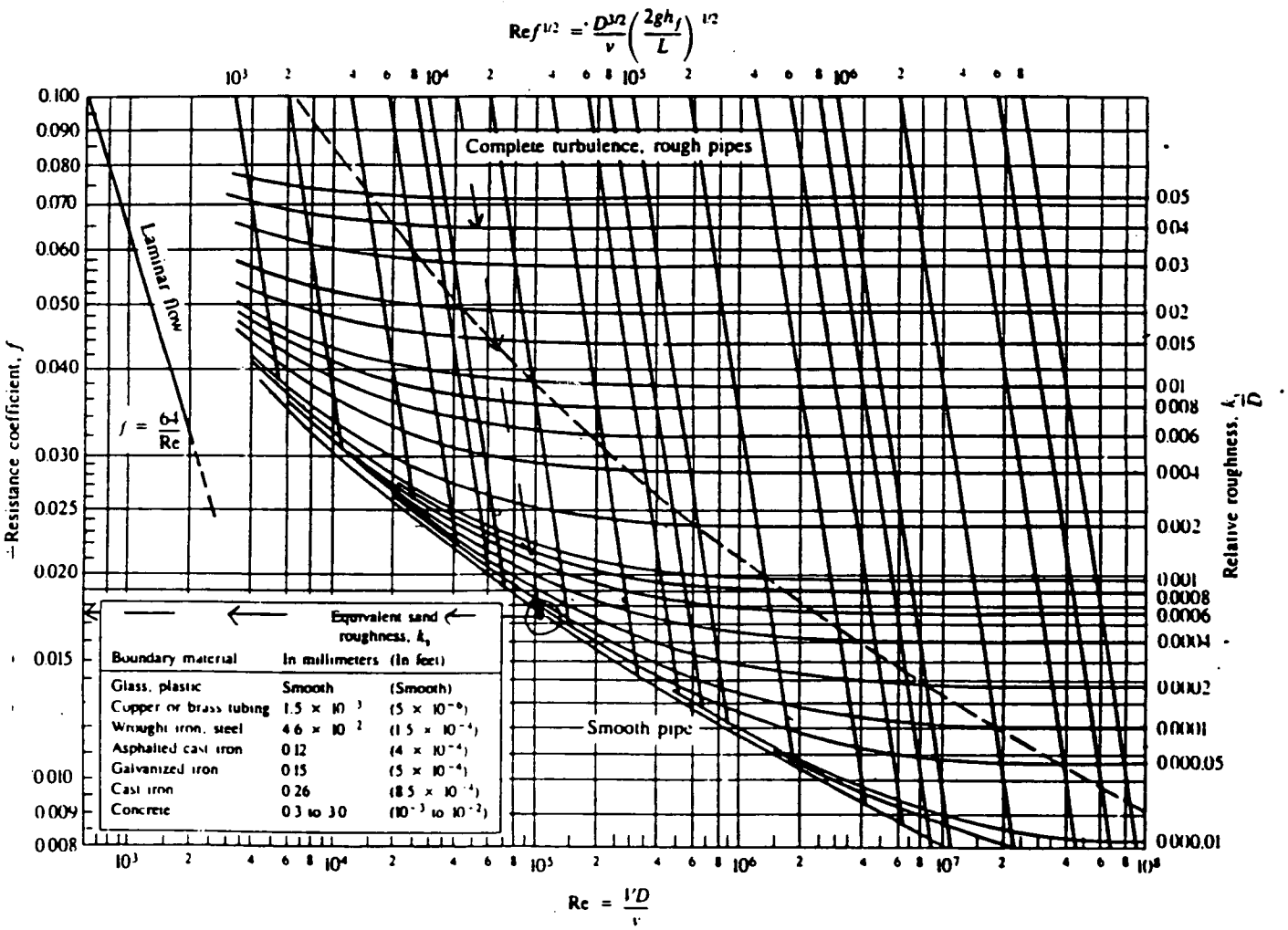
Written by: BRIAN JACOBSON Date: 96/06/11 (YY/MM/DD) Reviewed by: [illegible] Date: 96/6/24 (YY/MM/DD)

Client: FERMCO Project: Fernald OSDF Project/Proposal No.: GE3900 Task No.: 8.6

RB(DTL) 20 June 94

FIGURE 2

MOODY DIAGRAM



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where:

Re	=	Reynolds number = DV/ν; and
ν	=	kinematic viscosity of water.

The relative roughness curve to be used on the Moody Diagram is the smooth pipe curve.

As presented in Figure 3, the friction loss in the fittings will be calculated using the equivalent pipe lengths method. The friction head loss in the fittings [Phillips, 1991] is caused by:

- (1) 6" butterfly valve; ✓
- (1) 6" check valve; ✓
- (1) 6" tee (branch); ✓
- (13) 6" tee (line); ✓
- (3) 6" 90° ell; and ✓
- (4) 6" 45° ell. ✓

As presented in Figure 1, the friction head loss due to the pipe is caused by:

- 3750 ft of 6" pipe. ✓

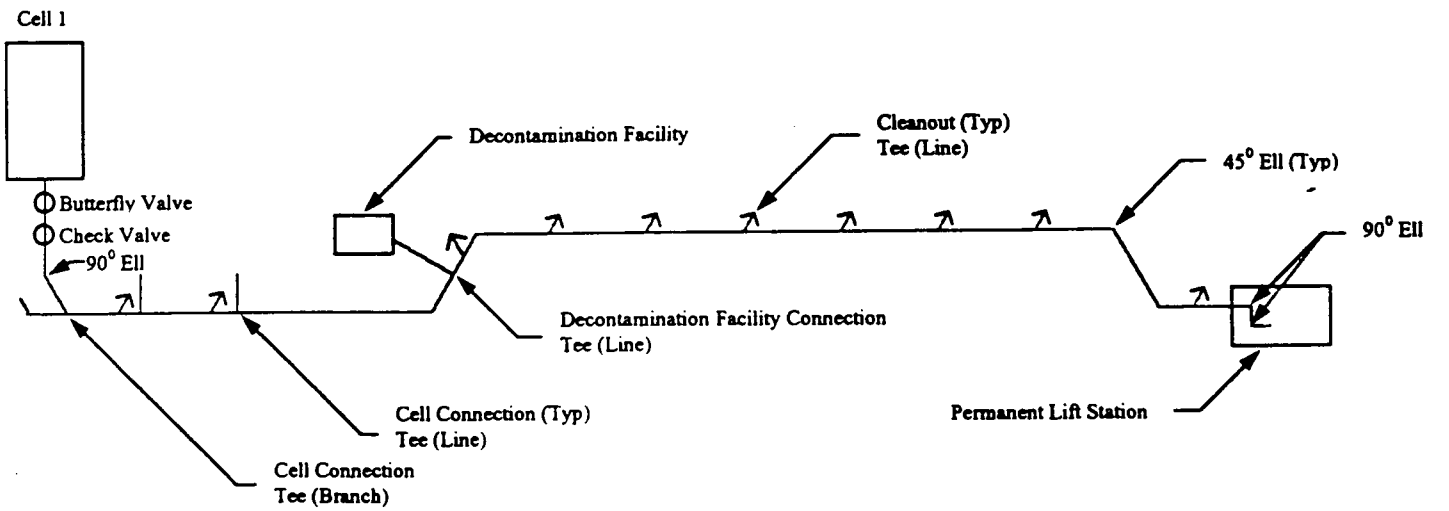
MAO 96/6/12

Written By : BRIAN D. JACOBSON Date: 12 June 96 Reviewed by: RAM Date: 24 JUNE 96

Client: FERMCO Project: Fernald OSDF Project/Proposal No.: GE3900 Task No.: 8.6

RB (DTL) 20 June 96

FIGURE 3
SCHEMATIC DIAGRAM
LOCATION OF FITTINGS



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MAO 96/6/12

Written By : BRIAN D. JACOBSON Date: 12 June 96 Reviewed by: RATM Date: 24 JUNE 96

Client: FERMCO Project: Fernald OSDF Project/Proposal No.: GE3900 Task No.: 8.6

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Hydraulic Pressure

The temporary gravity line resistance to hydraulic rupture will be evaluated using the following equation:

$$FS_{hr} = \frac{2P_{rating}}{P_h} \qquad (6)$$

where:

Fs_{hr} = factor of safety against hydraulic rupture;
P_{rating} = pressure rating of the pipe material (which includes an integral factor of safety of 2); and
P_h = hydraulic pressure in the pipe (taken as the hydraulic head multiplied by the unit weight of leachate).

REFERENCES

Phillips 66, "*Driscopipe System Design*", Manufacturers' literature, No. 1089-91 A17, Phillips 66, 1991.

Roberson/Crow, Engineering Fluid Mechanics, Fourth ed., Houghton Miffin Co., Boston, Mass., 1990

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Written By : BRIAN D. JACOBSON Date: 19 June 96 Reviewed by: [illegible] Date: 24 JUNE 96

Client: FERMCO Project: Fernald OSDF Project/Proposal No.: GE3900 Task No.: 8.6

BB (DTL) 20 June 96

LEACHATE TRANSMISSION SYSTEM (LTS)
TEMPORARY GRAVITY LINE DESIGN

DATA VERIFICATION

The temporary gravity line is a dual containment pipe with the inner pipe being a 6-in. diameter HDPE SDR-11 pipe and the outer pipe being a 10-in. diameter HDPE SDR-11 pipe. The flow capacity of the inner pipe will be calculated in accordance with the methods described in the Calculation Procedures section of this package. ✓

The characteristics of the 6-in. diameter inner pipe required to do this calculation are as follows:

- Inner diameter, D = 5.421 in. = 0.452 ft ✓
- Hydraulic radius, $R_h = D / 4 = 1.36$ in. = 0.1129 ft ✓
- Cross-sectional area, $Ap = \pi D^2 / 4 = 23.1$ in^2 = 0.160 ft^2 ✓
- Length of pipe, L = 3750 ft
- Hydraulic gradient, $i_p = 0.143°$ (0.25%) (taken as the minimum slope at any location along the entire length of the temporary gravity line as shown in Figure 1 of the Calculation Procedures section of this package which is conservative) ✓
- Manning's roughness coefficient, n = 0.013 (conservative for smooth HDPE pipe; a value of 0.009 is often used). ✓
- Baseline design flow rate during active operations, Q_{ao} = 22,803 gpd =15.8 gpm (from "Leachate Generation Rates" Calculation Package);
- Storm design flow rate during active operations, Q_s = 200 gpm
- Maximum elevation of impacted runoff in catchment area, Z_1 = 610 ft elevation; ✓
- Maximum elevation of liquid in permanent lift station, Z_2 = 575 ft elevation;
- Kinematic viscosity of water at a temperature of 40° F, ν = 1.66E-5 ft^2/s; ✓
- Equivalent sand roughness, ks = smooth (from table on Moody Diagram); and

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Written By : BRIAN D. JACOBSON Date: 19 June 96 Reviewed by: BAM Date: 24 JUNE 96

Client: FERMCO Project: Fernald OSDF Project/Proposal No.: GE3900 Task No.: 8.6

RB (DTL) 20 June 96

- Head losses from fittings, as presented in Figure 1:
-

$h_{L,\ fittings}$		K	Source	
(1)	6" butterfly valve;	40D	P	✓
(1)	6" check valve;	100D	P	✓
(1)	6" tee (branch);	50D	P	✓
(13)	6" tee (line);	20D	P	✓
(3)	6" 90° elbow; and	30D	P	✓
(4)	6" 45° elbow.	18D	P	✓

P = Phillips 66, "Driscopipe System Design", Manufacturers' literature, No. 1089-91 A17, Phillips 66, 1991.

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Written by: BRIAN JACOBSON Date: 96/06/19 (YY MM DD) Reviewed by: [illegible] Date: 24 / JUNE 96 (YY MM DD)

Client: FERMCO Project: Fernald OSDF Project/Proposal No.: GE3900 Task No.: 5.6

RB(DTL) 20 JUNE 96

FIGURE 1

PIPE FITTING LOSSES

Fitting Pressure Drop: Listed below in Chart 5 are various common piping system components and the associated pressure loss through the fitting expressed as an equivalent length of straight pipe in terms of diameters. The inside diameter (in feet) multiplied by the equivalent length diameters gives the equivalent length (in feet) of pipe. This equivalent length of pipe is added to the total footage of the piping system when calculating the total system pressure drop.

These equivalent lengths should be considered an approximation suitable for most installations.

Chart 5

Fabricated Fitting	Equiv. Length
Running Tee	20 D
Branch Tee	50 D
90° Fab. Ell	30 D
60° Fab. Ell	25 D
45° Fab. Ell	18 D
45° Fab. Wye	60 D
Conventional Globe Valve (Full Open)	350 D
Conventional Angle Valve (Full Open)	180 D
Conventional Wedge Gate Valve (Full Open)	15 D
Butterfly Valve (Full Open)	40 D
Conventional Swing Check Valve	100D

(See Appendix for further data on resistance of valves and fittings to flow).

Source: Phillips 66, "Drisopipe System Design" No. 1089-91 521

Written by: BRIAN JACOBSON Date: 96/06/21 (YY MM DD) Reviewed by: RAM Date: 96/6/24 (YY MM DD)

Client: FEMCO Project: Fernald OSDF Project/Proposal No.: GE3900 Task No.: 8.6

LEACHATE TRANSMISSION SYSTEM (LTS)
TEMPORARY GRAVITY LINE DESIGN
ANALYSIS RESULTS

GRAVITY FLOW CONDITION

$$Q_g = \frac{1.49 \quad 0.1129^{0.66} \; 0.0025^{0.5} \; 0.160}{0.013} = 0.217 \text{ cfs} \checkmark$$

$$0.217 \frac{ft^3}{s} \; \frac{60s}{1 min} \; \frac{7.48 gal}{ft^3} = 97.5 \text{ gal/min} \checkmark$$

Factor of Safety Baseline flow $\frac{97.5}{15.8} = 6.2 \checkmark$

PRESSURE FLOW CONDITION

Equivalent Length of Fittings

$$\left[1(40) + 1(100) + 1(50) + 13(20) + 3(30) + 4(18)\right] * \frac{5.421}{12} = 277 \text{ ft}$$

Equivalent Length of Pipe

$3750 + 277 = 4027$ ft ✓

$$Re f^{1/2} = \frac{0.452}{1.66 \times 10^{-5}}^{3/2} \left[\frac{2(32.2)(610-575)}{4027}\right]^{1/2} = 13696 \checkmark$$

$= 1.4E4$

$\frac{K_s}{D}$ = smooth curve on Moody Diagram

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Written by: BRIAN JACOBSON Date: 96/06/21 (YY MM DD) Reviewed by: DAM Date: 96/6/24 (YY MM DD)

Client: FERMCO Project: Fernald OSDF Project/Proposal No.: GE3900 Task No.: 8.6

FROM MOODY DIAGRAM

$f = 0.0175$

$h_f = f \frac{L}{D} \frac{V^2}{2g}$ SOLVE FOR V

$V = \sqrt{\frac{h_f}{f} \frac{D}{L} 2g}$

$V = \left[\frac{(610-575)}{0.0175} \frac{0.452}{4027} 2(32.2)\right]^{0.5} = 3.80 \text{ ft/s}$ ✓

$Q = VA$

$= 3.80 (0.160) = 0.608 \text{ ft}^3/\text{s}$ ✓

$0.608 \text{ ft}^3/\text{s} \cdot 60 \text{ s/min} \cdot 7.48 \text{ gal/ft}^3 = 273 \text{ gal/min}$ ✓

THEREFORE, FLOW WILL HAVE TO BE THROTTLED AT BUTTERFLY VALVE.

FACTOR OF SAFETY FOR FLOW CAPACITY $= \frac{273}{200} = 1.37$ ✓

FACTOR OF SAFETY DURING PRESSURE FLOW IS PRESSURE AT LOWEST POINT (HIGHEST PRESSURE) / PRESSURE RATING OF PIPE

$610 - 575 = 35 \text{ ft}$

$35 \text{ ft} \times 62.4 \frac{\text{lb}}{\text{ft}^3} \frac{1 \text{ ft}^2}{144 \text{ in}^2} = 15.2 \text{ lb/in}^2$

PRESSURE RATING OF PIPE (WHICH INCLUDES FACTOR OF SAFETY OF 2) IS 150 PSI

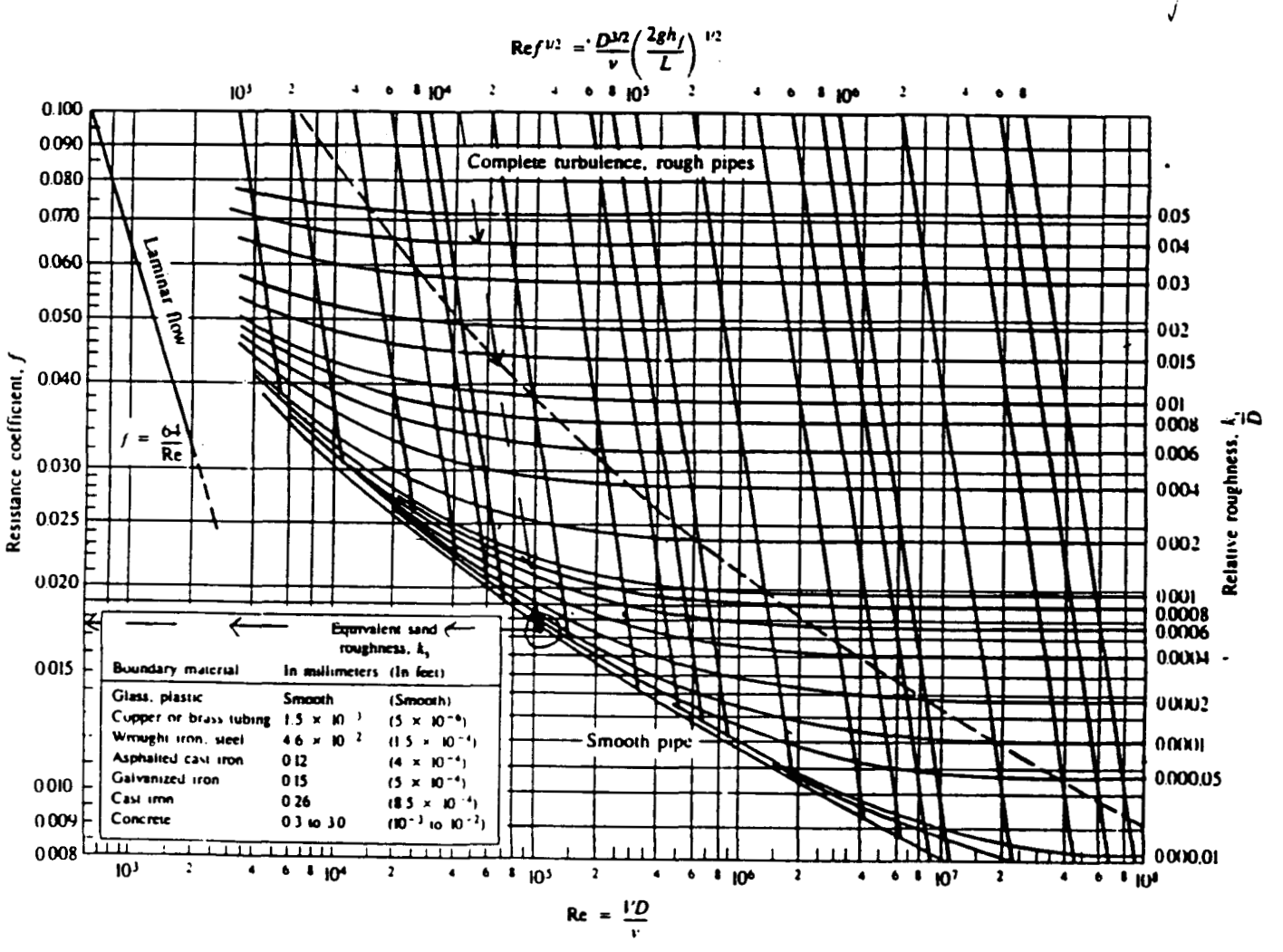
FACTOR OF SAFETY $= \frac{2 \cdot 150}{15.2} = 19.7$ ✓

Written by: BRIAN JACOBSON Date: 96/06/21 (YY MM DD) Reviewed by: [illegible] Date: 96/6/24 (YY MM DD)

Client: FERMCO Project: Fernald OSDF Project/Proposal No.: GE3900 Task No.: 8.6

FIGURE 1

MOODY DIAGRAM



524

2195

DCN-007 Calculations

525

COMPUTATION COVER SHEET

2195

SUBJECT OF COMPUTATIONS TEMPORARY GRAVITY LINE SDR CHANGE

Computations By:
(Cognizant Engineer)

Signature [signature] Date 26 NOV 1996

Printed Name BRIAN JACOBSON
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Assumptions and Procedures
Checked By:
(Checker)

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Printed Name MAJDI OTHMAN
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Computations
Checked by:

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and Title Project Engineer

Approved by:
(DTL and TETL)

Signature [signature] Date 26 NOV 96

Printed Name J F BERLIT PRINCIPAL
and Title

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
0	DCN 1700-007	3 FEB 97	BDJ	NVO	JFB

526

gpm) is not exceeded. Based on these requirements it is recommended that the maximum flow rate in the LTS gravity line (i.e., the storm design flow rate) be 80 gpm.

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LTS Gravity Line Structural Stability:

Calculations will be performed to ensure the LTS gravity line is able to withstand the loads applied on it with an adequate factor of safety. Failure mechanisms that will be checked are: (i) wall crushing; (ii) wall buckling; and (iii) excessive ring deflection. Stresses applied on the LTS gravity line include stresses due to traffic and stresses due to overburden materials. Plastic pipe can be designed to resist failure by the above mechanisms using design methods presented in the technical literature [Uni-Bell, 1991; Phillips 66, 1988, 1991; and Chevron, 1992].

The stresses due to traffic are assumed to be applied by a truck with a capacity of 35 tons and a wheel load of 20,000 lb when full. The total stress on the pipe is then the sum of the stresses applied by the soil layers and the stresses applied by the loaded truck, which can be calculated as described by ASCE [1979] as follows:

$$\sigma_{ic} = \gamma_p D_p + C_s \frac{PF_{ic}}{L_{ic} B_c} \quad (2)$$

where: σ_{ic} = stress on the pipe; γ_p = average unit weight of the overburden materials; D_p = thickness of the overburden materials; B_c = outer pipe diameter; C_s = load coefficient (Table 1), which is a function of $B_c/(2D_p)$ and $L_{ic}/(2D_p)$; P = concentrated load; F_{ic} = impact factor accounting for dynamic loads; and L_{ic} = effective length of pipe, which is arbitrarily defined as follows by ASCE [1979]: L_{ic} = 3 ft if pipe is longer than 3 ft, and L_{ic} = actual pipe length if pipe is shorter than 3 ft.

Wall Crushing: Wall crushing can occur when the stress in the pipe wall, due to external vertical pressure, exceeds the compressive strength of the pipe material. The factor of safety against pipe wall crushing may be calculated using the following equation:

$$FS_{wc} = \frac{2\sigma_y}{(SDR-1)\sigma_{max}} \quad (3)$$

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Written By: MAO Date: 96/2/16 Reviewed by: [illegible] Date: 24 FEB 96

Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE 3900 Task No.: 08.6

RB(DTL) 17 FEB 96

Table 1. Load Coefficient C_s.

$\frac{B_c}{2D_p}$ 10.75 / 2.($\frac{0.8333}{2(3)}$ = .149

$\frac{L_{1c}}{2D_p}$ $\frac{5}{2(3)}$ 0.8

$\frac{B_c}{2D_p}$	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.5	2.0	5.0
0.1	0.019	0.037	0.053	0.067	0.079	0.089	0.097	0.103	0.108	0.112	0.117	0.121	0.124	0.128
0.2	0.037	0.072	0.103	0.131	0.155	0.174	0.189	0.202	0.211	0.219	0.229	0.238	0.244	0.248
0.3	0.053	0.103	0.149	0.190	0.224	0.252	0.274	0.292	0.306	0.318	0.333	0.345	0.355	0.360
0.4	0.067	0.131	0.190	0.241	0.281	0.320	0.349	0.373	0.391	0.405	0.425	0.440	0.454	0.460
0.5	0.079	0.155	0.224	0.284	0.336	0.379	0.414	0.441	0.463	0.481	0.505	0.525	0.540	0.548
0.6	0.089	0.174	0.252	0.320	0.379	0.428	0.467	0.499	0.524	0.544	0.572	0.596	0.613	0.624
0.7	0.097	0.189	0.274	0.349	0.414	0.467	0.511	0.546	0.584	0.597	0.628	0.650	0.674	0.688
0.8	0.103	0.202	0.292	0.373	0.441	0.499	0.546	0.584	0.615	0.620	0.674	0.703	0.725	0.740
0.9	0.108	0.211	0.306	0.391	0.463	0.524	0.574	0.615	0.647	0.673	0.711	0.742	0.766	0.784
1.0	0.112	0.219	0.318	0.405	0.481	0.544	0.597	0.639	0.673	0.701	0.740	0.774	0.800	0.816
1.2	0.117	0.229	0.333	0.425	0.505	0.572	0.628	0.674	0.711	0.740	0.783	0.820	0.849	0.868
1.5	0.121	0.238	0.345	0.440	0.525	0.596	0.650	0.703	0.742	0.774	0.820	0.861	0.894	0.916
2.0	0.124	0.244	0.355	0.454	0.540	0.613	0.674	0.725	0.766	0.800	0.849	0.894	0.930	0.956

Note: This dimensionless coefficient has been obtained by elastic theory [ASCE, 1979].

$C_s = 0.117$

MAO
26 Nov 96

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Written By: MAS Date: 96/2/16 Reviewed by: RATM Date: 24 FEB 96

Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE3900 Task No.: 08.6

RB (DTL) 17 FEB 96

where: FS_{wc} = factor of safety against pipe wall crushing; σ_y = compressive yield strength of the pipe; SDR = standard dimension ratio of the pipe; and σ_{max} = maximum stress applied to the pipe.

Wall Buckling: Wall buckling, a longitudinal wrinkling in the pipe wall, can occur when the external vertical pressure exceeds the critical buckling pressure of the pipe/bedding aggregate system. The factor of safety against pipe wall buckling may be calculated using the following equation:

$$FS_{wb} = \frac{1.2}{\sigma_{max}}\left[\frac{E'E}{(SDR)^3}\right]^{1/2} \quad (4)$$

NOTE: PHILLIPS 66 (1991) APPLIES AN ADDITIONAL FACTOR OF $\sqrt{2.32}$ TO RIGHT HAND SIDE OF EQN.

where: FS_{wb} = factor of safety against pipe wall buckling; σ_{max} = maximum stress applied to the pipe; E' = modulus of soil reaction for pipe bedding; E = modulus of elasticity of the pipe material; and SDR = standard dimension ratio of the pipe.

Excessive Ring Deflection: Ring deflection is the change in vertical diameter of the pipe as the pipe/bedding aggregate system deforms under the external vertical pressure. The actual ring deflection of the pipe must be less than the allowable ring deflection of the pipe. The factor of safety against excessive ring deflection may be calculated using the following equation:

$$FS_{RD} = \frac{\Delta_R E'}{100\sigma_{max}} \quad (5)$$

NOTE: % MEAN & VERT. DIA. CHANGE ÷ ORIGINAL DIA. × 100

where: Δ_R = allowable ring deflection in percent; E' = modulus of soil reaction for pipe bedding; and σ_{max} = maximum stress applied to the pipe. The allowable ring deflection of the pipe will be obtained from the manufacturers and technical literature.

LTS Gravity Line Frost Protection:

Analyses included in the "Liner System Frost Protection" Calculations Package are applicable to the LTS gravity line. In that package, estimates were made of the minimum thickness of protective soil needed to provide frost protection of the clay liner. Recommendations were made that a 2-ft thick layer of a clayey or silty material or a 3-ft thick layer of gravel is adequate to provide frost protection. These

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Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE 3900 Task No.: Ø8.6

RB(DTL)17 FEB 96

recommendations will also be used for the LTS gravity line. Because the LTS gravity line will be at least 8 ft below the ground surface, the line is adequately protected from frost. Therefore, no additional calculations will be performed in this package.

REFERENCES

ASCE, "*Design and Construction of Sanitary and Storm Sewers*", Manual and Report on Engineering Practice No. 37, American Society of Civil Engineers, New York, NY, Printed 1969, Reprinted 1979.

Chevron Chemical Company, "*Plexco/Spirolite Engineering Manual, 2. System Design*", Chevron Chemical Company, Bensenville, IL, Aug 1992, 76 p.

Phillips 66, "*Driscopipe System Design*", Manufacturers' literature, No. 1160-88 A17, Phillips 66, 1988.

Phillips 66, "*Driscopipe System Design*", Manufacturers' literature, No. 1089-91 A17, Phillips 66, 1991.

Uni-Bell PVC Pipe Association, "*Handbook of PVC Pipe, Design and Construction*", Uni-Bell Plastic Pipe Association, 1991.

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Written By: MAO Date: 96/7/19 Reviewed by: RAM Date: 24 FEB 96

Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE3900 Task No.: 08.6

RB(DTL) 21 FEB 96

LEACHATE TRANSMISSION SYSTEM (LTS)
GRAVITY LINE DESIGN

DATA VERIFICATION

The LTS gravity line is a dual containment pipe with the inner pipe being a 6-in. diameter HDPE SDR-~~11~~ 32.5 pipe and the outer pipe being a 10-in. diameter HDPE SDR-~~11~~ 32.5 pipe. The flow capacity of the inner pipe will be calculated in accordance with the methods described in the Calculation Procedures section of this package.

The characteristics of the 6-in. diameter inner pipe required to do this calculation are as follows:

- inner diameter, B_i = 5.421 in. < minor changes - Not significant
- hydraulic radius, $R_h = B_i / 4$ = 1.36 in. (0.0345 m)
- cross-sectional area, $A_p = \pi B_i^2 / 4$ = 23.1 in^2 (1.5x10^{-2} m^2)
- hydraulic gradient, i_p = 0.286° (0.5%) (taken as the minimum slope along the entire length of the gravity line as shown in Figure 1 of the Calculation Procedures section of this package which is conservative)
- Manning's roughness coefficient, n = 0.013 s/m$^{0.33}$ (conservative for smooth HDPE pipe; a value of 0.009 is often used).
- Baseline design flow rate during active operations, Q_{ao} = 22,803 gpd =15.8 gpm (from "Leachate Generation Rates" Calculation Package)
- Baseline design flow rate during post closure, Q_{pc} = 1.4 gpd = 9.7x 10^{-4} gpm (from "Leachate Generation Rates" Calculation Package)
- Storm design flow rate during active operations, Q_s = 80 gpm

Changing SDR from 11 to 32.5 will increase flow capacity

The characteristics of the 10-in. diameter outer pipe and other parameters to be used in the structural stability calculations are as follows:

- outer diameter, B_c = 10.75 in. (0.896 ft) ~~minor change~~ same
- wall thickness, t = 0.977 in. 0.331 in.
- effective length of pipe, L_{ic} = 3 ft (1 m)

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Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE3900 Task No.: 08.6

RB(DTL) 21 FEB 96

- average unit weight of overburden materials, γ_p =125 pcf (conservative assumption for compacted backfill material) ✓
- maximum thickness of overburden materials, D_p = ~~8~~ 3 ft (more conservative wrt σ_{max}) (from Drawing G33 of the Intermediate Design Drawings, February 1996) ✓
- load coefficient C_s = ~~0.015~~ 0.117 ✓ (from Table 1 of Procedures section for L_{ic} / (2 D_p) = 3 ft / (2 x ~~8~~ 3 ft) = ~~0.1875~~ 0.5 ✓ and B_c / (2 D_p) = 0.896 ft / (2 x ~~8~~ 3 ft) = ~~0.056~~ ≈ 0.149) ✓
- concentrated load, P = 20,000 lb (90 kN) (assumed based on truck with a capacity of 35 tons and a wheel load of 20,000 lb when full) ✓
- impact factor accounting for dynamic loads, F_{ic} = 1.5 [ASCE, 1979; see Calculations Procedures section of this package for reference] ✓
- modulus of elasticity of pipe, E = 2.74 x 10^6 psf (1.31x10^5 kPa) as estimated from a manufacturer's literature [Phillips 66, 1988, 1991] ✓
- compressive yield strength of pipe, σ_y = 216,000 psf (10,346 kPa) as estimated from a manufacturer's literature [Phillips 66, 1988, 1991] ✓
- allowable ring deflection of SDR-~~11~~ 32.5 pipe used for gravity flow, Δ_R = ~~2.7~~ 8.1 percent as estimated from a manufacturer's literature [Phillips 66, 1988, 1991] ✓
- modulus of soil reaction for pipe bedding, E' = ~~432,000~~ 144,000 psf (20,560 kPa) ✓

Assuming loose sand or well compacted native soil (more conservative assumption)

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Written by: MAO Date: 96 / 2 / 23 Reviewed by: [illegible] Date: 96 / 2 / 24

Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE3900 Task No.: 08.6

LEACHATE TRANSMISSION SYSTEM (LTS)
GRAVITY LINE DESIGN

CALCULATION RESULTS

Evaluate Gravity Line Flow Capacity:

- $Q_c = \dfrac{R_h^{0.66}\, i_p^{0.5}\, A_p}{n}$

$$= \frac{(0.0345\,m)^{0.66}\,(0.005)^{0.5}\,(1.5\times10^{-2}\,m^2)}{0.013\,(s/m^{0.33})} = 0.0088\ m^3/s \checkmark$$

$$= 140\ gpm. \checkmark$$

- Q_{ao} = Baseline design flow rate during active operations

$= 15.8\ gpm \checkmark$

$$F.S. = \frac{Q_c}{Q_{ao}} = \frac{140\ gpm}{15.8\ gpm} = 8.9 > 3 \quad (o.k.) \checkmark$$

- Q_{pc} = Baseline design flow rate during post closure

$= 9.7\times10^{-4}\ gpm \checkmark$

$$F.S. = \frac{Q_c}{Q_{pc}} = \frac{140\ gpm}{9.7\times10^{-4}\ gpm} = 1.44\times10^{5} \gg 10 \quad (o.k.) \checkmark$$

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Written by: MAO Date: 96/2/23 (YY/MM/DD) Reviewed by: RAM Date: 96/2/24 (YY/MM/DD)

Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE3900 Task No.: 08.6

Revised BJ 26 Nov 1996

- Q_s = Storm design flow rate during active operations
  = 80 gpm

$$F.S. = \frac{Q_c}{Q_s} = \frac{140 \text{ gpm}}{80 \text{ gpm}} = 1.75 > 1.0 \text{ (o.k.)}$$

should go up a little

Therefore, flow capacity of LTS gravity line is adequate under all design conditions.

Evaluate Gravity Line Structural Stability

- $$\sigma_{max} = \gamma_p D_p + \frac{C_s P F_{ic}}{L_{ic} B_c}$$

$$= (125 \text{ pcf})(8 \text{ ft}) + \frac{(0.015)(20{,}000 \text{ lb})(1.5)}{(3 \text{ ft})(0.896 \text{ ft})}$$

$$= 1{,}67 \text{ psf.}$$

- Factor of safety against wall crushing, FS_{wc}

$$= \frac{2\,\sigma_y}{(SDR-1)\,\sigma_{max}} = \frac{2\,(216{,}000 \text{ psf})}{(11-1)\,(1{,}67 \text{ psf})} = 37 \text{ (o.k.)}$$

- Factor of Safety against wall buckling, FS_{wb}

$$= \frac{1.2}{\sigma_{max}}\left[\frac{E'E}{(SDR)^3}\right]^{1/2} = \frac{1.2}{1{,}67 \text{ psf}}\left[\frac{432{,}000 \text{ psf} \times 2.74 \times 10^6 \text{ psf}}{(11)^3}\right]^{1/2}$$

$$= 31 \text{ (o.k.)}$$

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Written by: MAO Date: 96/2/23 (YY/MM/DD) Reviewed by: RKM Date: 96/2/24 (YY/MM/DD)

Client: FERMCO Project: FERNALD OSDF Project/Proposal No.: GE 3900 Task No.: 08.6

- Factor of safety against ring deflection, FS_{RD}

$$= \frac{\Delta R \; E'}{100 \; \sigma_{max}} = \frac{(\cancel{2.7}\ 8.1)(\cancel{432,000}\ 144,000 \text{ psf})}{100\ (\cancel{1167}\ 1681 \text{ psf})} = \cancel{10}\ 6.9 \checkmark \text{ (o.k.)}$$

The pipe could be reduced in SDR up to 32.5. SDR 26 was selected to provide extra construction durability. Note that C_S will decrease with decreased pipe diameter, therefore the loads and factors of safety for smaller pipe will be larger than the values calculated above.

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Existing Pipe Calculations

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Evaluation of Pressure Testing

COMPUTATION COVER SHEET

2195

SUBJECT OF COMPUTATIONS Leachate Transmission System Gravity Line - Pressure Testing of 6" Carrier Pipe

Computations By: (Cognizant Engineer)
Signature: Gina K Martin
Date: 25 MARCH 99
Printed Name and Title: GINA K. MARTIN, SR. STAFF ENGINEER

Assumptions and Procedures Checked By: (Checker)
Signature: Brian D Jacobson
Date: 31 MAR 99
Printed Name and Title: BRIAN D JACOBSON, PROJECT ENGINEER

Computations Checked by:
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Date: 31 MAR 99
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Date: 1 APRIL 99
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Approved by: (PDP)
Signature: Brian D. Jacobson
Date: 31 MAR 99
Printed Name and Title: BRIAN D JACOBSON

Approved by: (DTL and TETL)
Signature: [illegible]
Date: 1 Apr 99
Printed Name and Title: Kenneth W Cargill, Associate

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
A	FDF Review	1 Apr 99	[illegible]		[illegible]
B	DOE Review	15 Apr 99	[illegible]		[illegible]

538

Written By : Gina K. Martin Date: 3/25/99 Reviewed by: Brian D. Jacobsen BDJ 3/31/99 Date: 3/31/99

Client: FDF Project: Fernald OSDF Project/Proposal No.: GQ0573 Task No.: 3.2

GKM MAR 25 1999

LEACHATE TRANSMISSION SYSTEM (LTS) GRAVITY LINE DESIGN EVALUATION OF PRESSURE TESTING

EXECUTIVE SUMMARY

PURPOSE OF ANALYSIS

The purpose of this analysis is to evaluate the performance of the as-built SDR 26 Leachate Transmission System (LTS) permanent and temporary gravity lines during pressure testing. The analyses will compare the design criteria for the LTS permanent and temporary gravity lines (LTS gravity lines) with the original (SDR-11) design, the design approved with DCN-1700-007, and the as-built condition. During early stages of the On-site Disposal Facility (OSDF) development, the LTS permanent gravity line will transfer leachate and liquids collected from the OSDF cells to the LTS temporary gravity line which in turn flows to the permanent lift station. However, during later stages of the OSDF development (e.g., during Cell 6 construction) and after closure, the LTS permanent gravity line will transfer flows directly to the permanent lift station.

METHODS OF ANALYSIS

- The as-built condition of the LTS gravity lines was evaluated based on data collected during the pressure testing, televideo along the length of the pipe, and construction quality assurance documentation.
- The factor of safety against hydraulic rupture of the LTS gravity lines (under pressure testing conditions) was calculated.
- The structural stability of the carrier pipe including unconstrained buckling, and ring deflection was evaluated based on the site construction and operational records, televideo, and pipe testing records. Additional information was inferred from samples and pictures of excavated pipe. Structural stability (i.e., resistance to unconstrained wall buckling and excessive ring deflection) of the LTS gravity line was evaluated using procedures recommended in the technical literature [Uni-Bell, 1991; Phillips 66, 1988, 1991, 1998; and Chevron, 1992].

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Written By : Gina K. Martin Date: 3/25/99 Reviewed by: Brian D. Jacobsen BDJ 3/31/99 Date: 3/31/99

Client: FDF Project: Fernald OSDF Project/Proposal No.: GQ0573 Task No.: 3.2

GKM MAR 25 1999

CONCLUSIONS

The summarized results for the as-built LTS gravity lines were based on an average deflection of 20 percent as interpreted from the televideo analysis.

Hydraulic Rupture

	As-Built LTS (SDR 26)
Hydraulic Rupture FS	
Containment Pipe	4.8
Carrier Pipe	2.2

Structural Stability for Carrier Pipe

	As-Built LTS (SDR 26)
Wall Buckling FS	
Pressure Testing MH #1 to MH #2	Exceeded
Pressure Testing MH #2 to MH#3	Exceeded
Pressure Testing #3 to PLS	Exceeded
Leak Condition	1.1
Ring Deflection	Exceeded

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Written By : Gina K. Martin Date: 3/25/99 Reviewed by: Brian D. Jacobsen BDJ 3/31/99 Date: 3/31/99

Client: FDF Project: Fernald OSDF Project/Proposal No.: GQ0573 Task No.: 3.2

GKM MAR 25 1999

LEACHATE TRANSMISSION SYSTEM (LTS) GRAVITY LINE DESIGN EVALUATION OF PRESSURE TESTING CALCULATION PROCEDURES

INTRODUCTION

The purpose of this package is to present the calculation procedures for the LTS gravity line design. The LTS gravity line extends between the leachate collection system (LCS) manholes along the western boundary of the On-site Disposal Facility (OSDF) and terminates into the permanent lift station as shown in Figure 1. During the active life of the OSDF, the LTS gravity line transfers leachate and liquids collected from the OSDF cells to a temporary gravity line. The temporary gravity line transfers liquids from the LTS gravity line to a permanent lift station located south-west of the OSDF. During later stages of the OSDF development (e.g., during Cell 6 construction) and after closure, the LTS gravity line will transfer flows directly to the permanent lift station. A forcemain will transfer flows from the permanent lift station to the Biosurge Lagoon located at the FERNALD site.

The calculation package titled "*Leachate Transmission System Gravity Line Design, Construction and Operation*" demonstrates that the LTS gravity line has adequate capacity to convey design flow rates, adequate structural resistance to withstand stresses applied on it from overburden materials and from equipment traffic, and should be protected from frost with a soil cover of adequate thickness and thermal properties. The carrier pipe was subjected to short-term external stresses during pressure testing of the containment pipe. The methods to perform these evaluations are described below.

Hydraulic Rupture of Carrier Pipe

The LTS gravity line resistance to hydraulic rupture will be evaluated using the following equation:

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Written By : Gina K. Martin Date: 3/25/99 Reviewed by: Brian D. Jacobsen BDJ 3/31/99 Date: 3/31/99

Client: FDF Project: Fernald OSDF Project/Proposal No.: GQ0573 Task No.: 3.2

GKM MAR 25 1999

$$FS_{hr} = \frac{2P_{rating}}{P_t} \quad (1)$$

where: FS_{hr} = factor of safety against hydraulic rupture; P_{rating} = pressure rating of the pipe material (which includes an integral factor of safety of 2); and P_t = hydraulic pressure in the pipe during pressure testing.

LTS GRAVITY LINE STRUCTURAL STABILITY

Overview

Calculations will be performed to ensure the as-built LTS gravity line is able to withstand the loads applied on it with an adequate factor of safety. Failure mechanisms that will be checked are: (i) unconstrained wall buckling; and (ii) excessive ring deflection. External stresses applied on the LTS gravity line carrier pipe include those due to pressure testing and filling and draining of the pipes in preparation for testing. Plastic pipe can be designed to resist failure by the above mechanisms using design methods presented in the technical literature [Uni-Bell, 1991; Phillips 66, 1988, 1991, 1998; and Chevron, 1992].

The carrier pipe does not feel overburden and equipment loads due to the protection of the containment pipe. The LTS gravity line was pressure tested by VBS (construction contractor) during December 1997 to evaluate the potential for leaks within the system. Detailed information related to the pressure testing is provided in Section 3 of the report.* The structural stability of the LTS pipes are evaluated for the pressures used during the pressure testing.

Unconstrained Wall Buckling

Pipe wall buckling will be evaluated for the carrier pipe. The carrier pipe has no lateral forces to resist buckling and therefore will be evaluated for unconstrained pipe wall buckling.

* April 1997. GeoSyntec. Evaluation of Leachate Transmission System.

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Written by: ____ Date: __/__/__ (YY MM DD) Reviewed by: BPH 3/31/99 Date: __/__/__ (YY MM DD)

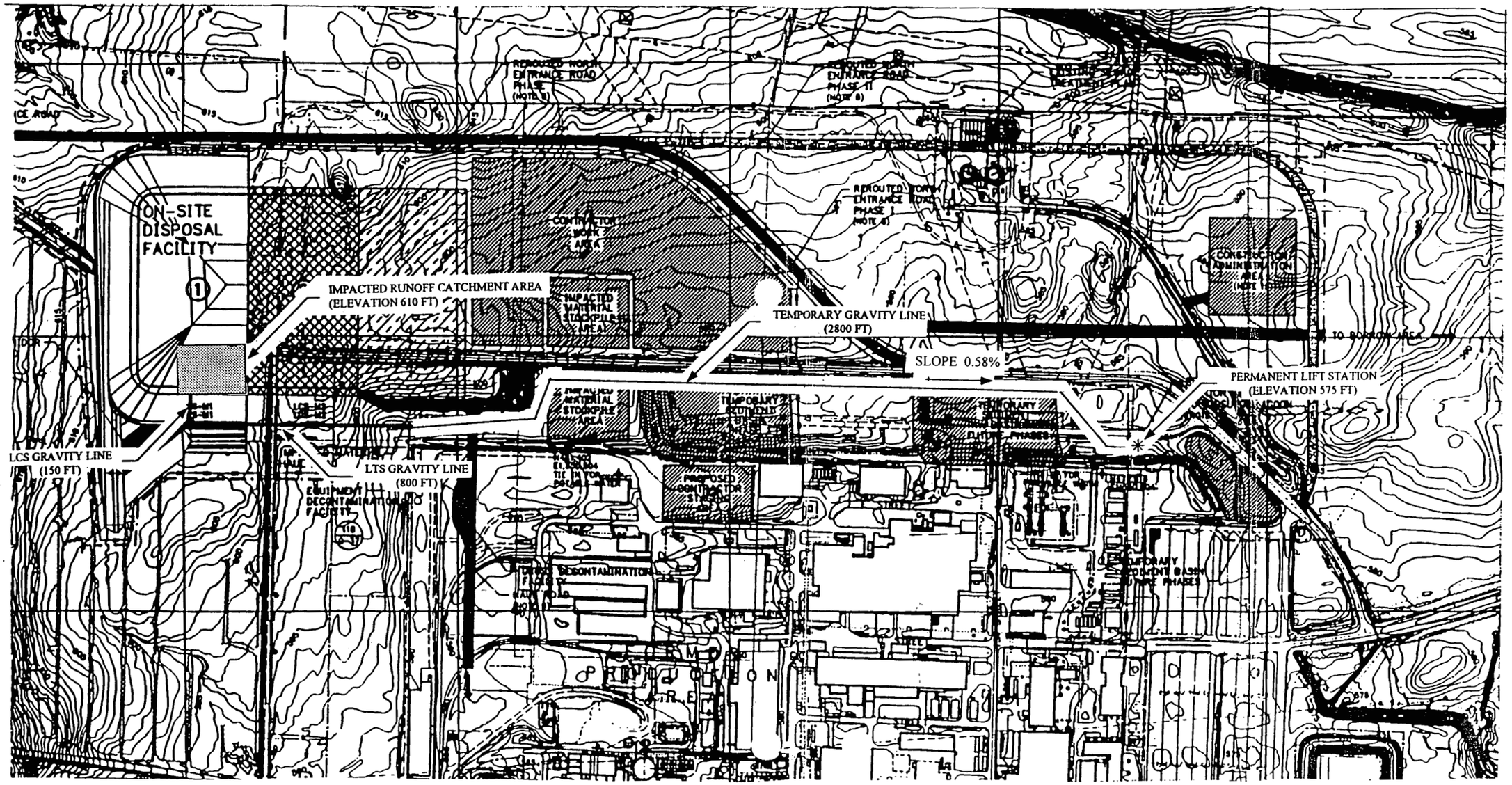
Client: ____ Project: ____ Project/Proposal No.: ____ Task No.: ____

2195

6KM MAR 25 1999

FIGURE 1

TEMPORARY GRAVITY LINE



Scale: N.T.S.

543

Written By : Gina K. Martin Date: 3/25/99 Reviewed by: Brian D. Jacobsen BDJ 3/31/99 Date: 3/31/99

Client: FDF Project: Fernald OSDF Project/Proposal No.: GQ0573 Task No.: 3.2

GKM MAR 25 1999

If an unconstrained pipe is subjected to pressures such as external hydrostatic load in the outer containment pipe or vacuum due to column separation of flow in a gravity pipeline, unconstrained buckling may occur. The factor of safety against unconstrained wall buckling can be calculated as follows:

$$FS_{ucwb} = \frac{2E}{\sigma_{\max}(1-\mu^2)}\left[\frac{1}{(SDR-1)}\right]^3 \tag{2}$$

where: FS_{ucwb} = factor of safety against unconstrained pipe wall buckling; σ_{max} = maximum stress applied to the carrier pipe (test pressure + hydrostatic pressure); E = modulus of elasticity of the pipe material; μ = Poisson's ratio of pipe material; and SDR = standard dimension ratio of the pipe

Excessive Ring Deflection

Ring deflection is the change in diameter of the pipe as the pipe deforms under the external pressure. The actual ring deflection of the pipe should be less than the allowable ring deflection of the pipe. The factor of safety against excessive ring deflection may be calculated using the following equation:

$$FS_{RD} = \frac{\Delta_R}{\left(1-\frac{D_{\min}}{D_o}\right)*100} \tag{3}$$

where: Δ_R = allowable ring deflection in percent; D_{Min} = minimum outside diameter; and D_0 = pipe nominal outside diameter. The allowable ring deflection of the pipe will be obtained from the manufacturers and technical literature. Ring deflection was measured by analysis of the images captured from the televideo logs (Appendix F). The ratios of the major and minor axes of the pipe were scaled at each butt fusion joint and electrofusion coupling. An ovality ratio was calculated as follows:

$$OvalityRatio = \frac{D_{\min or}}{D_{major}} \tag{4}$$

The measured ovality ratios were converted to percent ring deflection by equating the circumference of a circular pipe and an oval pipe as shown in Table 1. A detailed analyses of the measured percent ring deflection is presented in Appendix F of this report.

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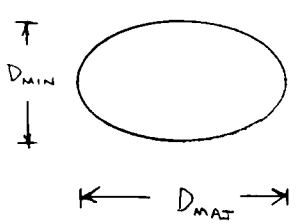
TABLE 1
OVALITY TO PERCENT DEFLECTION CONVERSION

Deflection Percent (%)	Major Diameter (in)	Minor Diameter (in)	Ovality Ratio (-)
0%	6.115	6.115	1.00
1%	6.176	6.054	0.98
2%	6.235	5.993	0.96
3%	6.293	5.932	0.94
4%	6.350	5.870	0.92
5%	6.406	5.809	0.91
6%	6.461	5.748	0.89
7%	6.515	5.687	0.87
8%	6.568	5.626	0.86
9%	6.620	5.565	0.84
10%	6.671	5.504	0.83
11%	6.721	5.442	0.81
12%	6.770	5.381	0.79
13%	6.818	5.320	0.78
14%	6.865	5.259	0.77
15%	6.912	5.198	0.75
16%	6.957	5.137	0.74
17%	7.002	5.075	0.72
18%	7.046	5.014	0.71
19%	7.089	4.953	0.70
20%	7.131	4.892	0.69
21%	7.173	4.831	0.67
22%	7.214	4.770	0.66
23%	7.254	4.709	0.65
24%	7.293	4.647	0.64
25%	7.332	4.586	0.63

Deflection Percent (%)	Major Diameter (in)	Minor Diameter (in)	Ovality Ratio (-)
26%	7.370	4.525	0.61
27%	7.407	4.464	0.60
28%	7.443	4.403	0.59
29%	7.479	4.342	0.58
30%	7.514	4.281	0.57
31%	7.549	4.219	0.56
32%	7.583	4.158	0.55
33%	7.616	4.097	0.54
34%	7.648	4.036	0.53
35%	7.680	3.975	0.52
36%	7.712	3.914	0.51
37%	7.742	3.852	0.50
38%	7.773	3.791	0.49
39%	7.802	3.730	0.48
40%	7.831	3.669	0.47
41%	7.859	3.608	0.46
42%	7.887	3.547	0.45
43%	7.914	3.486	0.44
44%	7.941	3.424	0.43
45%	7.967	3.363	0.42
46%	7.993	3.302	0.41
47%	8.018	3.241	0.40
48%	8.042	3.180	0.40
49%	8.066	3.119	0.39
50%	8.089	3.058	0.38



$$\text{AREA} = \frac{\pi}{4}(D_{MAJ})(D_{MIN})$$

$$\text{CIRCUMFERENCE} = 2\pi\sqrt{\frac{\left(\frac{D_{MAJ}}{2}^2 + \frac{D_{MIN}}{2}^2\right)}{2}}$$

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Client: FDF Project: Fernald OSDF Project/Proposal No.: GQ0573 Task No.: 3.2

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LEACHATE TRANSMISSION SYSTEM (LTS)
GRAVITY LINE DESIGN
EVALUATION OF PRESSURE TESTING
DATA VERIFICATION

The structural stability of the containment pipe will be calculated in accordance with the methods described in the "Calculation Procedures" section of this package. The characteristics of the 6-in. diameter carrierd pipe required to evaluate structural stability are as listed below. Detailed information for the parameters listed in Table 2 are provided in the "Calculation Results".

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Table 2. Structural Stability Evaluation Data for the LTS Gravity Line

	As-Built LTS (SDR 26)	Reference
Outer diameter, B_c (in.)	6.625	Driscopipe, 1998
Wall thickness, t (in.)	0.255	Driscopipe, 1998
Pipe modulus of elasticity, E (psi)	See Figure 2	Driscopipe, 1991
Pipe compressive yield strength, σ_y (psf)	216,000	Driscopipe, 1998
Pressure Testing (psi) MH #1 to MH #3 Carrier Test Pressure Containment Test Pressure Hydrostatic Test Pressure	 47.6 17.5 1.2	Construction Documentation TENSILE STRESS = SA = $\frac{(26-1)}{2}(17.5+1.2)$ = 233.8 psi BJ 4-14-99 SAY 230 psi
Pressure Testing MH #2 to MH#3 Carrier Test Pressure Containment Test Pressure Hydrostatic Test Pressure	 47.6 22 1.2	Construction Documentation TENSILE STRESS = SA = $\frac{(26-1)}{2}(22+1.2)$ = 290 psi
Pressure Testing Top MH #3 to PLS Carrier Test Pressure Containment Test Pressure Hydrostatic Test Pressure	 53.5 20 7.1	Construction Documentation TENSILE STRESS = SA = $\frac{(26-1)}{2}(20+7.1)$ = 338.8 psi SAY 340 psi
Hydrostatic Pressure due to leak (psi) (Manhole 3 full of water)	10.6	Construction Personnel
Allowable ring deflection (%)	6.5	Driscopipe, 1998
Allowable ring deflection (%)	6.5	Driscopipe, 1998

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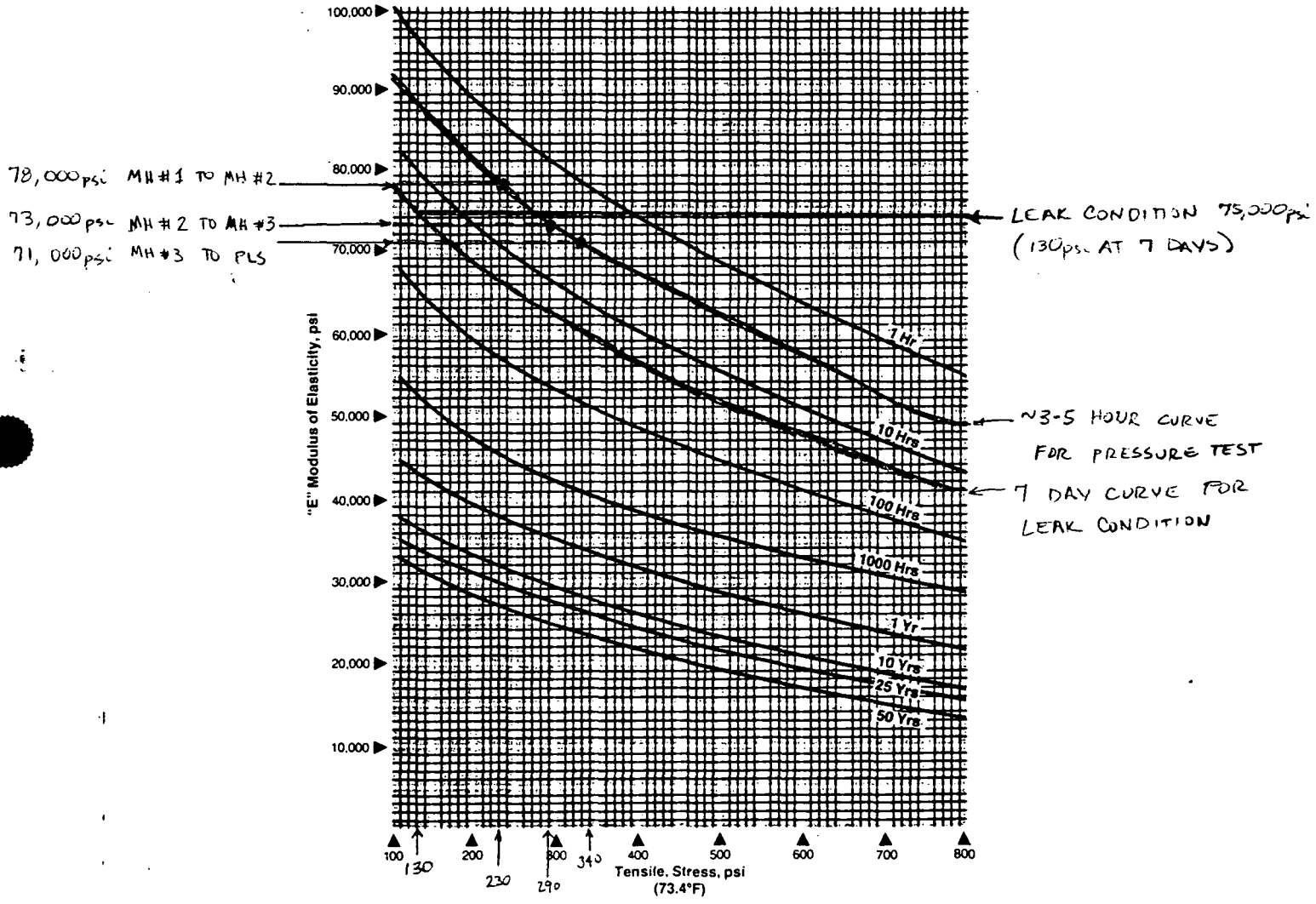
FIGURE 2

Time Dependent Modulus of Elasticity for Polyethylene Pipe vs. Stress Intensity (73.4°F)



NOTE: The short term modulus of elasticity of Driscopipe per ASTM D 638 is approximately 100,000 psi. Due to the cold flow (creep) characteristic of the pipe material, this modulus is dependent upon the stress intensity and the time duration of the applied stress.

Source: Drisco, 1991

TENSILE STRESS = $\sigma_A = \frac{(SDR - 1)}{2} P_T$

WHERE P_T = Applied Load

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GRAVITY LINE DESIGN
PRESSURE TESTING
CALCULATION RESULTS

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HYDRAULIC RUPTURE FACTOR OF SAFETY
MANHOLE #3 TO PLS
CONTAINMENT PIPE

$$FS_{HR} = \frac{2\,P_{RATING}}{P_T} = \frac{(2)(65_{psi})}{27.1\ psi}$$

$$FS_{HR} = 4.8$$

CARRIER PIPE

$$FS_{HR} = \frac{2\,P_{RATING}}{P_T} = \frac{(2)(65_{psi})}{60.6\ psi}$$

$$\boxed{FS_{HR} = 2.2}$$

COMBINED TEST AND HYDROSTATIC PRESSURE IN OTHER PIPE SEGMENTS WERE LOWER. THUS, OTHER PIPE SEGMENTS WOULD HAVE HIGHER FACTORS OF SAFETY

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Client: Project: Project/Proposal No.: Task No.:

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STRUCTURAL STABILITY

UNCONSTRAINED WALL BUCKLING (CARRIER PIPE)
MH #1 TO MH#2

$$FS_{UCWB} = \frac{2E}{\sigma_{max}(1-\mu^2)}\left[\frac{1}{(SDR-1)}\right]^3$$

WHERE $\sigma_{max} = \sigma_{HYD} + \sigma_{PRESS}$

$$= \frac{2(78\,000\,psi)}{(17.5+1.2)(1-0.45^2)}\left[\frac{1}{(26-1)}\right]^3$$

$$\boxed{FS_{UCWB} = 0.70} \rightarrow \text{EXCEEDED}$$

PRESSURE TESTING MH #2 TO MH #3

$$FS_{UCWB} = \frac{2(73{,}000\,psi)}{(22+1.2)(1-0.45^2)}\left[\frac{1}{(26-1)}\right]^3$$

$$\boxed{FS_{UCWB} = 0.51} \Rightarrow \text{EXCEEDED}$$

PRESSURE TESTING MH #3 TO PLS

$$FS_{UCWB} = \frac{2(71\,000\,psi)}{(20+7.1)(1-0.45^2)}\left[\frac{1}{(26-1)}\right]^3$$

$$\boxed{FS_{UCWB} = 0.42} \Rightarrow \text{EXCEEDED}$$

LEAK CONDITION

$$FS_{UCWB} = \frac{2(75{,}000\,psi)}{(7.1+3.5)(1-0.45^2)}\left[\frac{1}{26-1}\right]^3$$

$$\boxed{FS_{UCWB} = 1.1}$$

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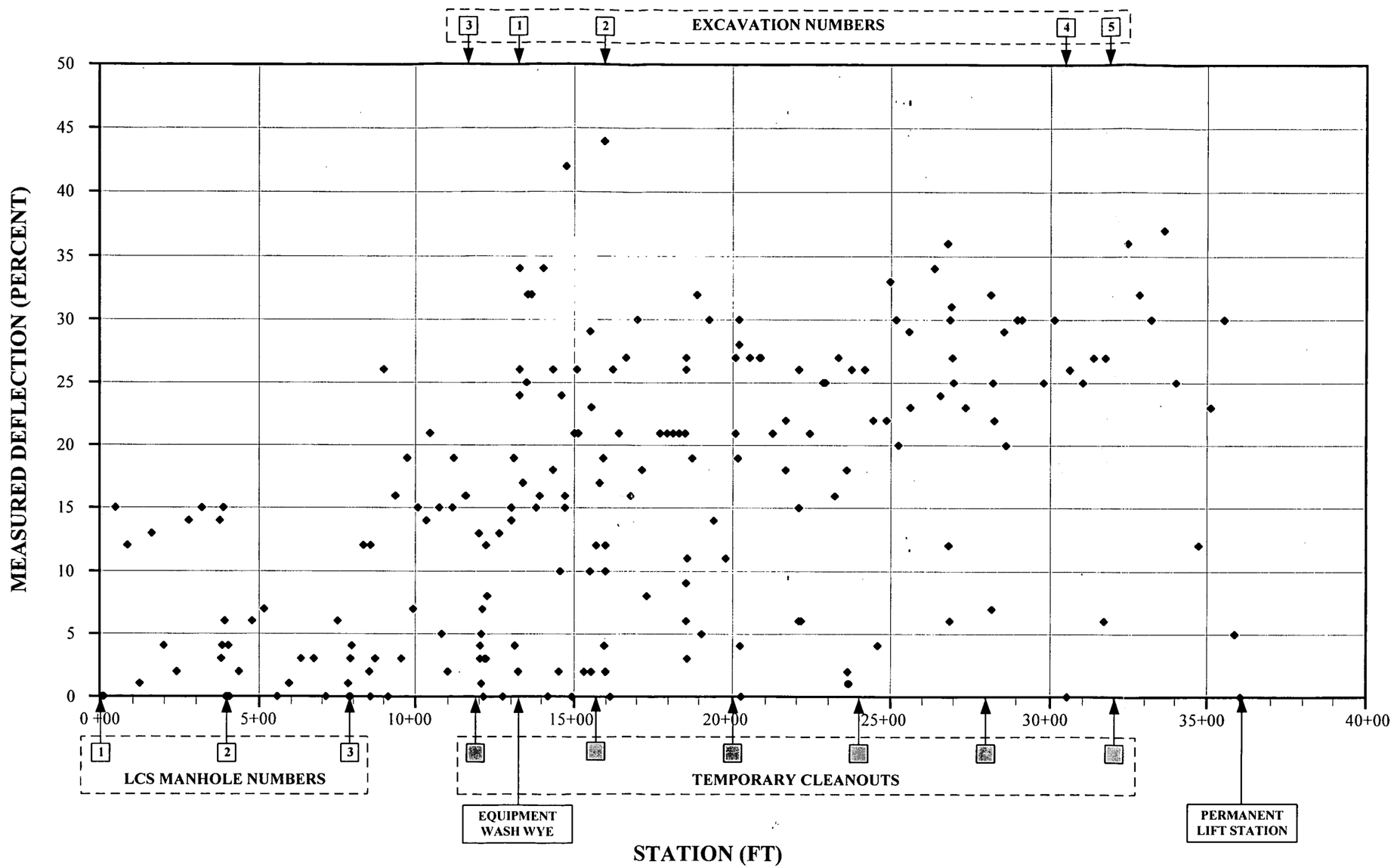
SUMMARY OF DEFLECTION MEASUREMENTS FROM VIDEO



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SUMMARY OF RING DEFLECTIONS

GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

FLUOR DANIEL FERNALD
LEACHATE TRANSMISSION SYSTEM INVESTIGATION

PROJECT NO. GQ0573-3.2	DATE: 25 MARCH 99	FIGURE NO. 3

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Evaluation of Existing Conditions

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COMPUTATION COVER SHEET

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SUBJECT OF COMPUTATIONS Leachate Transmission System Gravity Line – Construction and Operation

Computations By:
(Cognizant Engineer)

Signature Gina K Martin — Date 25 MARCH 99

Printed Name and Title GINA K MARTIN, SR. STAFF ENGINEER

Assumptions and Procedures Checked By:
(Checker)

Signature Brian D Jacobson — Date 31 MAR 99

Printed Name and Title BRIAN D JACOBSON, PROJECT ENGINEER

Computations Checked by:

Signature Brian D Jacobson — Date 31 MAR 99

Printed Name and Title BRIAN D JACOBSON, PROJECT ENGINEER

Computations Backchecked by:
(Cognizant Engineer)

Signature Gina K Martin — Date 1 APRIL 99

Printed Name and Title GINA K MARTIN, SR. STAFF ENGINEER

Approved by:
(PDP)

Signature Brian D Jacobson — Date 31 MAR 99

Printed Name and Title BRIAN D JACOBSON, PROJECT ENGINEER

Approved by:
(DTL and TETL)

Signature [illegible] — Date 1 Apr 99

Printed Name and Title Kenneth W Cargill, Associate

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
A	FDF Review	1 Apr 99			
B	DOE Review	15 Apr 99			

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Client: FDF Project: Fernald OSDF Project/Proposal No.: GQ0573 Task No.: 3.2

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LEACHATE TRANSMISSION SYSTEM (LTS) GRAVITY LINE DESIGN EVALUATION OF EXISTING CONDITIONS

EXECUTIVE SUMMARY

PURPOSE OF ANALYSIS

The purpose of this analysis is to evaluate the present and future performance of the as-built SDR-26 Leachate Transmission System (LTS) permanent and temporary gravity lines. The analyses will compare the design criteria for the LTS permanent and temporary gravity lines (LTS gravity lines) with the original (SDR-11) design, the design approved with DCN-1700-007, and the as-built condition. During early stages of the On-site Disposal Facility (OSDF) development, the LTS permanent gravity line will transfer leachate and liquids collected from the OSDF cells to the LTS temporary gravity line which in turn flows to the permanent lift station. However, during later stages of the OSDF development (e.g., during Cell 6 construction) and after closure, the LTS permanent gravity line will transfer flows directly to the permanent lift station.

METHODS OF ANALYSIS

- The original design condition of the LTS gravity lines was evaluated based on the results of the calculation package titled "*Leachate Transmission System (LTS) Gravity Line Design*", Revision 0.
- The DCN-1700-007 design condition of the LTS gravity lines was evaluated based on the specifications provided in the Design change notice and the Construction Specifications.
- The as-built condition of the LTS gravity lines was evaluated based on data collected during the pressure testing, televideo along the length of the pipe, and construction quality assurance documentation.
- The change in flow capacity of the pipe was evaluated based on Construction Specifications, and observed deflection measurements obtained from the televideo and measurements of excavated sections of the LTS. The LTS gravity lines flow capacity was calculated to verify it could handle design flow rates with adequate factors of safety. Manning's and the Darcy-Weisbach equations

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were used to calculate the flow capacities of the line under gravity and pressure flow conditions, respectively. These capacities were compared to baseline design flow rates for active-operations and post-closure conditions and to the storm design basis flow rate.

- The factor of safety against hydraulic rupture of the LTS gravity lines (under design operational pressure flow conditions) was calculated.
- The structural stability of the pipe including crushing, buckling, and ring deflection was evaluated based on the Construction Specifications, site construction and operational records, televideo, and anticipated future conditions. Additional information was inferred from samples and pictures of excavated pipe. Structural stability (i.e., resistance to wall crushing, wall buckling, and excessive ring deflection) of the LTS gravity line was evaluated using procedures recommended in the technical literature [Uni-Bell, 1991; Phillips 66, 1988, 1991, 1998; and Chevron, 1992].
- Soil cover thickness required for protection of the LTS gravity lines from frost was also reported based on the results of the calculation package titled "*Liner System Frost Protection*", Revision 0.

CONCLUSIONS

The Revision 0 results for both the LTS permanent and temporary gravity lines are presented only where different results were obtained from the calculations. The summarized results for the as-built LTS gravity line carrier pipe was based on an average deflection of 20 percent as interpreted from the televideo analysis. Structural stability for the containment pipe during construction and operation was reported with an overburden of 10 ft as conservatively estimated from the design drawings at station 22+50. Future operations were based on a 3 ft and 25 minimum and maximum cover, respectively.

Carrier Pipe Flow Capacity

	Revision 0 LTS (SDR 11)	As-Built LTS (SDR 26)
Gravity Flow Capacity FS		
Active Flow	8.9 > 3	11.1 > 3
Post Closure Flow	1.4E5 > 10	1.9E5 > 10
Pressure Flow Capacity FS	1.7 > 1	1.5 > 1
Annular Space, ft^3/ft		0.298
Hydraulic Rupture FS		
Static Head	19.7	8.2
Surge Pressure	NA	3.7

SSW

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Structural Stability for Containment Pipe

	Revision 0 LTS (SDR 11)	As-Built LTS (SDR 26)
Wall Crushing FS		
Construction and Operation	37	13.8
Future Operation	37	5.8
Wall Buckling FS		
Construction and Operation	31	7.1
Future Operation	31	2.6
Ring Deflection		
Construction and Operation	10	22.5
Future Operation	10	9.4

Frost Protection

- Thickness of silty or clayey cover recommended to protect the LTS gravity line from frost = 2 ft
- Thickness of gravel recommended to protect the LTS gravity line from frost = 3 ft

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LEACHATE TRANSMISSION SYSTEM (LTS) GRAVITY LINE DESIGN EVALUATION OF EXISTING CONDITIONS

CALCULATION PROCEDURES

INTRODUCTION

The purpose of this package is to present the calculation procedures for the LTS gravity line design. The LTS gravity lines extend between the leachate collection system (LCS) manholes along the western boundary of the On-site Disposal Facility (OSDF) and terminates into the permanent lift station as shown in Figure 1. During the active life of the OSDF, the LTS permanent gravity line transfers leachate and liquids collected from the OSDF cells to a LTS temporary gravity line. The LTS temporary gravity line transfers liquids from the LTS permanent gravity line to a permanent lift station located southwest of the OSDF. During later stages of the OSDF development (e.g., during Cell 6 construction) and after closure, the LTS permanent gravity line will transfer flows directly to the permanent lift station. A forcemain will transfer flows from the permanent lift station to the Biosurge Lagoon located at the FERNALD site.

The construction equipment loads and loads from overburden materials were compared with the Revision 0 design loads. The Revision 0 design loads were greater than the actual construction loads imposed on the pipe, therefore, the design loads were used as the basis for calculation. The results of the on-site equipment analysis are presented in Table 1. The results of the calculation are summarized in tabular form and can be used as the basis for load restriction for future operations.

The calculations will be performed to demonstrate the LTS gravity line has adequate capacity to convey design flow rates, adequate structural resistance to withstand stresses applied on it from overburden materials and from equipment traffic, and a soil cover of adequate thickness and thermal properties to protect from frost. Methods to perform these evaluations are described below.

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YY MM DD YY MM DD

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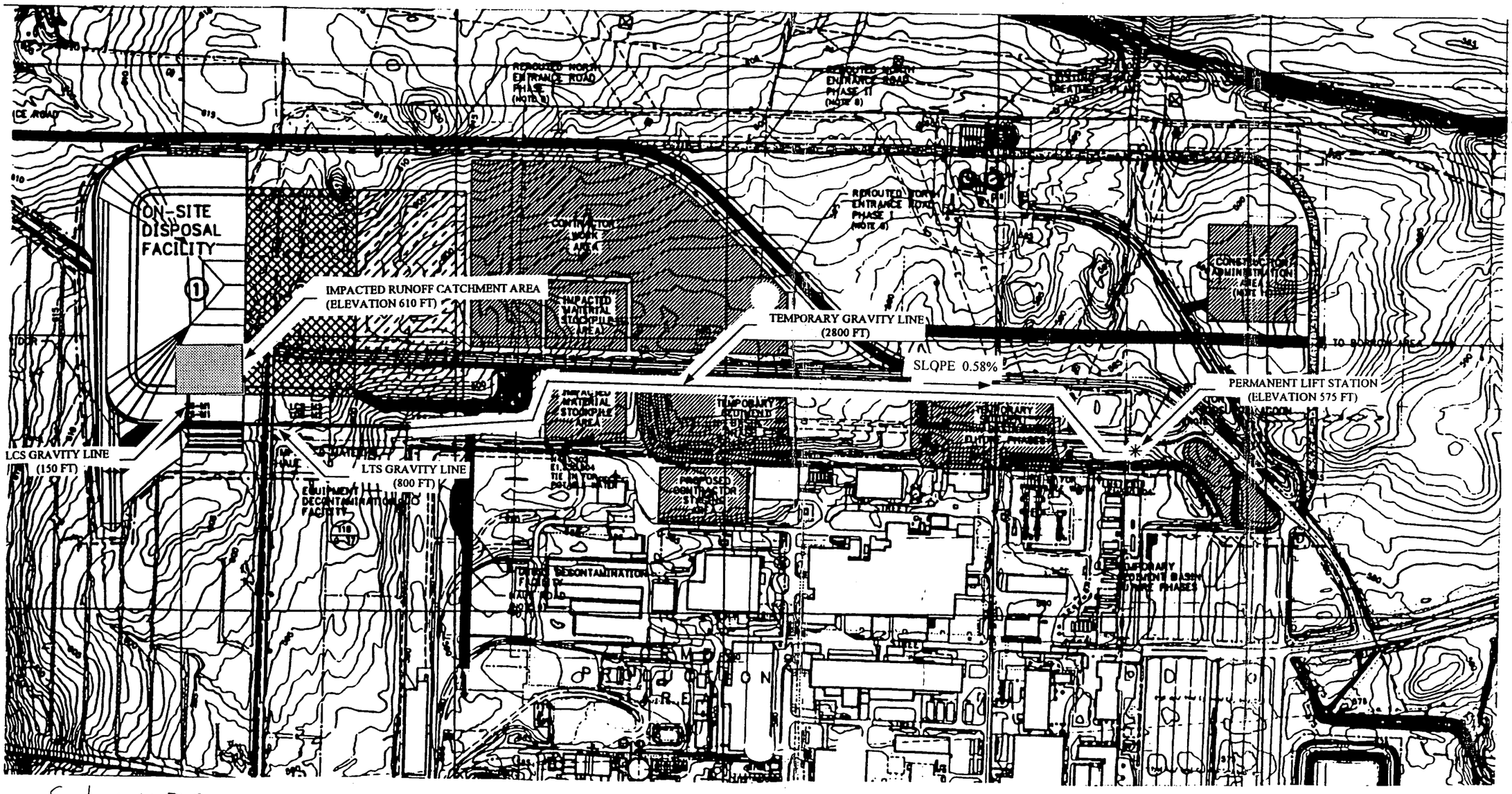
FIGURE 1
TEMPORARY GRAVITY LINE



Scale : N.T.S.

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Table 1
CONSTRUCTION EQUIPMENT
CONSIDERED FOR
CALCULATION OF LTS
PIPE STRUCTURAL STABILITY

Equipment	Gross Vehicle Weight (lb)	Front Axle (lb)	Back Axle (lb)	Maximum Wheel Load (lb)
CAT D8 DOZER	84,026	-	-	5,436 [5]
CAT 350 TRACKHOE (330L)	73,877	-	-	2,607 [5]
CAT 826G COMPACTOR [1]	69,733	41,840 [6]	27,893 [6]	20,920
CAT D25 OR D30 ARTICULATING TRUCK [2]	108,278	47,642	66,050	33,025
CAT 637 SCRAPER	112,090	58,915	57,166	28,583
5000 GALLON WATER WAGON (D20D)	112,754 [3]	75,545	37,209	37,773
VOLVO 990 FRONT END LOADER [7]	45,500 [6]	27,300 [6]	18,200 [6]	13,650
35 TON (D350D)	124,221	69,564	27,329 [4]	34,782

Use 40,000 to be conservative

[1] 826C COMPACTOR was used
[2] D30 was used
[3] GVW = 72,754 lb (CAT D20D) plus 20 tons water was used
[4] 22% GVW for Center same as Back Axle
[5] Maximum Wheel Load equivalent for 20" x 18" area
[6] 60/40 weight distribution between axles was assumed
[7] CAT 966F Loader was used

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LTS GRAVITY LINE FLOW CAPACITY

Design Flow Rates

As discussed in the "Leachate Generation Rates" Calculation Package (LGRCP) and the Design Criteria Package (DCP), the as-built LTS gravity line must have adequate capacity to convey: (i) the baseline design flow rate during active operations with a factor of safety no less than three; (ii) the baseline design flow rate after cell closure with a factor of safety no less than ten; and (iii) the storm design flow rate during active cell operations with a factor of safety no less than one. The baseline design flow rates are solely a function of the leachate generation rates calculated for the OSDF. Accordingly, baseline design flow rates for active-operation and post-closure conditions calculated in the LGRCP (i.e., 15.8 gpm and 9.7×10^{-4} gpm, respectively) will be used in this calculation package.

The storm design flow rate is a function of: (i) the rate of direct infiltration of storm water runoff from active portions of the OSDF into the LCS of the cell containing the runoff; (ii) the mechanical flow control systems on the LTS gravity line; (iii) the storage capacity of the permanent lift station; and (iv) the maximum acceptable leachate discharge rate from the permanent lift station. Analyses performed in the "Required Cell Leachate Storage" Calculation Package, Revision 0 [Geosyntec, 1997] indicate that storm water runoff from active portions of the OSDF are substantial and therefore infiltration of this runoff into the LCS pipe and thereafter into the LTS gravity line must be regulated through mechanical controls imposed on the LTS gravity line. The rate of flow of the impacted runoff into the LCS pipe, which will be defined as the storm design flow rate, will be the lesser of: (i) flow rate in the as-built LTS gravity line at capacity under pressure flow conditions; and (ii) maximum acceptable leachate discharge rate from the permanent lift station of 200 gpm. The flow capacity of the LTS gravity line under pressure flow conditions is larger than the maximum acceptable leachate discharge rate of 200 gpm (as illustrated in this calculation package). Therefore, the storm design flow rate for the LTS gravity line is 200 gpm.

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Gravity Flow Condition

The LTS gravity line flow capacity will be calculated using Manning's equation for pipes as follows:

$$Q_g = \frac{1.49 R_h^{0.67} i_p^{0.5} A_p}{n} \tag{1}$$

where: Q_g = pipe flow capacity (in English units); R_h = hydraulic radius (defined as the ratio of the flow area to the perimeter of the wetted area); i_p = hydraulic gradient (slope of the pipe); A_p = cross-sectional area of the as-built pipe; and n = Manning's roughness coefficient. The Manning's equation assumes steady uniform fully turbulent flow conditions.

Pressure Flow Condition

The LTS gravity line will flow under pressure if the flow rate in the line exceeds its capacity under the gravity-flow condition. The capacity of the line under the pressure-flow condition will be calculated using the following procedure:

$$Q = VA_p \tag{2}$$

where: Q = flow rate; V = average velocity of the liquid = Q/A_p; A_p = area of the as-built pipe.

The Darcy-Weisbach equation, typically presented as follows:

$$h_f = f \frac{L}{D} \frac{V^2}{2g} \tag{3}$$

is rearranged to solve for velocity as follows:

$$V = \sqrt{\frac{2gh_f D}{fL}} \tag{4}$$

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where: h_f = friction head in pipe = $Z_1 - Z_2$ (i.e., liquid elevation in Cell 1 - liquid elevation in the PLS); g = gravitational acceleration; D = minor axis diameter of as-built pipe; f = friction factor; and L = length of pipe.

The friction factor is obtained from the Moody diagram [Roberson/Crow, 1990] shown in Figure 2. Two terms are required to determine the friction factor: (i) a combination of the Darcy-Weisbach and Reynolds equations as presented below, and (ii) the relative roughness of the pipe. The first term is as follows:

$$\mathrm{Re}\, f^{1/2} = \frac{D^{3/2}}{\nu}\left(\frac{2gh_f}{L}\right)^{1/2} \tag{5}$$

where: Re = Reynolds number = DV/ν; and ν = kinematic viscosity of water.

The relative roughness curve to be used on the Moody Diagram is for a smooth pipe.

The pressure flow condition to be analyzed relates to flow of leachate contained in the Cell 1 impacted runoff catchment area through the LTS gravity line to the permanent lift station. It is anticipated that this flow rate will exceed the gravity flow rate capacity of the line and therefore the pipe will be under pressure. As presented in Figure 3, the friction loss in the fittings will be calculated using the equivalent pipe lengths method. The friction head loss due to fittings between Cell 1 and the permanent lift station includes: (i) two 6" butterfly valves; (ii) one 6" check valve; (iii) one 6" tee (branch); (iv) thirteen 6" tees (line); (v) three 6" 90° ells, and four 6" 45° elbows.

Annular Space Volume

The annular space volume was calculated to evaluate the volume of liquid that would be released to the containment pipe prior to detection in a manhole. The annular space was calculated as follows:

$$V_{as} = \frac{\pi}{4}(D_{10"}^2 - D_{6"}^2)L \tag{6}$$

where: V_{as} = Volume of annular space; $D_{10"}$ = inside diameter of 10 in. pipe; $D_{6"}$ = outside diameter of 6" pipe; and L = unit length of pipe.

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Client: Project: Project/Proposal No.: Task No.:

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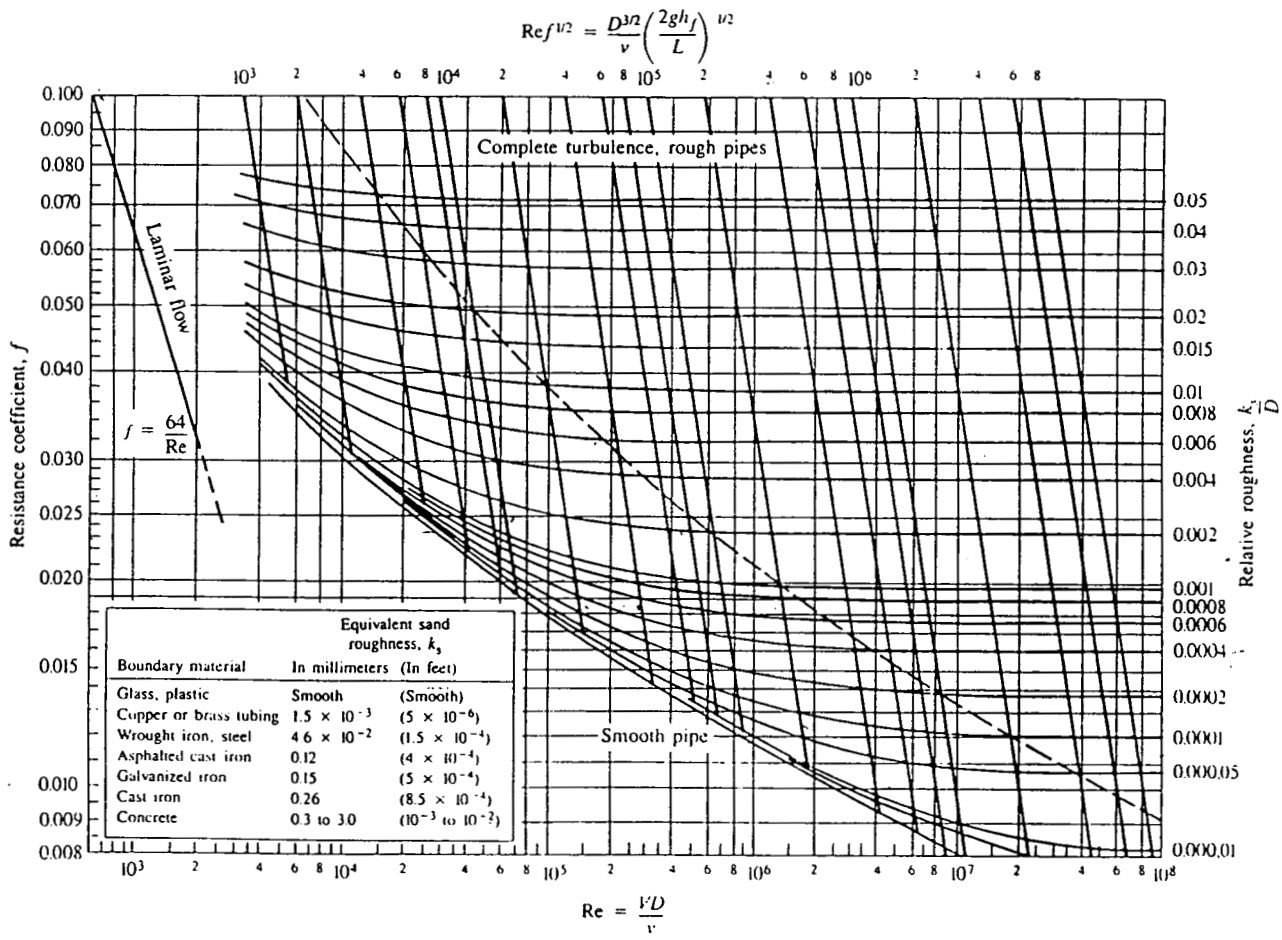
FIGURE 2

MOODY DIAGRAM



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Written By : Gina K. Martin Date: 03/25/99 Reviewed by: Brian D. Jacobson BDJ 4/1/99 Date: 03/31/99

Client: FDF Project: Fernald OSDF Project/Proposal No.: GQ0573 Task No.: 3.2

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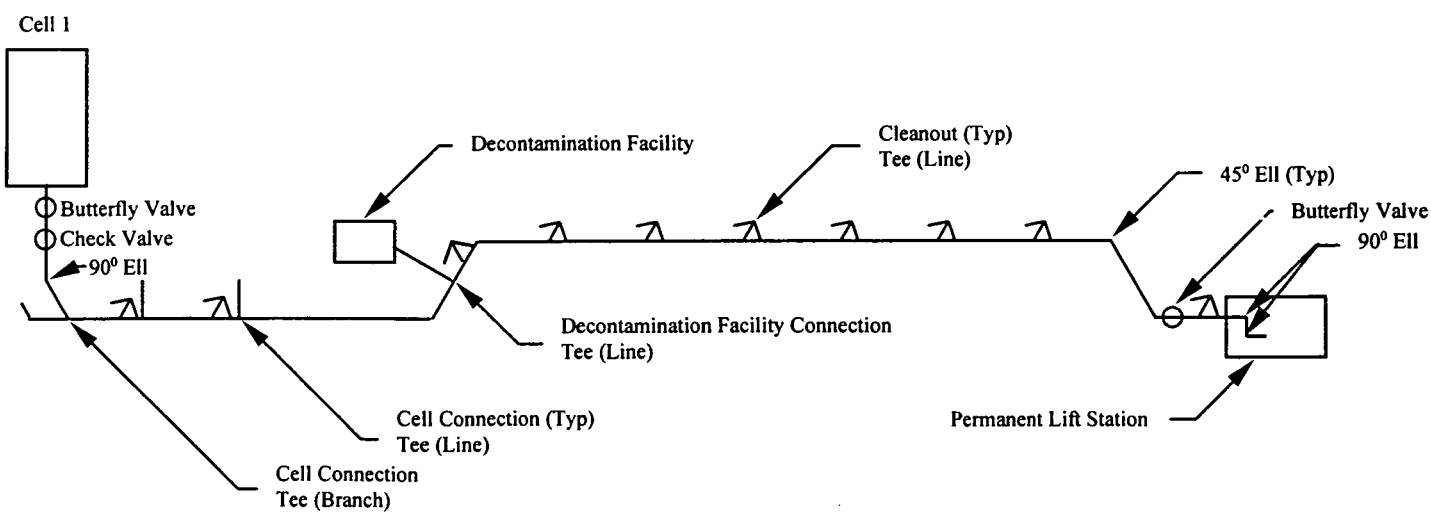
FIGURE 3
SCHEMATIC DIAGRAM
LOCATION OF FITTINGS



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Hydraulic Rupture of Carrier Pipe

The LTS gravity lines resistance to hydraulic rupture will be evaluated based on operation of the butterfly valve at the permanent lift station. The valve can be partially closed to restrict flow to the storm design basis flow rate or fully closed to store leachate after a storm event. The valve has a gear type operator that will limit the speed the valve can be closed. Calculations will be performed to evaluate the pressure due to the static head with the valve closed and the potential surge pressure due to rapid closing of the valve. Pressure changes in the pipe due to GKM changes in slope along the alignment of the pipe will also be evaluated. The static pressure with the valve closed is evaluated using the following equation:

$$FS_{hr} = \frac{2P_{rating}}{P_h} \tag{7}$$

where: FS_{shr} = factor of safety against hydraulic rupture; P_{rating} = pressure rating of the pipe material (which includes an integral factor of safety of 2); and P_h = hydraulic pressure in the pipe (taken as the hydraulic head multiplied by the unit weight of leachate; i.e., $(Z_1-Z_2)\,\gamma_w$).

The surge pressure is evaluated using the following equation:

$$FS_{shr} = \frac{2P_{rating}}{P_h + P_s} \tag{8}$$

where: FS_{shr} = factor of safety against hydraulic rupture; P_{rating} = pressure rating of the pipe material (which includes an integral factor of safety of 2); and P_h = hydraulic pressure in the pipe (taken as the hydraulic head multiplied by the unit weight of leachate; i.e., $(Z_1-Z_2)\,\gamma_w$), and P_s (1) = surge pressure calculated as follows:

(1) THIS CALCULATION FOR SURGE PRESSURE ASSUMES THE VALVE IS CLOSED RAPIDLY WHICH IS CONSERVATIVE FOR A WORM GEAR ACTUATOR.

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$$P_s = \frac{wSV}{g} \tag{9}$$

$$S = \sqrt{\frac{EE'}{\frac{w}{g}\left(E' + \frac{ED}{t}\right)}} \tag{10}$$

where: w = liquid weight; S = wave velocity; V[1] = liquid velocity change; g = acceleration of gravity; E = liquid bulk modulus; E' = pipe elastic modulus; and t = pipe wall thickness.

The pressure change in the carrier pipe due to the change in slope will be evaluated based on the profile of the pipe. The pipe profile is presented in Figures in Section 3 as 3-4a, 3-4b, and 3-4c. However, the pipe profile gradually decreases in slope towards the PLS. Thus, positive pressures would be maintained in the TGL along the alignment. Liquid separation and the resulting vacuum can occur only if the profile has significant increases in slope along the pipe alignment.

(1) THIS CALCULATION ASSUMES THE PIPE IS FLOWING FULL. THE LIQUID VELOCITY CHANGE IS CALCULATED ASSUMING A MAXIMUM FLOWRATE OF 200 gpm. THE FLOW MUST BE THROTTLED USING THE VALVES AT THE CELLS IN ORDER TO NOT EXCEED 200 gpm. THE MAXIMUM FLOW CAPACITY OF THE PIPE IS 366 gpm.

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Written By : Gina K. Martin Date: 3/25/99 Reviewed by: Brian D. Jacobson 4/1/99 Date: 3/31/99

Client: FDF Project: Fernald OSDF Project/Proposal No.: GQ0573 Task No.: 3.2

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LTS GRAVITY LINE STRUCTURAL STABILITY

Overview

Calculations will be performed to ensure the as-built LTS gravity line containment pipe is able to withstand the loads applied on it with an adequate factor of safety. Failure mechanisms that will be checked are: (i) wall crushing; (ii) constrained wall buckling; (iii) excessive ring deflection. Stresses applied on the LTS gravity line include those due to traffic and overburden materials. In addition, future-loading conditions to the LTS will be also evaluated. Plastic pipe can be designed to resist failure by the above mechanisms using design methods presented in the technical literature [Uni-Bell, 1991; Phillips 66, 1988, 1991, 1998; and Chevron, 1992].

The LTS gravity line will undergo stresses applied during construction and operation. The following two loading conditions are evaluated in this calculation package:

1. actual construction and overburden loads that were applied to the LTS gravity line;
2. future loading criteria for construction and operation of the On Site Disposal Facility (OSDF).

Construction loading conditions, including weight of trucks and depth of cover, were taken from construction records. The total stress on the pipe is calculated as the sum of the stresses applied by the overlying soil and the live load applied by an overpassing loaded truck. This stress can be calculated as described by ASCE [1979] as follows:

$$\sigma_{ic} = \gamma_p D_p + C_s \frac{PF_{ic}}{L_{ic} B_c} \tag{11}$$

where: σ_{ic} = stress on the pipe: γ_p = average unit weight of the overburden materials; D_p = thickness of the overburden materials; B_c = outer pipe diameter; C_s = load coefficient, which is a function of $B_c/(2D_p)$ and $L_{ic}/(2D_p)$; P = concentrated load; F_{ic} = impact factor accounting for dynamic loads; and L_{ic} = effective length of pipe, which is arbitrarily defined as follows by ASCE [1979]: L_{ic} = 3 ft if pipe is longer than 3 ft, and L_{ic} = actual pipe length if pipe is shorter than 3 ft.

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The following ~~Forward~~ calculations are performed to determine the allowable loading conditions for the as-built LTS gravity line for future construction and operation. Maximum traffic loads, minimum cover, are provided.

Wall Crushing

Wall crushing can occur when the stress in the pipe wall, due to external vertical pressure, exceeds the compressive strength of the pipe material. Wall crushing is evaluated for the containment pipe for various loading conditions relating to overburden and traffic loads. The factor of safety against pipe wall crushing for the containment may be calculated using the following equation:

$$FS_{wc} = \frac{2\sigma_y}{(SDR-1)\sigma_{max}} \tag{12}$$

where: FS_{wc} = factor of safety against pipe wall crushing; σ_y = compressive yield strength of the pipe; SDR = standard dimension ratio of the pipe; and σ_{max} = maximum stress applied to the pipe.

Constrained Wall Buckling

Constrained wall buckling, a longitudinal wrinkling in the pipe wall, can occur when the external vertical pressure exceeds the critical buckling pressure of the pipe/bedding aggregate system. The factor of safety against constrained pipe wall buckling may be calculated using the following equation:

$$FS_{cwb} = f_o \frac{1.2}{\sigma_{max}} \left[\frac{E'E}{(SDR)^3} \right]^{1/2} \tag{13}$$

where: FS_{cwb} = factor of safety against pipe constrained wall buckling; f_o = reduction factor due to ovality; σ_{max} = maximum stress applied to the containment pipe; E' = modulus of soil reaction for pipe bedding; E = modulus of elasticity of the pipe material; and SDR = standard dimension ratio of the pipe.

Excessive Ring Deflection 569

Ring deflection is the change in vertical diameter of the pipe as the pipe/bedding aggregate system deforms under the external vertical pressure. The actual ring deflection of the pipe must be less

than the allowable ring deflection of the pipe. The factor of safety against excessive ring deflection may be calculated using the following equation:

$$FS_{RD} = \frac{\Delta_R E'}{100\sigma_{max}} \tag{14}$$

where: Δ_R = allowable ring deflection in percent; E' = modulus of soil reaction for pipe bedding; and σ_{max} = maximum stress applied to the pipe. The allowable ring deflection of the pipe will be obtained from the manufacturers and technical literature.

LTS GRAVITY LINE FROST PROTECTION

Analyses included in the "Liner System Frost Protection" Calculations Package [GeoSyntec, 1997] are applicable to the LTS gravity line. In that package, estimates were made of the minimum thickness of protective soil needed to provide frost protection of the clay liner. Recommendations were made that a 2-ft thick layer of a clayey or silty material or a 3-ft thick layer of gravel is adequate to provide frost protection. These recommendations will also be used for the LTS gravity line. Because the LTS gravity line will be more than 3 ft below the ground surface, the line is adequately protected from frost. Therefore, no additional calculations will be performed in this package.

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REFERENCES

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Client: FDF Project: Fernald OSDF Project/Proposal No.: GQ0573 Task No.: 3.2

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APR 1 1999

LEACHATE TRANSMISSION SYSTEM (LTS)
GRAVITY LINE DESIGN
EVALUATION OF EXISTING CONDITIONS

DATA VERIFICATION

The LTS gravity line is a dual containment pipe with the inner pipe being a 6-in. diameter HDPE SDR-26 pipe and the outer pipe being a 10-in. diameter HDPE SDR-26 pipe. The as-built LTS gravity line carrier pipe has undergone some deflection changing the physical dimensions to be more of an elliptical shape. The deformation in the pipe will affect the flow capacity due to a change in the hydraulic radius. Because the carrier pipe is not subjected to external loads, the structural stability is not evaluated herein.

The flow capacity of the inner pipe will be calculated in accordance with the methods described in the "Calculation Procedures" section of this package. The characteristics of the 6-in. diameter carrier pipe required to calculate its flow capacity under gravity and pressure conditions are as listed below in Table 2. Additionally, data required to calculate the factor of safety against pressure rupture of the carrier pipe are provided. Detailed information for the parameters listed below are provided in the "Calculation Results". Values for the Revision 0 design (SDR 11) are included for completeness.

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Client: FDF Project: Fernald OSDF Project/Proposal No.: GQ0573 Task No.: 3.2

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Table 2. Flow Capacity Data for LTS Gravity Line

	Revision 0 LTS (SDR 11)	As-Built LTS (SDR26)	Reference
Inner diameter-6", B_I (in)	5.421	See Table 4	Driscopipe, 1998
Outer diameter-6", $D_{6"}$(in)	5.421	6.625	Driscopipe, 1998
Inner diameter-10", $D_{10"}$(in)	8.796	9.924	Driscopipe, 1998
Hydraulic radius, R_h(in)	1.36	See Table 4	N/A
Cross-sectional Area, A_p(in^2)	23.1	See Table 4	N/A
Hydraulic gradient, i_p	0.5 %	0.58 %	Figures 3-4a, 3-4b, 3-4c
Manning's coeff., n (s/m $^{0.33}$)	0.013	0.013 (1)	Driscopipe, 1998
Active flow rate, Q_{ao}(gpd)	22,803	22,803	Leachate Generation Rates, Revision 0
Post closure flow rate, Q_{pc} (gpd)	1.4	1.4	Leachate Generation Calculation Package, Revision 0
Pipe length, L (ft)	3780	3780	Design Drawings
Storm flow rate, Q_s (gpm)	200	200	Design Criteria Package
Max elevation, Z_1(ft)	610	610	Design Drawings
Min elevation, Z_2(ft)	575	575	Design Drawings
Kinematic viscosity of water at 40°F (ft^2/s)	1.66 x 10^{-5}	1.66 x 10^{-5}	N/A
Head losses from fittings in terms of pipe diameter, D			Driscopipe, 1998
6" butterfly valve	40D	40D	Driscopipe, 1998
6" check valve	100D	100D	Driscopipe, 1998
6" tee, branch	50D	50D	Driscopipe, 1998
6" tee, line	20D	20D	Driscopipe, 1998
6" 90° elbow	30D	30D	Driscopipe, 1998
Pipe pressure rating, P_{rating} (psi)	150	65	Driscopipe, 1998

NOTE 1. MANNINGS "N" CONSERVATIVELY ASSUMED TO BE 0.013 INSTEAD OF THE TYPICAL VALUE OF 0.009 TO ACCOUNT FOR LONG TERM SCALING AND BIOFOULING DURING 200-yr DESIGN LIFE.

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GKM 15 APRIL 1999

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The structural stability of the containment pipe will be calculated in accordance with the methods described in the "Calculation Procedures" section of this package. The characteristics of the 10-in. diameter containment pipe required to evaluate structural stability are as listed below. Detailed information for the parameters listed below are provided in the "Calculation Results". Values for the Revision 0 design (SDR 11) are included for completeness.

Table 3. Structural Stability Evaluation Data for the LTS Gravity Line

	Revision 0 LTS (SDR 11)	As-Built LTS (SDR 26)	Reference
Outer diameter, 10-in., B_c (in.)	10.75	10.75	Driscopipe, 1998
Wall thickness, 10-in., t (in.) 6-in	0.977	0.413 0.255	Chevron, 1992 DRISCOPIPE 1996
Pipe modulus of elasticity, E (psi)			
Short Term	150,000	150,000	Driscopipe, 1998
Long Term	19,027	See Figure 4	Driscopipe, 1994
Water modulus of elasticity, E (psi)	320,000	320,000	N/A
Pipe compressive yield strength, σ_y (psf)	216,000	216,000	Driscopipe, 1998
Modulus of soil reaction, E' (psf)	432,000	432,000	Driscopipe, 1998
Impact factor, F_{ic}	1.5	1.5	Driscopipe, 1998
Load Coefficient, C_s	0.015	See Table 5	ASCE, 1979/Driscopipe 1992
Effective pipe length, L_{ic}	3 ft	3 ft	ASCE, 1979
Unit weight of overburden materials, γ_p (pcf.)	125	125	Design Criteria Package
Max thickness of overburden materials, D_p	8	10	Design Drawings at Station 22+50
Concentrated load, P (lbs)	20,000	Table 1	Construction Documentation
Reduction of Allowable Buckling Pressure due to Ovality, f	N/A	0.68	Chevron, 1992
Allowable ring deflection (%)	2.7	6.5	Driscopipe, 1998

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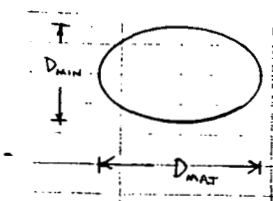
TABLE 4
PIPE INSIDE DIAMETER, HYDRAULIC RADIUS, AND CROSS-SECTIONAL AREA
SDR-26 PIPE

Deflection Percent (%)	Major Diameter (in)	Minor Diameter (in)	Hydraulic Radius (ft)	Wetted Perimeter (ft)	Area (ft^2)
0%	6.115	6.115	0.1274	1.6009	0.2039
1%	6.176	6.054	0.1274	1.6009	0.2039
2%	6.235	5.993	0.1273	1.6009	0.2038
3%	6.293	5.932	0.1272	1.6009	0.2036
4%	6.350	5.870	0.1270	1.6009	0.2033
5%	6.406	5.809	0.1268	1.6009	0.2030
6%	6.461	5.748	0.1265	1.6009	0.2026
7%	6.515	5.687	0.1262	1.6009	0.2021
8%	6.568	5.626	0.1259	1.6009	0.2015
9%	6.620	5.565	0.1255	1.6009	0.2009
10%	6.671	5.504	0.1251	1.6009	0.2002
12%	6.770	5.381	0.1241	1.6009	0.1987
14%	6.865	5.259	0.1230	1.6009	0.1969
16%	6.957	5.137	0.1217	1.6009	0.1949
18%	7.046	5.014	0.1204	1.6009	0.1927
20%	7.131	4.892	0.1189	1.6009	0.1903
22%	7.214	4.770	0.1172	1.6009	0.1877
24%	7.293	4.647	0.1155	1.6009	0.1849
26%	7.370	4.525	0.1136	1.6009	0.1819
28%	7.443	4.403	0.1116	1.6009	0.1787
30%	7.514	4.281	0.1096	1.6009	0.1754
32%	7.583	4.158	0.1074	1.6009	0.1720
34%	7.648	4.036	0.1052	1.6009	0.1684
36%	7.712	3.914	0.1028	1.6009	0.1646
38%	7.773	3.791	0.1004	1.6009	0.1607
40%	7.831	3.669	0.0979	1.6009	0.1567
42%	7.887	3.547	0.0953	1.6009	0.1526
44%	7.941	3.424	0.0926	1.6009	0.1483
46%	7.993	3.302	0.0899	1.6009	0.1439
48%	8.042	3.180	0.0871	1.6009	0.1395
50%	8.089	3.058	0.0843	1.6009	0.1349



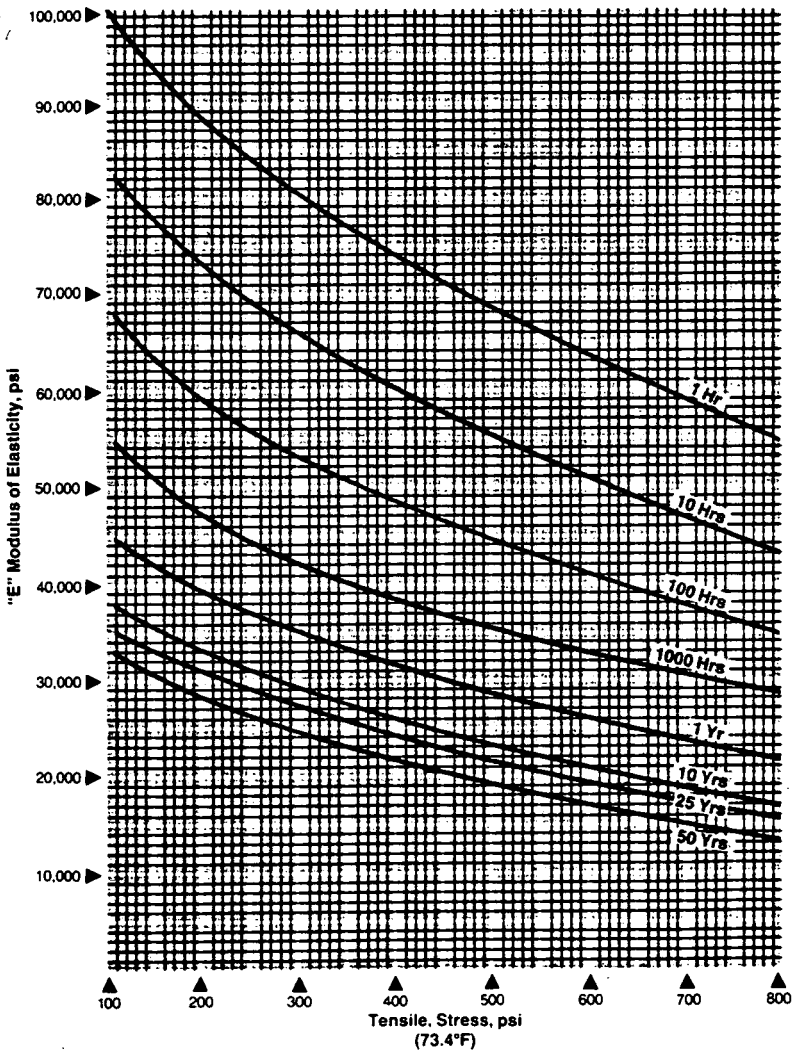
$$\text{AREA} = \frac{\pi}{4}(D_{MAJ})(D_{MIN})$$

$$\text{CIRCUMFERENCE} = 2\pi\sqrt{\frac{\left(\frac{D_{MAJ}}{2}^2 + \frac{D_{MIN}}{2}^2\right)}{2}}$$

FOR FULL PIPE FLOW $\rightarrow R_h = \frac{\text{AREA}}{\text{CIRCUMFERENCE}}$

FIGURE 4

Time Dependent Modulus of Elasticity for Polyethylene Pipe vs. Stress Intensity (73.4°F)



NOTE: The short term modulus of elasticity of Driscopipe per ASTM D 638 is approximately 100,000 psi. Due to the cold flow (creep) characteristic of the pipe material, this modulus is dependent upon the stress intensity and the time duration of the applied stress.

Source: Drisco, 1991

TENSILE STRESS $= S_A = \frac{(SDR - 1)}{2} P_T$

WHERE P_T = Applied Load

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TABLE 5
LOAD COEFFICIENT

$B_c/(2D_p)$	$L_{ic}/(2D_p)$						
	0.1	0.2	0.3	0.4	0.5	0.6	0.7
0.1	0.019	0.037	0.053	0.067	0.079	0.089	0.097
0.2	0.037	0.072	0.103	0.131	0.155	0.174	0.189
0.3	0.053	0.103	0.149	0.190	0.224	0.252	0.274
0.4	0.067	0.131	0.190	0.241	0.284	0.320	0.349
0.5	0.079	0.155	0.224	0.284	0.336	0.379	0.414
0.6	0.089	0.174	0.252	0.320	0.379	0.428	0.467
0.7	0.097	0.189	0.274	0.349	0.414	0.467	0.511
0.8	0.103	0.202	0.292	0.373	0.441	0.499	0.546
0.9	0.108	0.211	0.306	0.391	0.463	0.524	0.574
1.0	0.112	0.219	0.318	0.405	0.481	0.544	0.597
1.2	0.117	0.229	0.333	0.425	0.505	0.572	0.628
1.5	0.121	0.238	0.346	0.442	0.525	0.596	0.655
2.0	0.124	0.244	0.355	0.454	0.540	0.613	0.674
20.0	0.127	0.248	0.361	0.462	0.550	0.625	0.688
	0.8	0.9	1.0	1.2	1.5	2.0	20.0
0.1	0.103	0.108	0.112	0.117	0.121	0.124	0.127
0.2	0.202	0.211	0.219	0.229	0.238	0.244	0.248
0.3	0.292	0.306	0.318	0.333	0.346	0.355	0.361
0.4	0.373	0.391	0.405	0.425	0.442	0.454	0.462
0.5	0.441	0.463	0.481	0.505	0.525	0.540	0.550
0.6	0.499	0.524	0.544	0.572	0.596	0.613	0.625
0.7	0.546	0.574	0.597	0.628	0.655	0.674	0.688
0.8	0.584	0.615	0.639	0.674	0.703	0.725	0.740
0.9	0.615	0.647	0.673	0.711	0.743	0.766	0.783
1.0	0.639	0.673	0.701	0.740	0.775	0.800	0.818
1.2	0.674	0.711	0.740	0.783	0.821	0.849	0.871
1.5	0.703	0.743	0.775	0.821	0.863	0.895	0.920
2.0	0.725	0.766	0.800	0.849	0.895	0.930	0.960
20.0	0.740	0.783	0.818	0.871	0.920	0.960	1.000

Source: Plexco Engineering Manual, 1992

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Client: Project: Project/Proposal No.: Task No.:

LEACHATE TRANSMISSION SYSTEM (LTS)
GRAVITY LINE DESIGN
EVALUATION OF EXISTING CONDITIONS

GKM APR 1 1999

CALCULATION RESULTS

LTS GRAVITY LINE FLOW CAPACITY

GRAVITY FLOW CONDITIONS

$$Q_g = \frac{1.49 R_h^{0.66} i_p^{0.5} A_p}{n}$$ <MAX CAPACITY FOR GRAVITY>

- R_h and A_p taken from Table 4 for 20% deflection

$$Q_g = \frac{(1.49)(0.1189)^{0.67}(0.0058)^{0.5}\ 0.1903}{0.013} = 0.399\ ft^3/sec$$

$$\boxed{Q_g = 179\ gpm}$$ <SEE TABLE 6 FOR VARIOUS DEFLECTION>

Q_{AO} = BASELINE DESIGN FLOW RATE DURING ACTIVE OPERATION

= 15.8 gpm

$$FS = \frac{Q_g}{Q_{AO}} = \frac{179\ gpm}{15.8\ gpm} = 11.3 > 3 \therefore OK$$

Q_{pc} = BASELINE FLOW FOR POST CLOSURE = 9.7×10^{-4} gpm

$$FS = \frac{Q_g}{Q_{pc}} = \frac{179\ gpm}{9.7 \times 10^{-4}\ gpm} = 1.84 \times 10^5 > 10 \therefore OK$$

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TABLE 6

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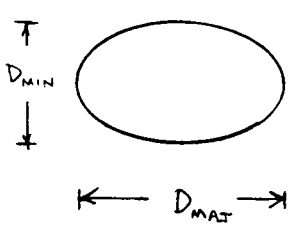
Elliptical Pipe Gravity Flow Analysis
SDR-26 HDPE Pipe

Inputs			
Pipe ID (in)	Slope (ft/ft)	Mannings (-)	Design Flow (gpm)
6.115	0.0058	0.013	15.8

Analysis Results										
Deflection Percent (%)	Major Diameter (in)	Minor Diameter (in)	Area (in^2)	Ovality Ratio (-)	Pipe Velocity (fps)	Flow Capacity (gpm)	Hydraulic Radius (ft)	Wetted Perimeter (ft)	Area (ft^2)	Factor of Safety (-)
0%	6.115	6.115	29.369	1.00	2.20	201.6	0.1274	1.6009	0.2039	12.8
1%	6.176	6.054	29.363	0.98	2.20	201.6	0.1274	1.6009	0.2039	12.8
2%	6.235	5.993	29.346	0.96	2.20	201.4	0.1273	1.6009	0.2038	12.7
3%	6.293	5.932	29.317	0.94	2.20	201.0	0.1272	1.6009	0.2036	12.7
4%	6.350	5.870	29.278	0.92	2.20	200.6	0.1270	1.6009	0.2033	12.7
5%	6.406	5.809	29.229	0.91	2.20	200.0	0.1268	1.6009	0.2030	12.7
6%	6.461	5.748	29.169	0.89	2.19	199.3	0.1265	1.6009	0.2026	12.6
7%	6.515	5.687	29.099	0.87	2.19	198.5	0.1262	1.6009	0.2021	12.6
8%	6.568	5.626	29.020	0.86	2.19	197.6	0.1259	1.6009	0.2015	12.5
9%	6.620	5.565	28.931	0.84	2.18	196.6	0.1255	1.6009	0.2009	12.4
10%	6.671	5.504	28.834	0.83	2.18	195.5	0.1251	1.6009	0.2002	12.4
12%	6.770	5.381	28.611	0.79	2.16	193.0	0.1241	1.6009	0.1987	12.2
14%	6.865	5.259	28.355	0.77	2.15	190.2	0.1230	1.6009	0.1969	12.0
16%	6.957	5.137	28.067	0.74	2.14	186.9	0.1217	1.6009	0.1949	11.8
18%	7.046	5.014	27.748	0.71	2.12	183.4	0.1204	1.6009	0.1927	11.6
20%	7.131	4.892	27.399	0.69	2.10	179.6	0.1189	1.6009	0.1903	11.4
22%	7.214	4.770	27.023	0.66	2.08	175.5	0.1172	1.6009	0.1877	11.1
24%	7.293	4.647	26.620	0.64	2.06	171.2	0.1155	1.6009	0.1849	10.8
26%	7.370	4.525	26.191	0.61	2.04	166.6	0.1136	1.6009	0.1819	10.5
28%	7.443	4.403	25.738	0.59	2.02	161.8	0.1116	1.6009	0.1787	10.2
30%	7.514	4.281	25.262	0.57	1.99	156.9	0.1096	1.6009	0.1754	9.9
32%	7.583	4.158	24.764	0.55	1.97	151.7	0.1074	1.6009	0.1720	9.6
34%	7.648	4.036	24.244	0.53	1.94	146.5	0.1052	1.6009	0.1684	9.3
36%	7.712	3.914	23.704	0.51	1.91	141.1	0.1028	1.6009	0.1646	8.9
38%	7.773	3.791	23.144	0.49	1.88	135.5	0.1004	1.6009	0.1607	8.6
40%	7.831	3.669	22.566	0.47	1.85	130.0	0.0979	1.6009	0.1567	8.2
42%	7.887	3.547	21.970	0.45	1.81	124.3	0.0953	1.6009	0.1526	7.9
44%	7.941	3.424	21.358	0.43	1.78	118.6	0.0926	1.6009	0.1483	7.5
46%	7.993	3.302	20.729	0.41	1.75	112.8	0.0899	1.6009	0.1439	7.1
48%	8.042	3.180	20.084	0.40	1.71	107.0	0.0871	1.6009	0.1395	6.8
50%	8.089	3.058	19.425	0.38	1.67	101.2	0.0843	1.6009	0.1349	6.4



$$\text{AREA} = \frac{\pi}{4}(D_{MAJ})(D_{MIN})$$

$$\text{CIRCUMFERENCE} = 2\pi\sqrt{\frac{\left(\frac{D_{MAJ}}{2}^2 + \frac{D_{MIN}}{2}^2\right)}{2}}$$

FOR FULL PIPE FLOW $\Rightarrow R_h = \frac{\text{AREA}}{\text{CIRCUMFERENCE}}$

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Client: Project: Project/Proposal No.: Task No.:

PRESSURE FLOW CONDITIONS

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PIPE LENGTH:

CELL 1	TO	MH #1	150 ft
MH #1	TO	MH #2	800 ft
MH #3	TO	PLS	2830 ft
			3780 ft

EQUIVALENT LENGTH OF FITTINGS:

$= 2 \times 40D + 1 \times 100D + 1 \times 50D + 13 \times 20D + 3 \times 30D + 4 \times 18D = 652D$

$= 652 \left(\frac{6.115 \text{ in}}{12 \text{ in/ft}} \right) = 332 \text{ ft}$

TOTAL EQUIVALENT LENGTH $= 3780 \text{ ft} + 332 \text{ ft} = 4112 \text{ ft}$

FOR DEFLECTION = 20% <AVERAGE VALUE>

$$Re\, f^{1/2} = \frac{D^{3/2}}{\nu} \left(\frac{2 g h_f}{L} \right)^{1/2}$$

$D_{20\%} = 4.892 \text{ in} = 0.408 \text{ ft}$

$A_{20\%} = 27.399 \text{ in}^2 = 0.1903 \text{ ft}^2$

$$Re\, f^{1/2} = \frac{(0.408 \text{ ft})^{3/2}}{1.66 \text{ E-5 ft}^2/\text{sec}} \left[\frac{(2)(32.2 \text{ ft/s}^2)(610 - 575)}{4112} \right]^{1/2}$$

$= 1.16 \times 10^4$

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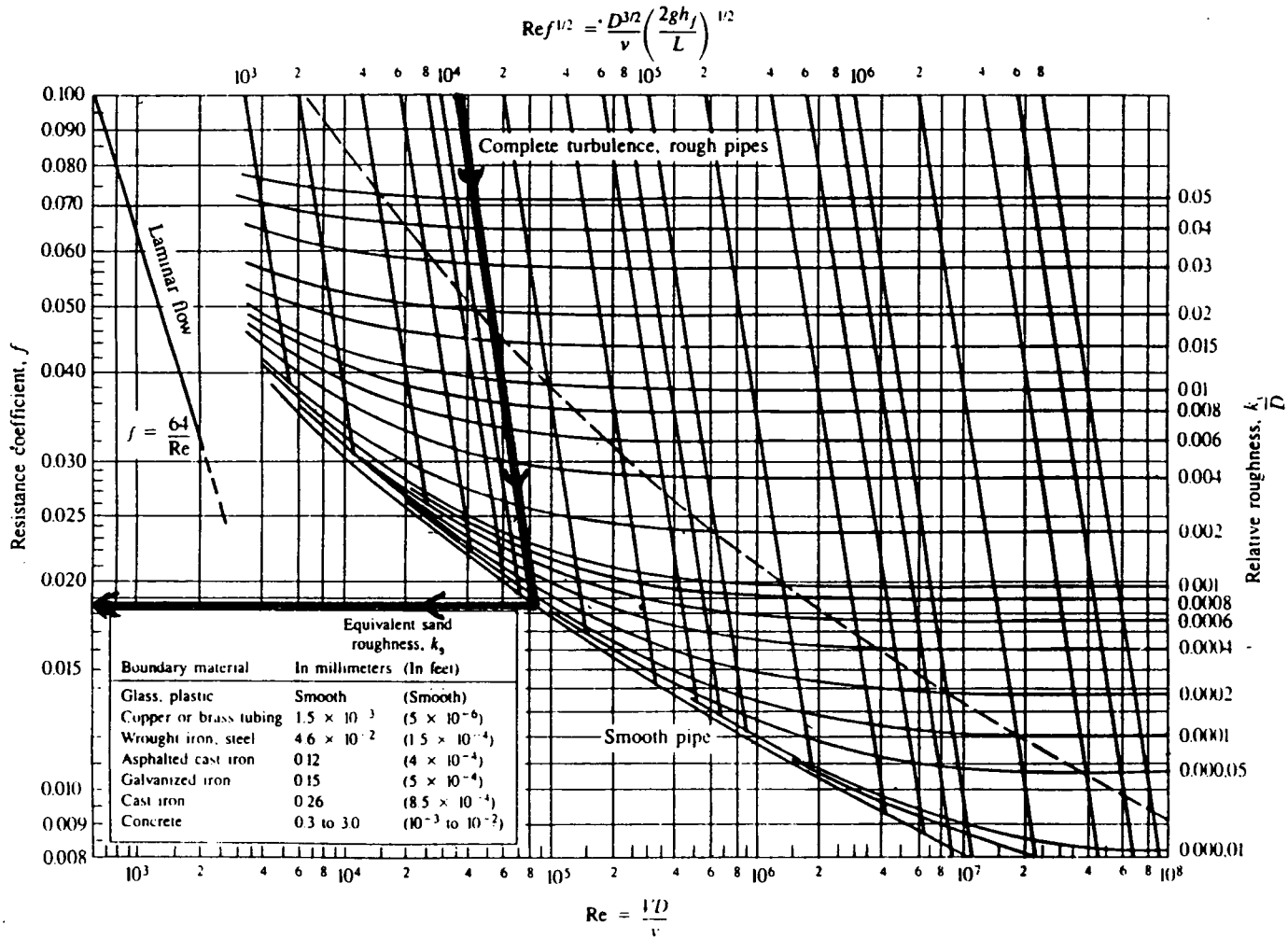
FIGURE 5
MOODY DIAGRAM



Source: Roberson/Crow, 1990

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PRESSURE FLOW CON'T

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k_s/D = SMOOTH CURVE ON MOODY DIAGRAM

FROM MOODY DIAGRAM $\Rightarrow f = 0.018$ (FIGURE 5)

$$V = \sqrt{\frac{2g h_f D}{f L}} = \sqrt{\frac{(2)(32.2\ ft/s^2)(610' - 575')(0.408')}{(0.018)(4112)}}$$

$V = 3.5\ ft/sec$

$Q_p = VA = (3.5\ ft/sec)(0.1903\ ft^2) = 0.67\ ft^3/sec$

$Q_p = 299\ gpm$

Q_s = STORM DESIGN BASIS FLOW RATE = 200 gpm

$$FS_p = \frac{Q_p}{Q_s} = \frac{299\ gpm}{200\ gpm}$$

FS = 1.5 <SEE TABLE 7 FOR VARIOUS DEFLECTION FS>

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TABLE 7

Elliptical Pipe Pressure Flow Analysis
SDR-26 HDPE Pipe

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Inputs		
Pipe ID (in)	Design Flow (gpm)	Length (ft)
6.115	200.0	4112

Analysis Results										
Deflection Percent (%)	Major Diameter (in)	Minor Diameter (in)	Area (in^2)	Ovality Ratio (-)	Pipe Velocity (fps)	Flow Capacity (gpm)	Reynolds Number (-)	Friction Factor (-)	Head Loss (ft)	Factor of Safety (-)
0%	6.115	6.115	29.369	1.00	4.0	366	1.2E+05	0.0175	35.00	1.83
1%	6.176	6.054	29.363	0.98	4.0	363	1.2E+05	0.0175	35.00	1.82
2%	6.235	5.993	29.346	0.96	3.9	361	1.2E+05	0.0176	35.00	1.80
3%	6.293	5.932	29.317	0.94	3.9	358	1.2E+05	0.0177	35.00	1.79
4%	6.350	5.870	29.278	0.92	3.9	355	1.1E+05	0.0177	35.00	1.78
5%	6.406	5.809	29.229	0.91	3.9	352	1.1E+05	0.0178	35.00	1.76
6%	6.461	5.748	29.169	0.89	3.8	349	1.1E+05	0.0178	35.00	1.74
7%	6.515	5.687	29.099	0.87	3.8	345	1.1E+05	0.0179	35.00	1.73
8%	6.568	5.626	29.020	0.86	3.8	342	1.1E+05	0.0180	35.00	1.71
9%	6.620	5.565	28.931	0.84	3.8	338	1.0E+05	0.0180	35.00	1.69
10%	6.671	5.504	28.834	0.83	3.7	335	1.0E+05	0.0181	35.00	1.67
12%	6.770	5.381	28.611	0.79	3.7	327	9.9E+04	0.0183	35.00	1.64
14%	6.865	5.259	28.355	0.77	3.6	319	9.5E+04	0.0184	35.00	1.60
16%	6.957	5.137	28.067	0.74	3.6	311	9.2E+04	0.0186	35.00	1.56
18%	7.046	5.014	27.748	0.71	3.5	303	8.8E+04	0.0187	35.00	1.51
20%	7.131	4.892	27.399	0.69	3.4	294	8.5E+04	0.0189	35.00	1.47
22%	7.214	4.770	27.023	0.66	3.4	285	8.1E+04	0.0190	35.00	1.42
24%	7.293	4.647	26.620	0.64	3.3	276	7.8E+04	0.0192	35.00	1.38
26%	7.370	4.525	26.191	0.61	3.3	267	7.4E+04	0.0194	35.00	1.33
28%	7.443	4.403	25.738	0.59	3.2	257	7.1E+04	0.0196	35.00	1.29
30%	7.514	4.281	25.262	0.57	3.1	248	6.8E+04	0.0198	35.00	1.24
32%	7.583	4.158	24.764	0.55	3.1	238	6.4E+04	0.0200	35.00	1.19
34%	7.648	4.036	24.244	0.53	3.0	229	6.1E+04	0.0202	35.00	1.14
36%	7.712	3.914	23.704	0.51	3.0	219	5.8E+04	0.0204	35.00	1.09
38%	7.773	3.791	23.144	0.49	2.9	209	5.5E+04	0.0206	35.00	1.05
40%	7.831	3.669	22.566	0.47	2.8	200	5.2E+04	0.0208	35.00	1.00
42%	7.887	3.547	21.970	0.45	2.8	190	4.9E+04	0.0211	35.00	0.95
44%	7.941	3.424	21.358	0.43	2.7	180	4.7E+04	0.0213	35.00	0.90
46%	7.993	3.302	20.729	0.41	2.6	171	4.4E+04	0.0216	35.00	0.85
48%	8.042	3.180	20.084	0.40	2.6	161	4.1E+04	0.0219	35.00	0.81
50%	8.089	3.058	19.425	0.38	2.5	152	3.9E+04	0.0222	35.00	0.76

NOTE THAT FLOW FROM CELL 2 OR 3 WOULD BE GREATER THAN FROM CELL 1 DUE TO SHORTER PIPE LENGTHS.

FOR EXAMPLE: CELL 1 → PLS AVERAGE HEAD LOSS = $\frac{35'}{4112'}$ = 0.0085 ft/ft

DISTANCE FROM CELL 1 → CELL 3 = 800 FT

800 FT × 0.0085 ft/ft = 6.8 FT OF HEADLOSS

ELEVATION DIFFERENCE CELL 1 → CELL 3 = 6 FT

THEREFORE FLOW WILL BE LARGER FOR LATTER CELLS

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ANNULAR SPACE VOLUME CALCULATION

ID 10" PIPE = 9.924" = 0.827'

ID 6" PIPE = 6.625" = 0.552'

$$V_A = \frac{\pi}{4}\left(D_{10''}^2 - D_{6''}^2\right) \times 1' = \frac{\pi}{4}\left((0.827')^2 - (0.552')^2\right) = \boxed{0.298\ ft^3/ft}$$

FACTOR OF SAFETY AGAINST HYDRAULIC RUPTURE

$$FS = \frac{2Pr}{(z_1 - z_2)\gamma_w} = \frac{(2)(65\,psi)(144\,in^2/ft^2)}{(610' - 575')(62.4\,pcf)}$$

$$\boxed{FS = 8.6}$$

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Written by: BDJ Date: / / Reviewed by: GKM BDJ 4/1/99 Date: / /

Client: Project: Project/Proposal No.: Task No.:

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Hydraulic Rupture of Carrier Pipe

Static Head

$$P_h = (Z_1 - Z_2)\gamma_w = (610-575)\,ft \cdot 62.4\,\frac{lb}{ft^3} \cdot \frac{1\,ft^2}{144\,in^2} = 15.2\,psi$$

$$FS_{hr} = \frac{2\,P_{rating}}{P_h} = \frac{2\,(65)}{15.2} = 8.2$$

Surge Pressure

$$P_h = 15.2\,psi$$

$$P_s = \frac{\gamma_w}{g} S V \qquad S = \sqrt{\frac{E E'}{\frac{\gamma_w}{g}\left(E' + \frac{E D}{t}\right)}}$$

$$S = \sqrt{\frac{(320{,}000)(144)(150{,}000)(144)}{\frac{62.4}{32.2}\left(150{,}000(144) + \frac{320{,}000(144)\,\frac{6.115}{12}}{\frac{0.255}{12}}\right)}}$$

$$S = 675.2$$

$$V = \frac{Q}{A} = \frac{200\,gpm / 7.481\,\frac{g}{ft^3} / 60\,\frac{sec}{min}}{\frac{\pi}{4}\left(\frac{6.115}{12}\right)^2} = 2.18\,ft/s$$

$$P_s = \frac{62.4}{32.2}(675.2)(2.18)\,\frac{1\,ft^2}{144\,in^2} = 19.8\,psi$$

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[* NOTE: FLOWRATE OF 200 gpm assumes flow is throttled back at cells. Pressure flow capacity of pipe is 366 gpm (TABLE 7). ASSUMES PIPE IS FLOWING FULL.]

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$$F_{S_{shr}} = \frac{2 \cdot P_{rating}}{P_h + P_s}$$

$$= \frac{2\,(65)}{15.2 + 19.8} = 3.7$$

Actual Factor of Safety will be higher because valve at PLS closes slowly due to worm gear actuator.

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STRUCTURAL STABILITY

$$\sigma_{max} = \gamma_p D_p + \frac{C_s P F_{ic}}{L_{ic} B_c}$$

<HAND CALC. FOR 3' OF FILL SEE TABLE 8 FOR VARIOUS COVER DEPTH>

$$= (125\,pcf)(3') + \frac{(0.117)(40{,}000\,lbs)(1.5)}{(3')(10.75\,in)(1\,ft/12\,in)}$$

$$\sigma_{max} = 2{,}987\ psf$$

FACTOR OF SAFETY AGAINST WALL CRUSHING

$$FS_{wc} = \frac{(2)(\sigma_y)}{(SDR-1)\,\sigma_{max}} = \frac{(2)(216{,}000\,psf)}{(26-1)(2{,}987\,psf)}$$

$$\boxed{FS_{wc} = 5.8}$$

FACTOR OF SAFETY AGAINST WALL BUCKLING

$$FS_{wb} = f_o \frac{1.2}{\sigma_{max}} \left[\frac{E'E}{(SDR)^3}\right]^{1/2} = (0.68)\frac{1.2}{2{,}987\,psf}\left[\frac{4.32\times10^5\,psi \times 4.46\times10^6\,psf}{(26)^3}\right]^{1/2}$$

$$\boxed{FS_{wb} = 2.6}$$

FACTOR OF SAFETY AGAINST RING DEFLECTION

$$FS_{RD} = \frac{\Delta R\, E'}{100\,\sigma_{max}} = \frac{(6.5)(432{,}000\,psf)}{(100)(2{,}986\,psf}$$

$$\boxed{FS_{wb} = 9.4}$$

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Table 8
Structural Stability Analyses

Pipe Properties

SDR	26	
D_{od}	0.896	ft
I	0.00587	$in.^4/in.$
t_{avg}	0.413	in.
E	varies	psi
σ_y	1500	psi

Input Variables

γ_{avg}	125	pcf
P=	40000	lbs
Fic=	1.5	
Lic=	3	ft
E'	3000	psi

Cover Depth (feet)	Cs	Static Load (psi)	Live Load (psi)	Total Load (psi)	Sa (Compressive Stress, psi)	E[1] (psi)	FS Crushing	FS Buckling	FS Ring Deflection
3	0.117	2.60	18	20.7	259	26,500	5.8	2.6	9.4
4	0.067	3.47	10	13.9	173	29,000	8.7	4.1	14.1
5	0.053	4.34	8	12.6	157	30,500	9.6	4.7	15.5
6	0	5.21	0	5.2	65	33,000	23.0	11.8	37.4
7	0	6.08	0	6.1	76	33,000	19.7	10.1	32.1
8	0	6.94	0	6.9	87	33,000	17.3	8.8	28.1
9	0	7.81	0	7.8	98	33,000	15.4	7.8	25.0
10	0	8.68	0	8.7	109	33,000	13.8	7.1	22.5
11	0	9.55	0	9.5	119	33,000	12.6	6.4	20.4
12	0	10.42	0	10.4	130	33,000	11.5	5.9	18.7
13	0	11.28	0	11.3	141	31,000	10.6	5.3	17.3
14	0	12.15	0	12.2	152	30,500	9.9	4.8	16.0
15	0	13.02	0	13.0	163	30,000	9.2	4.5	15.0
25	0	21.70	0	21.7	271	25,500	5.5	2.5	9.0

Notes:

1. Elastic modulus of pipe taken from 50 yr. Curve at given stress.

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APPENDIX H

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APPENDIX H
RELATED ASTM STANDARDS

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ASTM F1041

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Designation: F 1041 - 92

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Standard Guide for Squeeze-Off of Polyolefin Gas Pressure Pipe and Tubing[1]

This standard is issued under the fixed designation F 1041; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide describes general procedures for squeeze-off of polyolefin gas pressure pipe and tubing. Pipe and squeeze tool manufacturers should be requested to supply specific recommendations for squeeze-off with their materials or products.

1.2 Governing codes and project specifications should be consulted. Nothing in this document should be construed as recommending practices or systems at variance with governing codes and project specifications.

1.3 This guide covers squeeze-off of polyolefin pipe and tubing in accordance with Specification D 2513.

1.4 Where applicable in this guide, "pipe" shall mean "pipe and tubing".

1.5 The values as stated in inch-pound units are to be regarded as the standard. The values in parentheses are given for information only.

1.6 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Document

2.1 *ASTM Standards:*

D 2513 Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings[2]

3. Significance and Use

3.1 Squeeze-off is a technique used to control the flow of gas through a pipe by the compressing action of a mechanical or hydraulic device. Squeeze-off may be used to reduce the flow of gas to an acceptable rate and under certain conditions complete stoppage of flow may be attained.

3.2 Proper squeeze-off procedures result in significant time saving in the reduction of gas flow in an emergency and in the maintenance and operation, or both, of a gas distribution system. Improper squeeze-off can cause damage to the pipe or create a safety hazard, or both.

4. Operator Experience

4.1 Each squeeze-off shall be made in accordance with written procedures that have been proven by test or experience to produce safe squeeze-off. The person actually responsible for the squeeze-off shall ensure that detailed procedures are developed in conjunction with the owner of the pipe system, the manufacturer of the pipe, and the manufacturer of the squeeze-off tools. These procedures shall include safety precautions to be followed and are to be issued before actual squeeze-off operations commence.

4.2 Skill and knowledge on the part of the operator are required to obtain good, safe squeeze-off. This skill and knowledge shall be obtained by making squeeze-offs in accordance with written procedures under the guidance of experienced operators.

5. Pipe and Conditions

5.1 In order to obtain proper squeeze-off, it is necessary to consider the pipe diameter, wall thickness, pipe material, internal pressure, and environmental conditions. The user shall request the pipe manufacturer to supply specific recommendations for the squeeze-off of the manufacturer's product with considerations for internal pressure and ambient temperature.

6. Apparatus

6.1 *Squeeze-off Tool*—A squeeze-off tool shall have the following features: proper squeeze bar configuration, force mechanism, over-squeeze protection, and premature release protection.

6.2 *Squeeze Bar Configuration*—The squeeze bars should be of a configuration which compresses the pipe wall to reduce the gas flow but does not damage the pipe. Therefore, squeeze bars are generally configured as circular, flat with rounded edges, or two circular bars side by side. Circular bars are generally restricted, as follows:

nominal pipe size, in.	minimum diameter in.	(mm)
½ – ¾	1.0	(25)
1 – 2	1.25	(32)
3 – 4	1.5	(38)
6 – 8	2.0	(51)
10 – 12	3.0	(76)
14 – 16	3.5	(89)

6.3 *Force Mechanism*—The force mechanism shall be capable of squeezing the pipe to the gap stops or until flow control has been obtained. Generally, in squeeze-off tools for pipe of 4 in. and smaller nominal diameter, the force is applied mechanically. Squeeze-off tools for pipe of a nominal diameter larger than 4 in. are generally operated hydraulically.

6.4 *Over-Squeeze Protection*—Over-squeeze protection shall be built into the squeeze-off tool. Obtain from the pipe manufacturer the safe limit to which pipe can be squeezed without causing damage to the pipe. The safe limit is expressed in terms of a minimum gap (*MG*), as follows:

[1] This guide is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.60 on Gas.

Current edition approved June 15, 1992. Published October 1992. Originally published as F 1041 - 87. Last previous edition F 1041 - 87.

[2] *Annual Book of ASTM Standards*, Vol 08.04.

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$MG = (2)\ (0.7)\ (t_{max})$
where:
2 = two pipe walls,
0.7 = 30 % compression, and
t_{max} = maximum wall thickness for pipe.
Over-squeeze protection is generally provided by mechanical stops.

6.5 *Premature Release Protection*—Premature release protection shall be built into the squeeze-off tool to prevent unintentional release in the squeeze mode. With hydraulic tools unintentional release could occur in event of hydraulic system failure. Premature release protection is generally provided by a mechanical lock-off device.

7. Procedure

7.1 Proper squeeze-off procedures shall address safety considerations, tool location, tool operation, tool removal, and post squeeze-off considerations.

7.2 *Safety Considerations*—Pressure control situations requiring squeeze-off may involve working in the vicinity of escaping gas. Consider the possibility and potential hazard of static electricity and observe safety precautions. Safety precautions regarding static electricity generally include performing squeeze-off in separate bellhole remote from the blowing gas, grounding the squeeze-off tool and applying a wet rag to the pipe surface to provide for dissipation of static charge to the ground. Check the squeeze-off tool prior to use to assure it is the correct size, is properly functioning, and is properly adjusted for the squeeze-off to be done.

7.3 *Tool Location*—Center the squeeze-off tool on and square to the pipe. This will allow the pipe to flatten freely without jamming against the tool frame or abutments. Locate a squeeze-off tool at least three pipe diameters or 12 in. (305 mm), whichever is greater, from any fusion joint (1.5 diameters for butt-fusion joint) or mechanical fitting.

7.4 *Tool Operation*—Operate the squeeze-off tool at a slow enough rate to allow stress relaxation in the pipe to occur. This is particularly helpful when pipe becomes stiff in cold weather. Squeeze the pipe until the flow of gas ceases or the mechanical stop is contacted, whichever comes first. Continuing to operate the squeeze-off tool beyond this point can cause pipe or tool damage. When the squeezed-off position is reached, on some tools, a mechanical lock-off device must be manually engaged.

7.5 *Tool Removal*—Remove the squeeze-off tool in a controlled manner. If the tool has a mechanical lock-off device, disengage it. Avoid sudden release of mechanical or hydraulic pressure. Controlled release is necessary so flow control may be quickly reestablished if required. A release rate of 0.5 in./min or less should be maintained to minimize pipe material damage. After squeeze-off pressure has been released, round the pipe. Rounding can be done by rotating the squeeze-off tool 90° and applying enough force to round the pipe or by using a special tool designed for this purpose.

7.6 *Post Squeeze-off Considerations*—After the squeeze-off tool has been removed, inspect the squeezed section for any damage. Procedures should include actions to be taken if damage is found. Procedures should not allow the same area to be squeezed off more than once.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, PA 19103.

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ASTM D2513

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Designation: D 2513 – 95b

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Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings[1]

This standard is issued under the fixed designation D 2513; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

1. Scope

1.1 This specification covers requirements and test methods for material (see Appendix X1) dimensions and tolerances, hydrostatic burst strength, chemical resistance, and impact resistance of plastic pipe, tubing, and fittings for use in gas mains and services for direct burial and reliner applications. The Annexes provide specific requirements and test methods for each of the materials currently approved. If and when additional materials are available, specific annex requirements will be added. The pipe, tubing, and fittings covered by this specification are intended for use in the distribution of natural gas. Use of polyethylene systems with liquefied petroleum gas is covered in Appendix X2.

1.1.1 This specification does not cover threaded pipe. Design considerations are discussed in Appendix X2. In-plant quality control programs are specified in Annexes A4 and A5.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are provided for information purposes only.

1.3 The following is an index of the annexes and appendixes in this specification:

Annex	Subject
A1	Polyethylene (PE) Pipe, Tubing, and Fittings
A2	Poly (Vinyl Chloride) (PVC) Pipe, Tubing, and Fittings
A3	Polybutylene (PB) Pipe, Tubing, and Fittings
A4	In-Plant Quality Control for all materials up to 12 in.
A5	In-Plant Quality Control for PE materials between 14 and 24 in.

Appendixes	Subject
X1	New Materials
X2	Design Consideration

1.4 The following precautionary caveat pertains only to the test method portion, Section 6, of this specification. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

2.1.1 *Terminology:*

D 1600 Terminology for Abbreviated Terms Relating to Plastics[2]

F 412 Terminology Relating to Plastic Piping Systems[3]

2.1.2 *Test Methods for:*

D 543 Resistance of Plastics to Chemical Reagents[2]

D 638 Tensile Properties of Plastics[2]

D 1598 Time-to-Failure of Plastic Pipe Under Constant Internal Pressure[3]

D 1599 Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings[3]

D 2122 Determining Dimensions of Thermoplastic Pipe and Fittings[3]

D 2290 Apparent Tensile Strength of Ring or Tubular Plastics and Reinforced Plastics by Split Disk Method[4]

D 2837 Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials[2]

2.1.4 *Practices for:*

D 618 Conditioning Plastics and Electrical Insulating Materials for Testing[2]

D 1898 Sampling of Plastics[2]

D 2657 Heat-Joining Polyolefin Pipe and Fittings[3]

D 2774 Underground Installation of Thermoplastic Pressure Piping[3]

F 699 Accelerated Conditioning of Polybutylene Pipe and Tubing for Subsequent Quality Control Testing[3]

2.2 *ANSI Standards:*

B16.40 Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems[5]

B31.8 Gas Transmission and Distribution Piping Systems[5]

2.3 *Federal Specifications:*

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)[6]

OPS Part 192 Title 49, Code of Federal Regulations[6]

2.4 *Military Standards:*

MIL-STD-129 Marking for Shipment and Storage[6]

MIL-STD-1235 (ORD) Single- and Multi-Level Continuous Sampling Procedures and Tables for Inspection by Attributes

2.5 *Other Documents:*

Plastic Pipe Institute: TR-3, Policies and Procedures for Developing Recommended Hydrostatic Design[7]

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[1] This specification is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.60 on Gas.

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[2] *Annual Book of ASTM Standards*, Vol 08.01.

[3] *Annual Book of ASTM Standards*, Vol 08.04.

[4] *Annual Book of ASTM Standards*, Vol 15.03.

[5] Available from American National Standards Institute, 1430 Broadway, New York, NY 10018.

[6] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111 – 5094, Attn: NPODS.

[7] Plastic Pipe Institute, Division of Society of the Plastic Industry, Inc., 355 Lexington Avenue, New York, NY 10017.

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TABLE 1 Outside Diameters and Tolerances for Plastic Pipe, in. (mm)

Nominal Pipe Size	Outside Diameter	Tolerance	Tolerances For Maximum and Minimum Out-of-Roundness			
			SDR 32.5	SDR 26	SDR 21	SDR 17 SDR 13.5 SDR 11
½	0.840 (21.3)	±0.004 (±0.102)	...	...	±0.015 (±0.381)	±0.008 (±0.203)
¾	1.050 (26.7)	±0.004 (±0.102)	...	...	±0.015 (±0.381)	±0.010 (±0.254)
1	1.315 (33.4)	±0.005 (±0.127)	...	...	±0.015 (±0.381)	±0.010 (±0.254)
1¼	1.660 (42.1)	±0.005 (±0.127)	...	...	±0.015 (±0.381)	±0.012 (±0.305)
1½	1.900 (48.3)	±0.006 (±0.152)	...	...	±0.030 (±0.762)	±0.012 (±0.305)
2	2.375 (60.3)	±0.006 (±0.152)	...	...	±0.030 (±0.762)	±0.012 (±0.305)
2½	2.875 (73.0)	±0.007 (±0.179)	...	...	±0.030 (±0.762)	±0.015 (±0.381)
3	3.500 (88.9)	±0.008 (±0.203)	...	...	±0.030 (±0.762)	±0.015 (±0.381)
3½	4.000 (101.6)	±0.008 (±0.203)	...	...	±0.050 (±1.25)	±0.015 (±0.381)
4	4.500 (114.3)	±0.009 (±0.229)	...	...	±0.050 (±1.25)	±0.015 (±0.381)
5	5.563 (141.3)	±0.010 (±0.254)	...	...	±0.050 (±1.25)	±0.030 (±0.762)
6	6.625 (168.3)	±0.011 (±0.279)	±0.060 (±1.50)	±0.055 (±1.37)	±0.050 (±1.25)	±0.035 (±0.889)
8	8.625 (219.1)	±0.013 (±0.330)	±0.12 (±3.05)	±0.080 (±2.03)	±0.060 (±1.50)	±0.040 (±1.02)
10	10.750 (273.0)	±0.015 (±0.381)	±0.12 (±3.05)	±0.10 (±2.54)	±0.070 (±1.79)	±0.050 (±1.25)
12	12.750 (323.8)	±0.017 (±0.432)	±0.14 (±3.56)	±0.10 (±2.54)	±0.070 (±1.79)	±0.050 (±1.25)

National Fire Protection Association: NFPA 58, Storage and Handling Liquefied Petroleum Gases[8]

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology F 412, and abbreviations are in accordance with Terminology D 1600, unless otherwise specified.

3.2 The gas industry terminology used in this specification is in accordance with ANSI B31.8 or 49 CFR Part 192, unless otherwise indicated.

3.3 The term *pipe* used herein refers to both pipe and tubing unless specifically stated otherwise.

3.4 *standard thermoplastic material designated code*—the pipe material designation code shall consist of the abbreviation for the type of plastic (PE, PVC, or PB) followed by Arabic numerals which describe the short term properties in accordance with applicable ASTM standards, the hydrostatic design stress for water at 73.4°F (23°C) in units of 100 psi with any decimal figures dropped. Where the hydrostatic design stress code contains less than two figures, a zero is used before the number. Thus, a complete material designation code shall consist of two or three letters and four figures for plastic pipe materials. For example, PE 2406 is a grade P24 polyethylene with a 630 psi design stress for water at 73.4°F (23°C). It should be noted that the hydrostatic design stresses for gas may be different than those for water and are not used in this designation code.

3.5 *thermoplastic pipe dimension ratio (DR)*—the ratio of pipe diameter to wall thickness. It is calculated by dividing the specified outside diameter of the pipe, in inches, by the minimum specified wall thickness, in inches. The standard dimension ratio (SDR) is a common numbering system which is derived from the ANSI preferred number series R 10.

3.6 *toe-in*—a small reduction of the outside diameter at the cut end of a length of thermoplastic pipe.

[8] National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

4. Materials

4.1 *General*—The plastic used to make pipe, tubing, and fittings shall be virgin plastic or reworked plastic (see 4.2) as specified in the Annexes and shall have a PPI recommended long-term hydrostatic stress rating.

4.2 *Rework Material*—Clean rework material of the same commercial designation, generated from the manufacturer's own pipe and fitting production may be used by the same manufacturer as long as the pipe, tubing, and fitting produced meet all the requirements of this specification.

5. Requirements

5.1 *General*—See the Annexes for specific product requirements in addition to the following. Pipe and tubing may be supplied in either coils or straight lengths. Any pipe and tubing supplied in coils must meet the same requirements before and after coiling.

5.2 *Workmanship*—The pipe, tubing, and fittings shall be homogeneous throughout and free of visible cracks, holes, foreign inclusion, blisters, and dents, or other injurious defects. The pipe, tubing, and fittings shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

5.3 *Pipe and Tubing Dimensions and Tolerances:*

5.3.1 *Dimension*—The dimensions shall be specified by wall thickness and outside diameter.

5.3.1.1 *Diameters*—The outside diameter shall meet the requirements given in Tables 1 or 2 when measured in accordance with 6.5.

5.3.1.2 *Toe-In*—When measured in accordance with 6.5.1.1, the outside diameter at the cut end of the pipe shall not be more than 1.5 % smaller than the undistorted outside diameter. Measurement of the undistorted outside diameter shall be made no closer than 1.5 pipe diameters or 11.8 in. (300 mm), whichever distance is less, from the cut end of the pipe. Undistorted outside diameter shall meet specifications on Table 1 or 2.

5.3.1.3 *Wall Thickness*—The wall thickness shall be as specified in Tables 2 or 3 when measured in accordance with 6.5.1.2. The minimum wall thickness at any point of

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TABLE 2 Plastic Tubing-Diameters, Wall Thicknesses, and Tolerances, in. (mm)

Nominal Tubing Size (CTS)	Outside Diameter	Tolerance	Minimum Wall Thickness	Wall Thickness Tolerance
¼	0.375 (9.52)	±0.004 (±0.10)	0.062 (1.58)	+0.006 (+0.15)
⅜	0.500 (12.7)	±0.004 (±0.10)	0.062 (1.58)	+0.006 (+0.15)
½	0.625 (15.9)	±0.004 (±0.10)	0.062 (1.58)	+0.006 (+0.15)
½	0.625 (15.9)	±0.004 (±0.10)	0.090 (2.27)	+0.009 (+0.23)
½	0.625 (15.9)	±0.004 (±0.10)	0.104 (2.64)	+0.010 (+0.25)
¾	0.875 (22.2)	±0.004 (±0.10)	0.062 (1.58)	+0.006 (+0.15)
¾	0.875 (22.2)	±0.004 (±0.10)	0.077 (1.95)	+0.008 (+0.20)
¾	0.875 (22.2)	±0.004 (±0.10)	0.090 (2.27)	+0.009 (+0.23)
1	1.125 (28.6)	±0.005 (±0.13)	0.062 (1.58)	+0.007 (+0.18)
1	1.125 (28.6)	±0.005 (±0.13)	0.090 (2.27)	+0.011 (+0.28)
1	1.125 (28.6)	±0.005 (±0.13)	0.099 (2.51)	+0.012 (+0.31)
1	1.125 (28.6)	±0.005 (±0.13)	0.101 (2.56)	+0.012 (+0.31)
1	1.125 (28.6)	±0.005 (±0.13)	0.121 (3.07)	+0.015 (+0.38)
1¼	1.375 (34.9)	±0.005 (±0.13)	0.062 (1.58)	+0.007 (+0.18)
1¼	1.375 (34.9)	±0.005 (±0.13)	0.090 (2.27)	+0.011 (+0.28)
1¼	1.375 (34.9)	±0.005 (±0.13)	0.121 (3.07)	+0.015 (+0.38)
1¾	1.875 (47.6)	±0.006 (±0.15)	0.062 (1.58)	+0.007 (+0.18)

measurement shall be not less than the minimum wall thickness specified in Tables 2 or 3.

5.3.1.4 *Wall Thickness Eccentricity Range*—The wall thickness eccentricity range shall be within 12 % when measured in accordance with 6.5.1.3.

5.3.1.5 *Ovality*—The ovality (cross section) of the pipe shall not exceed 5 % when measured in accordance with 6.5.3. Measurements on coiled pipe shall be made on a sample cut from the coil.

NOTE 1—Other factors, that is, installation compaction, static soil loading, and dynamic vehicular loads may increase the ovality; therefore, 5 % was chosen as the limit for the amount contributed by manufacturing, packing, in-plant storage, and shipping. For further information, see the literature.[9]

5.3.1.6 *Length*—The pipe and tubing may be supplied in straight lengths or coils as agreed upon between the manufacturer and the purchaser. The length shall not be less than the minimum length agreed upon when corrected to 73°F (23°C).

5.3.1.7 When sizes other than those listed in Tables 1, 2, or 3 are used, tolerances shall be: for outside diameter, use same tolerance of next smaller size; for wall thickness, use same tolerance percentage as shown in the tables.

5.3.2 *Fittings*—Fittings shall meet the requirements given in the applicable Annex.

5.4 *Chemical Resistance*—The pipe, tubing, and fittings shall not increase in weight more than 0.5 % (1.0 % for toluene in methanol) and shall not change more than ±12 % in apparent tensile yield strength when measured in accordance with 6.9.

NOTE 2—This pipe/tubing test is only an indication of what will happen as a result of short term exposure to these chemicals. For long term results, additional testing is required.

5.5 *Sustained Pressure*—The pipe, tubing, fittings, or systems shall not fail as defined in Test Method D 1598, when tested in accordance with 6.6.

[9] Allman, W. B., "Earthloading Design Considerations for Polyethylene Gas Distribution Systems," *Proceedings of the Fifth Plastic Pipe Symposium*, Nov. 13-15, 1974, Houston, TX, A.G.A., 1515 Wilson Blvd., Arlington, VA 22209, p. 55-71.

TABLE 3 Wall Thicknesses and Tolerances for Plastic Pipe, in. (mm)[A, B]

Nominal Pipe Size (IPS)	DR[C]	Minimum	Tolerance
½	D	0.062 (1.58)	+0.007 (+0.178)
	11.0	0.076 (1.93)	+0.009 (+0.229)
	9.33	0.090 (2.29)	+0.011 (+0.279)
¾	D	0.090 (2.29)	+0.011 (+0.279)
	11.0	0.095 (2.41)	+0.011 (+0.279)
	Sch 40	0.113 (2.87)	+0.014 (+0.356)
1	D	0.090 (2.29)	+0.011 (+0.279)
	13.5	0.097 (2.46)	+0.012 (+0.305)
	11.0	0.119 (3.02)	+0.014 (+0.356)
	9.9	0.133 (3.38)	+0.016 (+0.406)
	9.33	0.140 (3.56)	+0.017 (+0.432)
1¼	D	0.090 (2.29)	+0.011 (+0.279)
	17.0	0.098 (2.49)	+0.012 (+0.305)
	13.5	0.123 (3.12)	+0.015 (+0.381)
	Sch 40	0.140 (3.56)	+0.017 (+0.432)
	11.0	0.151 (3.84)	+0.018 (+0.457)
	10.0	0.166 (4.22)	+0.020 (+0.508)
	9.33	0.178 (4.52)	+0.021 (+0.533)
	6.0	0.277 (7.04)	+0.033 (+0.838)
1½	D	0.090 (2.29)	+0.011 (+0.279)
	17	0.112 (2.85)	+0.013 (+0.330)
	13.5	0.141 (3.58)	+0.017 (+0.432)
	Sch 40	0.145 (3.68)	+0.017 (+0.432)
	11	0.173 (4.39)	+0.021 (+0.533)
2	21	0.113 (2.87)	+0.014 (+0.356)
	17	0.140 (3.56)	+0.017 (+0.432)
	Sch 40	0.154 (3.91)	+0.018 (+0.457)
	13.5	0.176 (4.47)	+0.021 (+0.533)
	11	0.216 (5.49)	+0.026 (+0.660)
	9.33	0.255 (6.48)	+0.031 (+0.787)
2½	21	0.137 (3.48)	+0.016 (+0.406)
	17	0.169 (4.29)	+0.020 (+0.508)
	13.5	0.213 (5.41)	+0.026 (+0.660)
	11	0.261 (6.63)	+0.031 (+0.787)
3	21	0.167 (4.24)	+0.020 (+0.508)
	17	0.206 (5.23)	+0.025 (+0.635)
	Sch 40	0.216 (5.49)	+0.026 (+0.660)
	13.5	0.259 (6.58)	+0.031 (+0.787)
	11.5	0.304 (7.72)	+0.036 (+0.914)
	11	0.318 (8.08)	+0.038 (+0.965)
	9.33	0.375 (9.53)	+0.045 (+1.143)
3½	21	0.190 (4.83)	+0.023 (+0.584)
	17	0.236 (5.99)	+0.028 (+0.711)
	13.5	0.296 (7.52)	+0.036 (+0.914)
	11	0.363 (9.22)	+0.044 (+1.118)

Table 3 is continued

5.6 *Elevated Temperature Service*—Plastic piping material intended for use at temperatures above 100°F (38°C) shall have the PPI recommended hydrostatic design basis (HDB) (long-term strength) determined at the specified temperature in accordance with Test Method D 2837. The 100 000-h intercept shall be categorized in accordance with Table 4 and be listed as the "hydrostatic design basis of XXX psi at XXX °F for (compound name)."

NOTE 3—Many design factors for elevated temperature service cannot be covered in this specification. Users should consult applicable codes for limitations on pertinent maximum temperatures.

NOTE 4—In the absence of a HDB established at the specified temperature, the HDB of a higher temperature may be used in

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TABLE 3 *Continued*

Nominal Pipe Size (IPS)	DR[C]	Minimum	Tolerance
4	21	0.214 (5.44)	+0.026 (+0.660)
	19	0.237 (6.02)	+0.028 (+0.711)
	17	0.264 (6.71)	+0.032 (+0.813)
	13.5	0.333 (8.46)	+0.040 (+1.016)
	11.5	0.391 (9.93)	+0.047 (+1.194)
	11.0	0.409 (10.39)	+0.049 (+1.246)
	9.33	0.482 (12.24)	+0.058 (+1.473)
5	21.6	0.258 (6.55)	+0.031 (+0.787)
	21	0.265 (6.73)	+0.032 (+0.813)
	17	0.328 (8.33)	+0.039 (+0.991)
	13.5	0.413 (10.49)	+0.050 (+1.270)
	11	0.506 (12.85)	+0.061 (+1.549)
6	32.5	0.204 (5.18)	+0.024 (+0.610)
	26	0.255 (6.48)	+0.031 (+0.787)
	23.7	0.280 (7.11)	+0.034 (+0.864)
	21	0.316 (8.03)	+0.038 (+0.965)
	17	0.390 (9.91)	+0.047 (+1.194)
	13.5	0.491 (12.47)	+0.059 (+1.499)
	11.5	0.576 (14.63)	+0.069 (+1.753)
	11.0	0.602 (15.29)	+0.072 (+1.829)
8	32.5	0.265 (6.73)	+0.032 (+0.813)
	26	0.332 (8.43)	+0.040 (+1.016)
	21	0.410 (10.41)	+0.049 (+1.245)
	17	0.508 (12.90)	+0.061 (+1.549)
	13.5	0.639 (16.23)	+0.077 (+1.956)
	11.5	0.750 (19.05)	+0.090 (+2.286)
	11	0.785 (19.94)	+0.094 (+2.388)
10	32.5	0.331 (8.41)	+0.040 (+1.016)
	26	0.413 (10.49)	+0.050 (+1.270)
	21	0.511 (12.98)	+0.061 (+1.549)
	17	0.633 (16.08)	+0.076 (+1.930)
	13.5	0.797 (20.24)	+0.096 (+2.438)
	11.5	0.935 (23.75)	+0.112 (+2.845)
	11	0.978 (24.84)	+0.117 (+2.972)
12	32.5	0.392 (9.96)	+0.047 (+1.194)
	26	0.490 (12.45)	+0.059 (+1.499)
	21	0.608 (15.44)	+0.073 (+1.854)
	17	0.750 (19.05)	+0.090 (+2.286)
	13.5	0.945 (24.00)	+0.113 (+2.870)
	11.5	1.109 (28.17)	+0.133 (+3.378)
	11	1.160 (29.46)	+0.139 (+3.531)

[A] The sizes listed in Table 3 are those commercially available sizes used by the gas industry.

[B] The minimum is the lowest wall thickness of the pipe at any cross section. The maximum permitted wall thickness, at any cross section, is the minimum wall thickness plus the stated tolerance. All tolerances are on the plus side of the minimum requirement.

[C] The DR shown are designations commonly accepted by the gas industry and do not calculate exactly.

[D] These wall thicknesses are minimum and are not a function of the dimension ratios.

determining a design pressure rating at the specified temperature by arithmetic interpolation.

5.7 *Minimum Hydrostatic Burst Pressure*—The burst requirements for plastic pipe and tubing shall be as given in the appropriate annexes.

5.8 *Apparent Tensile Strength At Yield*—The minimum apparent tensile strengths at yield for plastic pipe and tubing are given in the annexes when determined in accordance with 6.8.

5.9 *Joints:*

5.9.1 *Solvent Cemented*—Joints of solvent cementable pipe and fittings shall be made in accordance with the user's written procedure.

5.9.2 *Heat Fusion:*

5.9.2.1 Heat fusion joints of thermoplastic pipe and fittings shall be made in accordance with Practice D 2657 and the user's written procedure.

5.9.2.2 PE butt fusion joining shall be between components (pipes, fittings, or valves) having the same SDR or DR. Butt fusion between unlike SDR or DR components shall be allowed only if it has been demonstrated that long term performance is not adversely affected. The minimum requirement to demonstrate long term performance shall be the validation procedure for PE in Test Method D 2837. The Hydrostatic Design Basis Category (HDBC) of the PE material shall be validated using specimens containing butt fusion joints resulting from different SDR's or DR's (pipe/pipe joints of the given PE material that pass shall validate pipe/pipe, pipe/fitting, or fitting/fitting joints of the same SDR ratio for that PE material).

5.9.3 *Mechanical*—Mechanical fittings shall be installed in accordance with the user's written procedures and the fitting manufacturer's recommended installation instructions. The joint shall be tested in accordance with the specific design category as outlined in 6.10.

5.10 *Plastic Valves*—All plastic gas valves shall meet the requirements of ANSI Standard B16.40.

6. Test Methods

6.1 *General*—The test methods in this specification cover plastic pipe, tubing, and fittings to be used for gas distribution. Test methods that are applicable from other specifications will be referenced in the paragraph pertaining to that particular test.

6.2 *Sampling*—Take a sample of the pipe, tubing, and fittings sufficient to determine conformance with this specification. About 40 ft (12 m) of pipe or tubing is required to make all the tests prescribed. The number of fittings required varies, depending upon the size and type of fitting. It is suggested that a sampling plan be agreed upon by the purchaser and the manufacturer (see Practice D 1898).

6.2.1 *Pipe Test Specimens*—Not less than 50 % of the test specimens required for any pressure test shall have at least a part of the marking in their central sections. The central section is that portion of pipe which is at least one pipe diameter away from an end closure.

6.3 *Conditioning*—Unless otherwise specified, condition the specimens prior to test at 73.4 ± 3.6°F (23 ± 2°C) and 50 ± 5 % relative humidity for not less than 40 h, in accordance with Procedure A of Practice D 618 for those tests where conditioning is required and in all cases of disagreement.

6.4 *Test Conditions*—Conduct the test in the standard laboratory atmosphere of 73.4 ± 3.6°F (23 ± 2°C) and 50 ± 5 % relative humidity, unless otherwise specified.

6.5 *Dimensions and Tolerances:*

6.5.1 *Pipe and Tubing*—Any length of pipe or tubing may be used to determine the dimensions. Coiled pipe shall be measured in the natural springback condition, unless specified otherwise.

6.5.1.1 *Diameter*—Measure the diameter of the pipe or tubing in accordance with Test Method D 2122. The average outside diameter for nonroundable pipe is the arithmetic

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average of the maximum and minimum diameters at any cross section on the length of the pipe. For roundable pipe the tolerances for out-of-roundness shall apply to measurements made after the pipe is rounded with the manufacturer's recommended equipment. See Test Method D 2122 for definitions of nonroundable and roundable pipe.

6.5.1.2 *Wall Thickness*—Make a minimum of six measurements at each cross section in accordance with Test Method D 2122.

6.5.1.3 *Wall Thickness Eccentricity Range*—Measure in a manner such that the maximum, A, and the minimum, B, wall thickness at single points of each cross section measured are obtained. Calculate the wall thickness eccentricity range, E, in percent for each cross section as follows:

$$E = [(A - B)/A] \times 100 \quad (1)$$

6.5.1.4 *Length*—Measure pipe or tubing length and other linear dimensions with a steel tape or other device, accurate to ±1/32 in. (±1 mm) in 10 ft (3 m).

6.5.2 *Fittings*—Measure the dimensions of fittings in accordance with Test Method D 2122.

6.5.3 *Ovality:*

6.5.3.1 *Apparatus*—A micrometer or vernier caliper accurate to within ±0.001 in. (±0.02 mm).

6.5.3.2 *Procedure*—Take a series of outside diameter (OD) measurements at closely spaced intervals around the circumference to ensure that the minimum and maximum diameters have been determined.

6.5.3.3 *Calculation*—Calculate the percent ovality as follows:

$$\%\ \text{ovality} = \frac{\text{maximum OD} - \text{minimum OD}}{\text{minimum OD} + \text{maximum OD}} \times 200 \quad (2)$$

6.6 *Sustained Pressure Test:*

6.6.1 Select six test specimens of pipe, tubing, or fittings at random, condition at the standard laboratory test temperature and humidity, and pressure test in accordance with Test Method D 1598.

6.6.1.1 Test specimens shall be prepared so that the minimum length of pipe on each side of the fitting is equal to 5 times the diameter of the pipe but in no case less than 12 in. (304 mm) for sizes less than 6 in. For sizes 6 in. and larger, the minimum length shall be equal to 3 times the diameter or 30 in. (762 mm), whichever is shorter.

6.6.1.2 Pressures used shall be as shown in the annexes or as calculated (using the pipe or tubing's actual measured minimum wall thickness, outside diameter, and the applicable fiber stress shown in the annexes), whichever is greater. Piping intended for use at temperatures of 100°F (38°C) and higher shall be tested at both 73°F (23°C) and the maximum design temperature. The test fiber stress shall be the hydrostatic design basis (HDB) or 80 % of the 100 000-h intercept of the material, whichever is greater.

NOTE 5—Air, methane, or nitrogen may be substituted for water as the test medium.

6.6.2 Maintain the specimens at the pressures required, held to ±10 psi (0.07 MPa), for a period of 1000 h at the test temperature ±3.6°F (±2°C) as specified in 6.6.1.

6.6.3 Failure of two of the six specimens tested shall constitute failure in the test. Failure of one of the six specimens tested is cause for retest of six additional specimens. Failure of one of the six specimens in retest shall constitute failure in the test. Evidence of failure of the pipe shall be as defined in Test Method D 1598.

6.7 *Minimum Hydrostatic Burst Pressure (Quick Burst)*—The test equipment, procedures, and failure definitions shall be as specified in Test Method D 1599 and the annexes. Pressures shall be as shown in the Annexes or as calculated (using the pipe or tubing's actual measured minimum wall thickness, outside diameter, and the applicable fiber stress), whichever is greater.

6.8 *Apparent Tensile Properties*—The procedure and test equipment shall be as specified in Test Method D 2290, Procedure B. The speed of testing shall be 0.5 in. (12.7 mm)/min. Cut "ring" specimens from pipe or tubing. They shall be ½ in. (12.7 mm) wide with a ¼-in. (6.3-mm) wide reduced section. Test a minimum of five specimens. This method is applicable to all pipe and tubing of nominal ¾-in. (19.0-mm) outside diameter and larger.

6.9 *Chemical Resistance*—Determine the resistance to the following chemicals in accordance with Test Method D 543. When testing extruded pipe or tubing, test specimens shall be cut rings as specified in 6.8.

Chemicals	Concentration (% by volume)
Mineral oil (USP)	100
Tertiary-butyl mercaptan	5 in mineral oil
Antifreeze agents (at least one shall be used):	
Methanol, or	100
Ethylene glycol	100
Toluene	15 in methanol

Test five specimens with each chemical. Weigh the specimens to the nearest 0.005 g and completely immerse them in the chemicals for 72 h. On removal from the chemicals, wipe the specimens with a clean dry cloth. Condition in air for 2 to 2¼ h and reweigh. Calculate the increase in weight to the nearest 0.01 % on the basis of initial weight. Test the specimen in tension in accordance with 6.8 within ½ h after weighing. Examine the weight and apparent tensile strength of each specimen for conformance to the requirement in 5.4.

NOTE 6—**Caution:** Because of the possible toxicity of these reagents, refer to the Material Safety Data Sheet on each of these reagents before using or handling them.

6.10 *Categorization of Mechanical Joints*—The following test methods provide a uniform procedure for qualification or categorization of mechanical joints using short term pullout resistance tests and burst tests. The mechanical joint categories and test methods are as follows:

6.10.1 *Category 1*—A mechanical joint design that provides a seal plus a resistance to a force on the pipe end equal to or greater than that which will cause a permanent deformation of the pipe or tubing.

6.10.1.1 The apparatus and report shall be as specified in Test Method D 638. The test shall be conducted at ambient temperatures, that is, 67 ± 10°F (19.4 ± 5.6°C). The speed of the testing shall be 0.2 in. (5 mm)/min ± 25 %. Five specimens shall be prepared following the manufacturer's published installation instructions. Length of the specimens shall be such that the unreinforced distance between the grip of the apparatus and the end of the stiffener is at least five times the nominal outside diameter of the pipe size being tested. Apply a load until permanent deformation (yield) occurs in the unreinforced area of the piping or tubing.

6.10.1.2 Results obtained from the above method pertain only to the specific outside diameter, wall thickness, and

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compound of the piping or tubing used in the test and specific fitting design tested.

NOTE 7—The ability to restrain pipe or tubing to its yield as specified above does not guarantee that a properly installed joint will prevent pullout under actual long-term field conditions. Joints that cannot pass this test would be expected to pullout under actual long term field conditions. To date, this test is the best available for disqualifying unsound joints.

6.10.2 *Category 2*—A mechanical joint design that provides a seal only (see Appendix X2.5.5). A mechanical joint designed for this category excludes any provisions in the design or installation of the joint to resist any axial pullout forces; therefore, tensile tests are not required.

6.10.2.1 The test assembly shall meet the burst test requirements of 5.7 when tested in accordance with Test Method D 1599 with end closures designed in accordance with Test Method D 1599.

6.10.3 *Category 3*—A mechanical joint design that provides a seal plus a pipe restraint rating equivalent to the anticipated thermal stresses occurring in a pipeline (see Appendix X2.4). This category has a manufacturer's rated pipe end restraint less than the value required to yield the pipe as outlined in 6.10.1 (Category 1).

6.10.3.1 The procedures and testing shall be the same as outlined in 6.10.1 (Category 1) except the test tensile values shall meet the rated values published by the mechanical fitting manufacturer.

7. Marking

7.1 *Pipe*—All required marking shall be legible, visible, and permanent. To ensure permanence, marking shall be applied so it can only be removed by physically removing part of the pipe wall. The marking shall (1) not reduce the wall thickness to less than the minimum value for the pipe, (2) not have any effect on the long-term strength of the pipe, and (3) not provide leakage channels when elastomeric gasket compression fittings are used to make the joints. These marking shall consist of the word GAS, the designation ASTM D 2513, the manufacturer's name or trademark, the normal pipe size including the sizing system used (IPS, CTS, or OD), DR or minimum wall thickness, material designation, and date of manufacture.

7.1.1 In addition to 7.1, the pipe marking shall include a coding that will enable the manufacturer to determine the location of manufacture, pipe production and resin lots, and any additional information which may be agreed upon between the manufacturer and purchaser. The manufacturer shall maintain such records for fifty years or for the design service life of the pipe, whichever is longer.

7.1.2 All the markings in 7.1 and 7.1.1 shall be repeated at intervals not exceeding 5 ft. (1.5 m). For indented printing, either the indented print line shall be in a color that contrasts with that of the pipe, or a separate print line (that may be non-permanent) shall be in a color that contrasts with the pipe. See Annexes A1 through A3 for possible additional specific marking requirements.

7.2 Pipe intended for natural gas service at elevated temperatures greater than 73°F (23°C) shall be marked with additional code letters from Table 4 (the first code letter to identify the temperature of pressure rating, the second code letter to identify HDB at highest recommended temperature, and the third code letter to identify the melt index).

7.3 *Fittings*—Fittings shall be marked with the applicable Fitting Specification if those specifications require fittings used for gas service to meet this specification. Otherwise they shall be marked ASTM D 2513.

8. Manufacturer's Caveat

8.1 When the product is marked with this ASTM designation (D 2513), the manufacturer affirms that the product was manufactured, inspected, sampled, and tested in accordance with this specification and has been found to meet the requirements of this specification.

TABLE 4 Pipe Category

Property	Test Method	Category						
		A	B	C	D	E	F	G
Temperature, °F (°C)	...	100(38)	120(49)	140(60)	160(71)	180(82)	...	...
Hydrostatic design basis, psi (MPa)	D 2837	400(2.8)	500(3.4)	630(4.3)	800(5.5)	1000(6.9)	1250(8.6)	1600(11.0)
Melt index	D 1238	>0.5	0.2–0.5	0.01–0.3	<0.01[A]	...	...	...

[A] Typically melt flow measured under condition 190/21.6 is less than 4.01 g/10 min.

Examples: CDB – At 140°F (60°C) the HDB is 800 psi (5.5 MPa). The approximate melt index range is 0.2 to 0.5 g/10 min for this PE pipe.
DF – At 160°F (71°C) the HDB is 1250 psi (8.6 MPa). A melt index range is not given for non-PE materials.

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SUPPLEMENTARY REQUIREMENT

GOVERNMENT/MILITARY PROCUREMENT

These requirements apply only to federal/military procurement, not domestic sales or transfers.

S1. *Responsibility for Inspection*—Unless otherwise specified in the contract or purchase order, the producer is responsible for performance of all inspection and test requirements specified herein. The producer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless the purchaser disapproves. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to ensure that material conforms to prescribed requirements.

NOTE S1—In U.S. federal contracts, the contractor is responsible for inspection.

S2. *Packaging and Marking for U.S. Government Procurement:*

S2.1 *Packaging*—Unless otherwise specified in the contract, the materials shall be packaged in accordance with the supplier's standard practices in a manner ensuring arrival at destination in satisfactory condition and which will be acceptable to the carrier at lowest rates. Containers and packing shall comply with Uniform Freight Classification rules or National Motor Freight Classification rules.

S2.2 *Marking*—Marking for shipment shall be in accordance with Fed. Std. No. 123 for civil agencies and MIL-STD 129 for military agencies.

NOTE S2—The inclusion of U.S. Government procurement requirements should not be construed as an indication that the U.S. Government uses or endorses the products described in this specification.

ANNEXES

(Mandatory Information)

A1. SUPPLEMENTAL REQUIREMENTS FOR GAS PRESSURE PIPE, TUBING, AND FITTINGS PRODUCED FROM POLYETHYLENE (PE) MATERIAL

A1.1 Scope

A1.1.1 This annex covers requirements for PE pipe, tubing, and fittings. These requirements are in addition to those in the main body of this specification.

NOTE A1.1—Because Table 1, which covers nominal pipe sizes up to 12 in. is in the body of this specification, and Table A1.3 is in Annex A1, the user should be aware of the larger tolerance allowed the larger pipe.

A1.2 Referenced Documents

A1.2.1 *ASTM Standards:*

A1.2.1.1 *Test Methods for:*

D 1238 Flow Rate of Thermoplastics by Extrusion Plastometers[3]

A1.2.1.2 *Specification for:*

D 1248 Polyethylene Plastics Molding and Extrusion Materials[3]

D 2683 Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing[2]

D 3261 Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing[2]

D 3350 Polyethylene Plastic Pipe and Fittings Materials[3]

F 1055 Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing[3]

TABLE A1.1 Specification D 3350 Cell Classifications of Polyethylene Pipe Tubing and Fittings Materials

PE Material Designation Code:	PE2406	PE3408
Physical Properties:		
Density	2	3
Melt index	1, 2, or 3	3, 4, or 5
Flexural modulus	3 or 4	4 or 5
Tensile strength	3 or 4	4 or 5
Environmental stress crack resistance	3	3
Hydrostatic design basis	3	4

A1.3 Materials

A1.3.1 *Classification*—Polyethylene materials suitable for use in the manufacture of pipe, tubing, and fittings under this specification shall be classified in accordance with Specification D 3350, and as shown in Table A1.1. *Example:* for a polyethylene material having an HDB of 1250 psi (8.6 MPa), Cell Class 3, the base resin density must have a cell classification of 2 or 3; the melt index classification must be 1, 2, 3, 4, 5, or 6; etc.

A1.3.2 *Short and Long Term Properties*—Polyethylene pipe, tubing, and fittings shall be made from PE materials which also satisfy the combinations of short- and long-term

TABLE A1.2 Short and Long Term Property Requirements

PE Material Designation Code	Short-Term in Accordance with D 1248	Long-Term in Accordance with D 2837[A]
PE 2406	Grade P 24	HDB of 1250 psi for 73°F
PE 3408	Grade P 34	HDB of 1600 psi for 73°F

[A] The hydrostatic design basis (HDB) shall be established using water or natural gas as the pressurizing fluid.

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TABLE A1.3 Outside Diameters and Tolerances, 14 in. and Larger Pipe

Nominal Pipe Size	Actual Outside Diameters, in. (mm)	
	Average	Tolerance
14	14.000 (355.6)	±0.063 (±1.60)
16	16.000 (406.4)	±0.072 (±1.83)
18	18.000 (457.2)	±0.081 (±2.06)
20	20.000 (508.0)	±0.090 (±2.29)
22	22.000 (558.8)	±0.099 (±2.51)
24	24.000 (609.6)	±0.108 (±2.74)

property requirements shown in Table A1.2.

A1.3.3 *Hydrostatic Design Basis Substantiation*—The HDB for PE materials for transport of natural gas or other fuel gas at 73°F (23°C) shall be substantiated by additional long-term stress rupture testing at 140°F (60°C) with natural gas or other fuel gas. The data are evaluated in accordance with the requirements of Test Method D 2837 with the 100 000-h intercept not less than 600 psi. Water may be used where previous tests have shown that these requirements can be met.

A1.3.4 *Additive Classes*—PE materials shall be either Class B, with antioxidant and UV stabilizer, or C as defined in Specification D 1248, or Class C or E as defined in Specification D 3350.

A1.4 Fittings

A1.4.1 PE fittings intended for use with the corresponding sized outside-diameter PE pipe shall meet the requirements of Specification D 2683 for socket-type fittings, Specification D 3261 for butt-type fittings, or Specification F 1055 for electrofusion-type fittings and the requirements of this specification.

A1.5 Requirements for Pipe and Fittings

A1.5.1 *Conditioning*—For those tests where conditioning is required or unless otherwise specified, condition the specimens prior to testing for a minimum of 1 h in water or 4 h in air at 73.4 ± 3.6°F (23 ± 2°C) or in accordance with 6.3. The conditioning requirements of 6.3 shall be used in all cases of disagreement.

A1.5.2 *Minimum Hydrostatic Burst Pressure/Apparent Tensile Strength (Quick Burst)*—The pipe or system shall fail in a ductile manner when tested in accordance with Test Method D 1599. For pipe sizes above 4-in. nominal diameter, the quick burst test (Test Method D 1599) may be replaced by the apparent ring tensile strength test (Test Method D 2290). The minimum apparent tensile strength at yield when determined in accordance with 6.8 shall be 2520 psi (17.4 MPa).

A1.5.3 *Sustained Pressure 73°F (23°C)*—The pipe or system shall not fail in less than 1000 h when tested in accordance with Test Method D 1598. For PE 2406 material, the stress shall be 1320 psi, for PE 3408 materials, the stress shall be 1600 psi.

A1.5.4 *Melt Index*—Melt index is the flow rate of PE material when measured in accordance with Test Method D 1238, condition 190/2.16 (formerly Condition E). Materials that record zero flow under condition 190/2.16 should be measured in accordance with condition 190/21.6 (formerly condition F). The melt index of pipe/fitting shall meet the designated category in Table 4. The sample shall be representative of the cross section of the pipe or fitting and diced to an appropriate size by a method not producing heat.

A1.5.5 *Squeeze-Off*—This requirement is limited to pipe sizes, wall thicknesses, squeeze procedures, and conditions deemed suitable for squeeze-off in service by the pipe manufacturer. There shall be no leakage or visual evidence of splitting, cracking, breaking or reduction in 1000-h sustained pressure category when pipe is tested as follows:

A1.5.5.1 Prepare six randomly selected pipe specimens in accordance with Test Method D 1598 except they shall be unfilled.

A1.5.5.2 The squeeze-off shall be effected at the midpoint of the test specimen, 90° to the point of the measured minimum wall thickness. Close the squeeze bars to the gap stop recommended by the pipe manufacturer and hold in constraint for four hours. Remove squeeze bars and reround pipe by closing squeeze bars at a point 90° from the squeeze area.

A1.5.5.3 Immediately upon removal of the squeeze-off tool, fill the specimens with room temperature water, condition, and test in accordance with 6.6

A1.5.6 *Thermal Stability*—The PE material shall contain sufficient antioxidant so that the minimum induction temperature shall be 428°F (220°C) when tested in accordance with Specification D 3350. The sample shall be representative of the cross section of the pipe or fittings.

A1.5.7 *Outdoor Storage Stability*—PE pipe stored outdoors and unprotected for at least two years from date of manufacture shall meet all the requirements of this specification. PE pipe stored outdoors for over two years from date of manufacture may be used if it meets the requirements of this specification.

A1.5.8 *Dimensions and Tolerances*—The outside diameter shall meet the requirements in Tables 1 and 2 in the main body for sizes up to 12 in., or in Table A1.3 for larger sizes. The minimum wall thickness shall meet the requirements in Tables 2 and 3 in the main body for sizes up to 12 in., or in Table A1.4 for larger sizes. When sizes other than those listed in these tables are used, the tolerances of the next lower size shall be used.

TABLE A1.4 Minimum Wall Thickness and Tolerance, 14 in. and Larger Pipe, in.

Nominal Pipe Size	SDR 32.5	SDR 26	SDR 21	SDR 17	DR 15.5	SDR 13.5	SDR 11	SDR 9	SDR 7.3
14	0.431 +0.052	0.538 +0.065	0.667 +0.080	0.824 +0.099	0.903 +0.108	1.037 +0.124	1.273 +0.153	1.556 +0.187	1.918 +0.230
16	0.492 +0.059	0.615 +0.074	0.762 +0.091	0.941 +0.113	1.032 +0.124	1.185 +0.142	1.455 +0.175	1.778 +0.213	...
18	0.554 +0.066	0.692 +0.083	0.857 +0.103	1.059 +0.127	1.161 +0.139	1.333 +0.160	1.636 +0.196	2.000 +0.240	...
20	0.615 +0.074	0.769 +0.092	0.952 +0.114	1.176 +0.141	1.290 +0.155	1.481 +0.178	1.818 +0.218	...	...
22	0.677 +0.081	0.846 +0.102	1.048 +0.126	1.294 +0.155	1.419 +0.170	1.630 +0.196	2.000 +0.240	...	...
24	0.738 +0.089	0.923 +0.111	1.143 +1.137	1.412 +0.169	1.548 +0.186	1.778 +0.213	2.182 +0.262	...	...

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A1.5.9 *Short Term Pressurization for Sizes Above 12 in.*—Pipe and molded or fabricated fittings shall not fail when tested in accordance with Test Method D 1599 with the hoop stress of 2500 psi for Class 2 density materials or 2900 psi for Class 3 density materials. Hoop stress calculation shall be based on the DR of the fitting at the point of fusion.

NOTE A1.2—The requirements in A1.5.8 are for laboratory proof testing only and should not be interpreted as applicable to on-site testing for acceptance of installed systems larger than 12 in. See appropriate installation standards or manufacturer's recommendations for field test procedures.

NOTE A1.3—**Safety Precaution**—Pressurization of pipe specimens above 12 in. nominal diameter being tested in accordance with A1.5.8 should not commence until it is certain that all entrapped air has been bled from the water-filled specimens.

A1.5.10 *HDBC Validation for PE Pipe*—The 73°F (23°C) Hydrostatic Design Basis Category (HDBC) of PE pipe shall be validated by the pipe producer using the PE validation procedure as outlined in Test Method D 2837. For PE 2406 materials, the HDBC of 1250 psi shall be validated; for PE 3408 materials, the HDBC of 1600 psi shall be validated.

A1.6 Marking

A1.6.1 PE pipe and tubing shall be marked with the melt index category in accordance with Table 4 in addition to the marking requirements of 7.1.

A2. SUPPLEMENTAL REQUIREMENTS FOR GAS PRESSURE PIPE, TUBING, AND FITTINGS PRODUCED FROM POLY (VINYL CHLORIDE) (PVC) COMPOUNDS

A2.1 Scope

A2.1.1 This annex covers requirements for PVC pipe, tubing, and fittings. These requirements are in addition to those in the main body of this specification.

A2.2 Referenced Documents

A2.2.1 *ASTM Standards:*

A2.2.1.1 *Specifications for:*

D 1784 Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds[2]

D 2241 Poly (Vinyl Chloride) (PVC) Pressure-Related Pipe (SDR-PR)[2]

D 2466 Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40[2]

D 2467 Socket Type Poly (Vinyl Chloride) (PVC) Plastic Fittings, Schedule 80[2]

D 2564 Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems[2]

D 2672 Joints for IPS PVC Pipe Using Solvent Cement[2]

D 2740 Poly (Vinyl Chloride) (PVC) Plastic Tubing[2]

A2.2.1.2 *Test Methods and Practices:*

D 2152 Degree of Fusion of Extruded Poly (Vinyl Chloride) (PVC) Pipe by Acetone Immersion[2]

D 2412 Determination of External Loading Properties of Plastic Pipe by Parallel Plate Loading[2]

D 2444 Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)[2]

D 2855 Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings[2]

F 402 Safe Handling and Solvent Cements Used for Joining Thermoplastic Pipe and Fittings[2]

A2.3 Materials

A2.3.1 PVC pipe, tubing, and fittings shall be made from the following PVC plastics as defined in Specification D 1784.

Type I, Grade 1, Class 12454B (PVC 11)
Type I, Grade 2, Class 12454C (PVC 12)
Type II, Grade 1, Class 14333D (PVC 21)

A2.4 Requirements

A2.4.1 Requirements for plain end pipe and tubing are specified in Specification D 2241. Belled end pipe requirements are specified in Specification D 2672. Fitting requirements are specified in Specification D 2466 for schedule 40 and Specification D 2467 for schedule 80. These fittings are intended for use with corresponding sized outside diameter pipe made from the same compound. The following additional requirements shall also be met.

A2.4.1.1 *Flattening*—There shall be no evidence of splitting, cracking, or breaking by the specimens subjected to this test and performed in accordance with Test Method D 2412. Flatten three specimens of the pipe, 2 in. (50.8 mm) long, between parallel plates in a suitable press until the distance between the plates is 40 % of the outside diameter of the pipe or the walls of pipe touch. The rate of loading shall be uniform and such that the compression is completed within 2 to 5 min. On removal of the load, examine the specimens for evidence of splitting, cracking, or breaking.

A2.4.1.2 *Impact Resistance*—The impact resistance for PVC pipe shall fall within the range specified by the manufacturer's designated Impact Classification Cell (IC). Table A2.1 lists impact classification cell for SDR 17 and 21 pipe. The impact classification rating for PVC pipe shall be

TABLE A2.1 Impact Requirements for PVC Pipe at 32 to 35°F (0 to 2°C) for SDR 17 and 21 Pipe

Impact Classification Cell	ft·lbf (J)		
	IC-1	IC-2	IC-3
Nominal Pipe Size, in.			
1	30 to 50 (41 to 68)	>50 to 65 (68 to 88)	>65 (88)
1¼	30 to 51 (41 to 68)	>50 to 65 (68 to 88)	>65 (88)
1½	40 to 60 (54 to 81)	>60 to 75 (81 to 102)	>75 (102)
2	70 to 90 (95 to 122)	>90 to 100 (122 to 136)	>100 (122)
3	120 to 140 (163 to 190)	>140 to 180 (190 to 244)	>180 (244)
4	160 to 200 (217 to 271)	>200 to 240 (271 to 326)	>240 (326)
6	200 to 260 (271 to 353)	>260 to 300 (353 to 407)	>300 (407)

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determined in accordance with Test Method D 2444 using a flat plate holder and 20-lb tup B for sizes 2 in. and less and 30-lb tup B for all larger sizes. The specimens shall be conditioned in a mixture of ice and water at 32 to 35°F (0 to 2°C) for 1 h (Note A2.1) and tested immediately on removal from this medium.

NOTE A2.1—Other conditioning media such as a refrigerated fluid bath of water and ethylene glycol at 32 to 35°F (0 to 2°C) for 1 h or a refrigerated air chamber at 32 to 35°F (0 to 2°C) for 4 h may be used if it can be demonstrated that equivalent results are obtained. However, in cases of disagreement, the ice water mixture shall be used.

A2.4.1.3 *Impact Quality Assurance*—The impact quality assurance is a GO/NO GO test. Five specimens shall be impacted in accordance with Test Method D 2444 using the tup and holder specified in A2.4.1.2 from a height determined by the lower value of the designated Impact Classification (IC) cell. All five specimens shall pass. If one specimen fails, a second set of five specimens shall be tested. None of the second set shall fail. If nine out of the total ten specimens pass, the lot shall be considered to have met the requirements of this test.

NOTE A2.2—This test is intended only for use as a quality control test, not for use as a simulated service test.

A2.4.1.4 *Extrusion Quality*—PVC pipe shall not flake or disintegrate when tested in accordance with the Test Method D 2152.

A2.4.1.5 *Outdoor Storage Stability*—PVC pipe when stored outdoors unprotected for six months from the date of extrusion shall meet all the requirements of this specification. PVC pipe stored outdoors for over six months from date of manufacture, may be used if it meets the requirements of this specification.

A2.4.1.6 *Solvent Cements for PVC Systems*—Solvent cements for PVC pipe and fittings shall meet the requirements of Specification D 2564.

A2.4.1.7 *Marking*—Impact Classification Cell, as determined by the manufacturer, shall be printed on the pipe in addition to the marking requirements of 7.1.

TABLE A2.2 Minimum Burst Pressure Test Requirements for PVC Pipe at 73°F (23°C)

Standard Demension Ratio	Minimum Burst Pressure, psi (MPa)	
	PVC 1120 PVC 1220	PVC 2110 PVC 2116
11	1250 (8.6)	1000 (6.9)
13.5	1000 (6.9)	800 (5.5)
17	800 (5.5)	630 (4.3)
21	630 (4.3)	500 (3.4)

TABLE A2.3 Minimum Fiber Stress, psi (MPa)

	Minimum Hydrostatic Burst Strength and Apparent Tensile Tests	Sustained Pressure Test
PVC 1120	6400 (44.1)	4200 (29.0)
PVC 1220	6400 (44.1)	4200 (29.0)
PVC 2110	5000 (34.5)	2300 (15.9)
PVC 2116	5000 (34.5)	3650 (23.2)

A2.4.1.8 *Minimum Hydrostatic Burst Strength/Apparent Tensile Strength*—The minimum burst pressure for PVC pipe shall be as given in Table A2.2 or as calculated (using the actural measured minimum wall, the actual measured average outside diameter, and the applicable fiber stress shown in Table A2.3) when determined in accordance with Test Method D 1599. For sizes above 4-in. nominal diameter, the quick burst (Test Method D 1599) may be replaced by the apparent ring tensile strength test (Test Method D 2290). The minimum fiber stress shall be as given in Table A2.3.

A2.4.1.9 *Sustained Pressure 73°F (23°C)*—The pipe or system shall not fail in less than 1000 h when tested in accordance with Test Method D 1598. The stress shall be as given in Table A2.3.

A2.5 Safety Requirements

A2.5.1 Safety requirements for handling solvent cements must be observed. Consult Practice F 402 and the solvent cement manufacturer for appropriate precautions.

A3. SUPPLEMENTAL REQUIREMENTS FOR GAS PRESSURE PIPE, TUBING, AND FITTINGS PRODUCED FROM POLYBUTYLENE (PB) MATERIAL

A3.1 Scope

A3.1.1 This annex covers requirements of PB pipe, tubing, and fittings. These requirements are additional to the main body of this specification.

A3.2 Referenced Documents

A3.2.1 *ASTM Standards:*

TABLE A3.1 Physical and Mechanical Property Valves for Pipe and Pipe Fittings

Pipe SDR	Flow Rate g/10 min	Burst Pressure Test		Sustained Pressure Test	
		Pressure psi (MPa)	Fiber Stress psi (MPa)	Pressure psi (MPa)	Fiber Stress psi (MPa)
11	0.25–0.75	440 (3.03)	2200 (15.17)	400 (2.76)	2000 (13.79)
13.5	0.25–0.75	350 (2.41)	2200 (15.17)	320 (2.21)	2000 (13.79)
17	0.25–0.75	275 (1.89)	2200 (15.17)	250 (1.72)	2000 (13.79)

A3.2.1.1 *ASTM Specifications:*

D 1238 Flow Rates of Thermoplastics by Extrusion Plastometer[3]

D 1708 Tensile Properties of Plastics by Use of Microntensile Specimens[3]

D 2581 Polybutylene (PB) Plastics Molding and Extrusion Materials[10]

D 3309 Polybutylene (PB) Plastic Hot and Cold Water Distribution Systems[2]

A3.3 Materials

A3.3.1 Pipe, tubing, and fittings compounds shall meet the requirements of Type II, Category I, Class B with antioxidant or Class C as defined in Specification D 2581.

[10] *Annual Book of ASTM Standards*, Vol 08.02.

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A3.4 Fittings

A3.4.1 PB socket fusion fittings for use with the corresponding sized outside diameter PB pipe shall meet the fitting requirements of Specification D 3309.

A3.5 Requirements

A3.5.1 The physical and mechanical property values for pipe and fittings shall be in accordance with Table A3.1.

A3.5.2 *Conditioning*—Because of the crystalline transformation which takes place after polybutylene resins are cooled from the melt, it is necessary to delay physical testing until 10 days after pipe extrusion. During this period, the pipe should be stored at temperatures between 40 and 100°F (4.4 and 37.7°C). Conditioning for testing in accordance with Procedure A of Practice D 618 may be initiated after 8 days or see Practice F 699.

A3.5.3 *Flow Rate*—The flow rate of the pipe and fittings shall meet the designated range in Table A3.1 when tested in accordance with Test Method D 1238. The sample shall be representative of the cross section of the pipe or fitting and diced to an appropriate size by a method not producing heat.

A3.5.4 *Squeeze-Off*—This requirement is limited to pipe sizes, wall thicknesses, squeeze procedures, and conditions deemed suitable for squeeze-off in service by the pipe manufacturer. There shall be no leakage of visual evidence of splitting, cracking, braking, or reduction in 1000-h sustained pressure category when pipe is tested as follows:

A3.5.4.1 Prepare six randomly selected pipe specimens in accordance with Test Method D 1598 except they shall be unfilled.

A3.5.4.2 The squeeze-off shall be effected at the midpoint of the test specimen, 90° to the point of the measured minimum wall thickness. Close the squeeze bars to the gap stop recommended by the pipe manufacturer, and hold in constraint for 4 h. Remove squeeze bars and re-round pipe by closing squeeze bars at a point 90° from the squeeze area (if recommended by the pipe manufacturer).

A3.5.4.3 Immediately upon removal of the squeeze-off tool, fill the specimens with room temperature water, condition, and test in accordance with 6.6.

A3.5.5 *Elongation at Break*—Elongation at break is a measure of the ductility of polybutylene pipe. The minimum elongation at break of machine direction (axial direction) microtensile specimens obtained from the pipe wall shall meet or exceed 125 %. The microtensile specimens shall be tested as specified in Test Method D 1708 using speed C, 0.4 to 0.5 in. (10 to 13 mm). This method can be used for pipe sizes ranging from ½ in. CTS through 2 in. IPS.

A3.5.6 *Minimum Hydrostatic Burst Pressure Apparent Tensile Strength (Quick Burst)*—The pipe or system shall fail in a ductile manner when tested in accordance with Test Method D 1599. For pipe sizes above 4 in. nominal diameter, the quick burst test (Test Method D 1599) may be replaced by the apparent ring tensile strength test (Test Method D 2290). The minimum apparent tensile strength at yield when determined in accordance with 6.8 shall be 2800 psi (19.3 MPa).

A3.5.7 *Sustained Pressure*—The pipe or system shall not fail in less than 1000 h at a hoop stress level less than the values listed in Table A3.1 when tested in accordance with Test Method D 1598. System combinations shall contain at least one piece of pipe, as measured from the fitting, having a minimum length of 12 in. or five times the pipe diameter, whichever is greater, and a maximum length of 3 ft (0.91 m).

A3.5.8 *Outdoor Storage Stability*—Black PB pipe, stored outdoors unprotected for a period of 2 years from date of manufacture, shall meet all the requirements of this specification. Black PB pipe stored outdoors for more than 2 years from date of manufacture, may be used if it meets the requirements of this specification. Non-black PB pipe, stored outdoors, unprotected for 45 days from date of manufacture, shall meet all of the requirements of this specification. Non-black PB pipe stored outdoors for more than 45 days from manufacture, may be used if it meets the requirements of this specification.

A4. IN-PLANT QUALITY CONTROL PROGRAM FOR PLASTIC PIPE, TUBING, AND FITTINGS UP TO AND INCLUDING 12 IN. NOMINAL DIAMETER

A4.1 Quality Control

A4.1.1 The following in-plant quality control program shall be used to assure compliance with this specification. The pipe and fittings producers shall maintain records on all aspects of this program and supply these to the purchaser, if requested.

A4.1.2 *In-Plant Quality Control Test Methods*—Test methods other than those specified in Section 6 may be used as long as they provide equivalent results. In case of disagreement, those test methods in the applicable ASTM standard shall be used.

TABLE A4.1 Material and Extrusion Process Qualification Test Conditions[A]

Temperature	Stress	Time Requirement
176 ± 3.6°F (80 ± 2°C)	580 ± 10 psi (4.0 ± 0.07 MPa)	1000 h
176 ± 3.6°F (80 ± 2°C)	670 ± 10 psi (4.6 ± 0.07 MPa)	170 h

[A] Methane should not be substituted for water in this 176°F (80°C) test.

A4.2 Pipe and Tubing Tests

A4.2.1 *Material and Extrusion Process Qualification*—Sustained pressure tests shall be made on one pipe or tubing

TABLE A4.2 Product Quality Control Tests

Property	Frequency
Diameter	Once every hour or once every coil, whichever is less frequent.
Wall thickness	Once every hour or once every coil, whichever is less frequent.
Burst pressure (see Note A4.2)	Once every 8 h or once every coil, whichever is less frequent, or multi-level plan described in A4.2.3.
Flattening (PVC Only)	Once every 8 h
Extrusion quality (PVC only)	Once every 2 h
Impact resistance (PVC Only)	Once every hour

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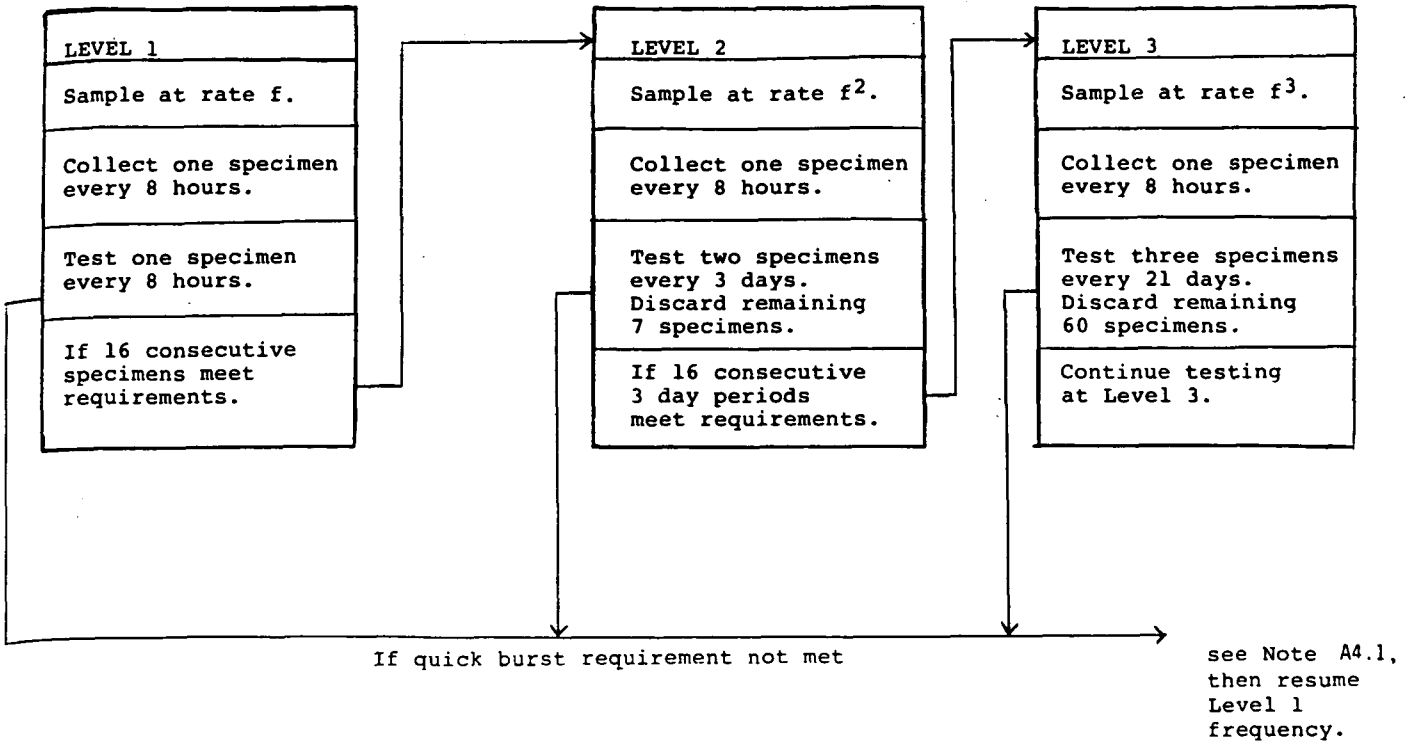

FIG. A4.1 Quick Burst Multilevel Sampling Plan

size in the range of 2 in., or less, and on one pipe size in the range of 2½ in., or greater. This test shall also be made on pipe and tubing from each particular commercial plastic resin initially, and at least twice a year thereafter for material and extrusion process qualification and not as a quality control on the product. This test shall be made in accordance with 6.6.1, 6.6.1.1 and 6.6.3 using either of the test conditions in Table A4.1.

A4.2.2 *Product Quality Control* (Note A4.1)—The tests in Table A4.2 shall be made per size per extrusion die at the denoted frequencies and the test results recorded and filed for inspection on request.

NOTE A4.1—When the pipe or tubing fails to meet this specification in any test, additional tests shall be made on the pipe or tubing produced back to the previous acceptable result to select the pipe or tubing produced in the interim that does pass the requirement. Pipe or tubing that does not meet the requirement shall be rejected.

NOTE A4.2—For pipe sizes above 4 in. nominal diameter, the quick burst test (Test Method D 1599) may be replaced by the Apparent Ring Tensile Strength Test (Test Method D 2290) if agreed to between the purchaser and the manufacturer.

A4.2.3 *Burst Pressure Multilevel Plan* (see Fig. A4.1)—This multilevel plan is based on MIL-STD-1235 (ORD), and may be used only when the same product is extruded continuously under the same operating conditions and production is at a steady rate. Before this reduced sampling plan may be considered, steady production conditions must be carefully chosen to ensure a continuous and consistent high quality output. Any interruption (shutdown) or change in resin lot number, percentage rework, or production conditions outside normal operating variations shall cause sampling to revert to Level 1. A sampling level change may be considered only when approved by a production supervisor or authorized quality control personnel.

Level 1 Test one specimen every 8 h. If 16 consecutive specimens have met requirements, proceed to Level 2.

Level 2 Collect one specimen every 8 h. After 72 h (3 days) or portion thereof, test two randomly selected specimens. If both pass, discard the remaining 7 specimens. If any specimen fails to meet requirements, revert to Level 1 (see also Note A2.1). Product for which a specimen has been collected should not be shipped until after the 72-h time period and randomly selected samples have been tested. Continue to test 2 out of 9 specimens for 16 three-day periods (48 days of production), then proceed to Level 3.

Level 3 Collect one specimen every 8 h. After 21 days or portion thereof, test three randomly selected specimens. If all three pass, discard the remaining specimens. If any specimen fails to meet requirements, revert to Level 1 (see also Note A4.1). Product for which a specimen has been collected shall not be shipped until after the 21-day time period. Continue testing at Level 3 until production conditions necessitate reverting to Level 1.

A4.3 Fittings Tests[11]

A4.3.1 The fittings tests listed in the following subparagraphs should be conducted at the frequencies indicated.

NOTE A4.3—When any fitting fails to meet the requirements of this specification, or the applicable referenced fitting specification, additional tests should be made on fittings produced back to previous acceptable result to select the fittings produced in the interim that do meet the requirements. Fittings that do not meet the requirements shall be rejected.

A4.3.1.1 *Dimensions:*

A4.3.1.1(*a*) *Socket Fittings:*

(1) *Socket Entrance, Bottom and Minimum Internal Di-*

[11] Supporting data are available from ASTM Headquarters. Request RR: F17-1018.

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ameters—Once an hour or one out of ten fittings, whichever is less frequent.

(2) *Wall Thickness*—At the beginning of each production setup for each cavity.

A4.3.1.1(*b*) *Butt Fusion Fittings:*

(1) *Outside Diameter and Wall Thickness*—Once an hour or one out of ten fittings, whichever is less frequent.

A4.3.1.2 *Other Tests:*

A4.3.1.2(*a*) *PVC Fittings*—The burst pressure shall be measured on one fitting per 8-h production.

A4.3.1.2(*b*) *PE and PB Fittings*—At the start of each production run, whenever production conditions have changed, or when the resin lot is changed, but not less frequently than once per 500 fittings thereafter, the following tests should be made:

(1) The knit line strength for at least one fitting from each cavity should be demonstrated by one of the following tests:

(*a*) Crushing a fitting, or a portion of a fitting, in a manner that applies load in the direction normal to the knit line. See Note A4.4.

(*b*) Apparent tensile strength tests of a ring cut from a fitting, with the load oriented normal to the knit line. See Note A4.5.

(*c*) Burst testing of the fitting. See Note A4.5.

(2) The integrity of at least one part from each mold cavity should be verified, using a method selected by the manufacturer as appropriate for his specific product and process.

NOTE A4.4—Separation in the knit constitutes a failure.

NOTE A4.5—In tests 2 and 3 the strength requirements shown in the annexes must be met.

A5. IN-PLANT QUALITY CONTROL PROGRAM FOR 14-IN. AND LARGER DIAMETER POLYETHYLENE PIPE

A5.1 Visual inspection of every length of pipe for workmanship defects shall be carried out at the manufacturer's plant. Measurements of outside diameter and wall thickness shall be made for each hour's production or each length of pipe, whichever is less frequent.

A5.2 Lengths of pipe that are shorter than standard shipping lengths may be butt-fused to produce standard lengths. Such build-up lengths must otherwise meet all of the product requirements of this specification.

A5.3 Manufacturers of pipe shall conduct such other quality control tests as are appropriate to their manufacturing operations that will provide assurance that the product requirements of A1.5 will be met in place of the actual performance of the specified tests.

NOTE A5.1—The pressure tests required under product requirements are tests for performance. These tests are not adaptable to in-plant quality control. Quality control tests have not been standardized because the requirements for such tests vary substantially from one manufacturing plant to another.

APPENDIXES

(Nonmandatory Information)

X1. NEW MATERIALS

X1.1 It is the intent of ASTM Committee F-17 on Plastic Piping Systems to consider for inclusion other kinds, types, and grades of thermoplastics in this specification, when evidence is presented to show that they are suitable for underground distribution of natural gas. Minimum requirements, in addition to all the pertinent parts of this specification are: (1) an ASTM material specification, (2) an ASTM product specification, (3) the material's long-term hydrostatic strength, determined in accordance with an appropriate test method such as Test Method D 2837, and (4) at least 3 years of service-related evidence to demonstrate that the material has performed satisfactorily as underground gas pressure piping.

X1.2 Each candidate material is considered individually with respect to its own properties, the intended application, and other pertinent usage experience. Experience with a related approved material may be applicable to a new material provided the germane correlations can be demonstrated.

X1.3 An example of appropriate evidence to meet service related requirements, but not necessarily the only way, would be a minimum of 3 years evaluation of representative piping systems in gas service under representative conditions without significant change in physical or mechanical properties. Such systems should aggregate at least 1000 ft (305 m) of piping to provide an ample basis for statistical evaluation. Piping systems should contain representative pipe sizes and companion pipe fittings such as elbows, tees, couplings, and caps. Recommendations for making individual service connections on both pressured and unpressured systems is also desirable information. If special backfill materials or techniques are necessary for satisfactory performance, they should be so stated and described; otherwise generally accepted industry practices are assumed to be adequate. Publications of the American Gas Association and the Plastic Pipe Institute contain information which may be useful in assessing the suitability or relevancy of candidate materials.

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X2. DESIGN CONSIDERATIONS

X2.1 General

X2.1.1 The design of a plastic piping system for natural gas service must include consideration of the combined effects of time, internal and external stress, and environment as an overall basis for selecting a specific kind and size of plastic pipe. The design stress for plastic pipe used for distribution of natural gas and petroleum fuels is regulated by the U.S. Department of Transportation as published in Part 192 Title 49 of the Code of Federal Regulations. The American Gas Association Plastic Materials Committee, the Fuel Gas Division of PPI, and members of ASTM Committee F-17 are cooperating with the ASME Gas Piping Technology Committee to provide assistance in selecting safe design stress levels for the various kinds of plastic pipe.

X2.2 Design Equations

X2.2.1 *Relationship Between Pipe Stress and Pressure*—The following expression is used to relate stress, pressure, pipe size, and wall thickness:

$$P = 2S/(DR - 1) \text{ or } 2S/[(D_o/t) - 1] \quad \text{(X2.1)}$$

where:

S = stress in the circumferential or hoop direction, psi (MPa),
P = internal pressure, psig (MPa),
DR = dimension ratio,
D_o = average outside diameter, in. (mm), and
t = minimum wall thickness, in. (mm).

X2.2.2 The following expression can be used to determine the burst pressure or sustained pressures needed in testing:

$$P_b = 2S_y/(DR - 1) \quad \text{(X2.2)}$$

where:

P_b = burst pressure, psig (MPa),
S_y = yield stress, psi (MPa), and
DR = dimension ratio.

$$P_s = 2S_f/(DR - 1) \quad \text{(X2.3)}$$

where:

P_s = sustained pressure, psig (MPa),
S_f = fiber stress psi (MPa), and
DR = dimension ratio.

X2.2.3 *Relation between Hydrostatic Design Basis (HDB) and Hydrostatic Design Stress (HDS)*—The *HDS* is determined by multiplying the *HDB* by a design factor, *f*. The design factor, *f*, has a value less than 1.0.

$$HDS = (HDB)(f) \quad \text{(X2.4)}$$

NOTE X2.1—The actual choice of design factor for a given installation must be reviewed by the design engineer taking into account federal, state, and local code requirements. For example, the design factor for gas pipelines under the jurisdiction of the Department of Transportation is 0.32.

X2.3 Design Stress and Internal Pressure

X2.3.1 The design stresses for natural gas pipe are based on the hydrostatic design basis categories at 73°F (23°C) obtained in accordance with Test Method D 2837. The test medium should be natural gas or simulated natural gas except that water may be used where previous tests have shown that for the particular type of plastic, water and natural gas give essentially the same test results. The hydrostatic design basis categories of the plastics presently included in the applicable ASTM specifications are as follows:

Plastic Pipe Material Designation	Hydrostatic Design Basis Categories at 73°F (23°C), psi (MPa)
PB 2110	2000 (13.8)
PE 2406	1250 (8.6)
PE 3408	1600 (11.0)
PVC 1120	4000 (27.6)
PVC 1220	4000 (27.6)
PVC 2110	2000 (13.8)
PVC 2116	3150 (24.8)

X2.3.2 The design stresses for natural gas and other fuel gases at service temperatures above 73°F (23°C) should be based on hydrostatic design basis categories of the pipe that are applicable for the particular use temperature.

NOTE X2.2—Water may be used where previous tests have shown that these requirements can be met.

X2.3.3 Strengths for other plastic pipe materials will be added when these materials are included in the applicable ASTM specifications. The design stresses are obtained by multiplying the hydrostatic design basis categories by design factors or service factors according to the class of location as described in Chapter IV of the American National Standard Code for Pressure Piping ANSI B31.8, or, for gas operators in the United States, Subpart C of the Minimum Federal Safety Standards for Transportation of Natural and Other Gas by Pipeline, Title 49, Code of Federal Regulations.

X2.3.4 Any plastic material to qualify for use as pipe for the transportation of liquefied petroleum gas (LPG) must be tested with LPG as the medium, and have a hydrostatic design basis category of 1000 psi (6.9 MPa) at 74°F (23°C), as determined by Test Method D 2837.

X2.3.5 For liquefied petroleum gas applications, a maximum operating pressure of 30 psig (206 kPa) is recommended in NFPA 58 by the members of the National Liquefied Petroleum Gas Association. Liquefied petroleum gas has a higher condensation temperature than does natural gas; this maximum pressure is recommended to ensure that plastic pipe is not subjected to excessive exposure to LPG liquids.

X2.4 Thermal Stress

X2.4.1 Calculate the longitudinal stress (theoretical) induced in a pipe member between fixed points as follows:

$$S = E \times C \times \Delta t \quad \text{(X2.5)}$$

where:

S = stress, psi (MPa),
E = modulus of elasticity, psi (MPa), instantaneous, at 73°F (23°C),
C = coefficient of expansion, in./in./°F, (mm/mm/°C), and
Δt = maximum temperature minus minimum temperature, °F (°C).

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X2.4.1.1 The measured stress has been determined to be less than that calculated. This difference is caused by the stress relaxation in viscoelastic materials.

X2.4.2 Calculate the theoretical force sustained at the fixed points (typically joints) in a pipe member as follows:

$$F = S \times A \quad \text{(X2.6)}$$

where:
F = force, lbf (N),
S = stress, psi (MPa), and
A = cross-sectional pipe wall area, in.^{2} (mm^2).

X2.4.3 Calculate pipe contraction in unrestrained pipe caused by a reduction in temperature as follows:

$$\Delta L = k \times L \times C \times \Delta t \quad \text{(X2.7)}$$

where:
ΔL = change in length,
k = 1000 for ΔL (mm), L (m), C (°C^{-1}), Δt (°C), or
k = 12 for ΔL (in.), L (ft), C (°F^{-1}), Δt (°F),
L = original length,
C = coefficient of linear expansion, and
Δt = temperature change.

X2.5 Installation Procedure

X2.5.1 It is recognized that certain minimum requirements exist for the support of earth loads from backfill and other external forces. Proper installation techniques can be used with flexible conduit (as defined by Marston and Spangler[12]) to support relatively large earth loads without excessive deflection by mobilizing lateral passive soil forces. Proper installation technique ensures that the necessary passive soil pressure at the side of the pipe will be developed and maintained. It is also recognized that internal pressures may be valuable in minimizing the deflection caused by earth loads. Installation procedures described in Recommended Practice B 2774, ANSI B31.8, and the AGA Plastic Pipe Manual for Gas Service are recommended.

X2.5.2 Unrestrained plastic pipe expands and contracts from thermal change significantly more than metallic pipe. This ratio may be of the magnitude of ten to one. Typical coefficients of thermal expansion for unrestrained pipe are as follows[1](see Note X2.3):

PB 7.2×10^{-5} (in./in.)/°F 19.44 (mm/mm)/°C
PE 9.0×10^{-5} (in./in.)/°F 24.30 (mm/mm)/°C
PVC 3.5×10^{-5} (in./in.)/°F 11.45 (mm/mm)/°C

Mains and service lines installed by insertion are considered to approximate unrestrained conditions inside the casing pipe except at end connections. Direct-burial pipe is considered to be partially restrained by passive soil pressures except in the vicinity of joints.

NOTE X2.3—Coefficient of thermal expansion for the specific pipe being considered should be used, if available.

X2.5.3 Internal pressure, earth settlement, ground movement, and thermal contraction impose stresses on the pipe that can be transmitted to joints. These stresses are additive. Installation practices should reflect the need for continuous support and containment of the pipe through suitable bedding and backfilling procedures. Attention should be given to all joints, particularly to transition joints between plastic and metal pipe.

X2.5.4 It is desirable to have pipe joints that are as strong as the pipe itself in the longitudinal (axial) direction. Thermal fusion, solvent cement joints, and mechanical joints outlined in 6.10, Category 1 can provide such joint strength. The joint strength is a function of the assembly procedure, the design of the fitting, and the pipe material and dimensions (see X2.5.5).

X2.5.5 For those mechanical devices that are not designed to restrain the pipe against pullout forces, provisions must be made in the field to prevent pullout, keeping in mind that mechanical joints are vulnerable to the effects of internal pressure, temperature changes, earth settlement, and ground movement. A somewhat limited alternative is to use long sleeve-type fittings that permit limited movement without loss of pressure seal. Otherwise, provisions must be made in the field to prevent pullout through suitable anchoring at the joint.

X2.5.6 Plastic pipe joined with mechanical connectors that utilize a compression-type gasket must be reinforced by means of a tubular stiffener that extends at least under the section of pipe being compressed by the gasket and the gripping device (where used). The stiffener shall be nonsplit-type design to meet the performance requirements recommended by the manufacturer of the fitting in which it is used, and the joint shall meet the test requirements outlined in 6.10.

X2.6 Repair Considerations

X2.6.1 Repairs may be made to plastic pipe under appropriate circumstances. Selection and installation considerations for the use of full encirclement band clamps are available in ASTM Guide F 1025. Additional information on repair of plastic pipe may be found in manufacturers' literature, the A. G. A. Plastic Pipe Manual for Gas Service, ANSI B31.8 Gas Transmission and Distribution Piping Systems, and in the ASME Guide for Gas Transmission and Distribution Piping Systems.

X2.7 Environmental Effects

X2.7.1 The long term effect of natural gas at 73°F (23°C) has been shown[13,14] to be essentially equivalent to that of water at 73°F (23°C) for three kinds of plastic pipe (PVC, PB, and PE). However, the effects of other liquid environments such as antifreeze agents, odorants, and hydrocarbons are known to be deleterious to some plastics, particularly when under service conditions, and therefore, should not be permitted in the gas system unless the plastic pipe has been fully evaluated under the service conditions.

[12] Spangler, M. G., "Secondary Stresses in Buried High Pressure Lines," *Iowa State College Bulletin*, Engineering Report 23 of the Iowa Engineering Experiment Station, 1954, 1955.

[13] Kuhlman, H. W., Leninger, R. I., and Wolter, Fritz, "Investigation of Engineering and Design Concepts for Plastics Pipe for Gas Distribution Application," presented at ANSI B31.8 meeting in St. Charles, IL, Oct. 19, 1965.

[14] Palermo, E. F., and Cassady, M. J., "Comparison of Long-Term Effect of Water and Methane on PE 2306 and PE 3406 Pipe Performance," presented at the American Gas Association Plastic Material Committee Winter Workshop, Feb. 23, 1982.

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This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, PA 19103.

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ASTM F1533

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Standard Specification for Deformed Polyethylene (PE) Liner[1]

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This standard is issued under the fixed designation F 1533; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers requirements and test methods for materials of deformed PE liner intended for the rehabilitation of gravity flow and nonpressure pipelines. This application is for municipal sewage, storm water, industrial process liquids and effluents, conduit, and ducts. This renewal process involves installing a deformed liner into an existing pipeline, conduit, or duct, then reforming the liner with heat and pressure to fit tightly to the bore of the original pipeline, conduit, or duct.

1.2 In referee decisions, inch-pound units shall be used. In all cases, the values given in parentheses are provided for information purposes only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing[2]

D 638 Test Method for Tensile Properties of Plastics[3]

D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials[3]

D 1600 Terminology for Abbreviated Terms Relating to Plastics[3]

D 1693 Test Method for Environmental Stress Cracking of Ethylene Plastics[3]

D 2122 Method for Determining Dimensions of Thermoplastic Pipe and Fittings[4]

D 2837 Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials[4]

D 3350 Specification for Polethylene Plastics Pipe and Fittings Materials[4]

F 412 Terminology Relating to Plastic Piping Systems[4]

F 1248 Test Method for Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe[4]

2.2 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)[5]

2.3 *Military Standard:*

MIL-STD-129 Marking for Shipment and Storage[6]

3. Terminology

3.1 *Definitions:*

3.1.1 Unless otherwise indicated, definitions are in accordance with Terminology F 412, and abbreviations are in accordance with Terminology D 1600.

3.1.2 *deformed liner*—polyethylene pipe manufactured in a deformed shape that reduces the cross-sectional area for insertion and rehabilitation of nonpressure pipelines, conduits, and ducts. (See Fig. 1.)

3.1.3 *reformed liner*—a reformed pipe is a sample for test purposes formed when the deformed pipe has been inserted into a given casing pipe and rerounded with heat and pressure to fit snugly to the casing pipe taking a given cross-section, in accordance with Sections 5 and 6. (See Fig. 1.)

4. Materials

4.1 Material requirements are applicable only to materials prior to extrusion into the liner. Post-extrusion product requirements are presented in Section 6.

4.2 *Material Classifications*—Polyethylene materials allowable for use in the manufacture of polyethylene liner under this specification shall have a Plastic Pipe Institute (PPI)[7] recommended Hydrostatic Design Basis in accordance with Table 1 and shall have a minimum classification in accordance with Specification D 3350, as shown in Table 2.

4.3 *Rework Material*—Clean, rework material, meeting requirements in 4.2, and generated from the manufacturer's own pipe production, may be used by the same manufacturer, with material meeting requirements in 4.2 in any combination, as long as the liner produced meets all of the requirements of this specification for the pipe designated.

5. Sampling

5.1 Reformed pipe sample preparation shall involve the rounding of a deformed pipe sample within a split pipe mold with an inside diameter equal to the nominal outside diameter shown in Table 4. A deformed pipe sample of sufficient length (10 ft maximum) to complete the testing requirements shall be inserted into the split pipe mold and secured at the ends. The ends shall have threaded nipples for

[1] This specification is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.26 on Olefin-Based Pipe.

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[2] *Annual Book of ASTM Standards*, Vol 10.01.

[3] *Annual Book of ASTM Standards*, Vol 08.01.

[4] *Annual Book of ASTM Standards*, Vol 08.04.

[5] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

[6] Available from the Superintendent of Documents, Washington, DC.

[7] Plastics Pipe Institute, Division of the Society of the Plastics Industry, Inc., Wayne Interchange Plaza II, 155 Route 46 West, Wayne, NJ 07470.

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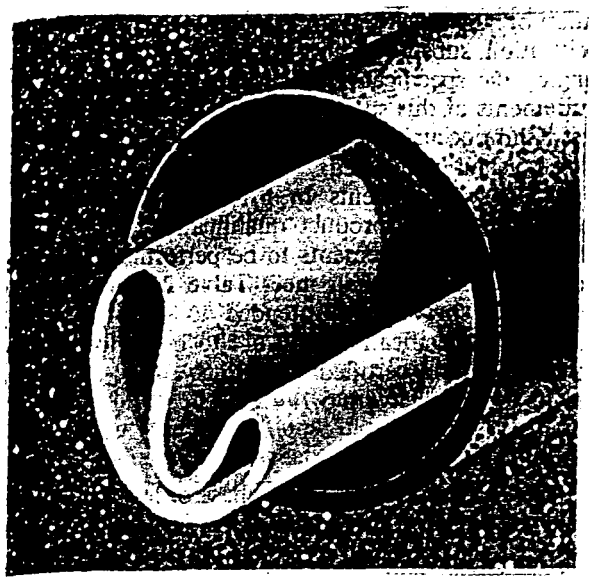
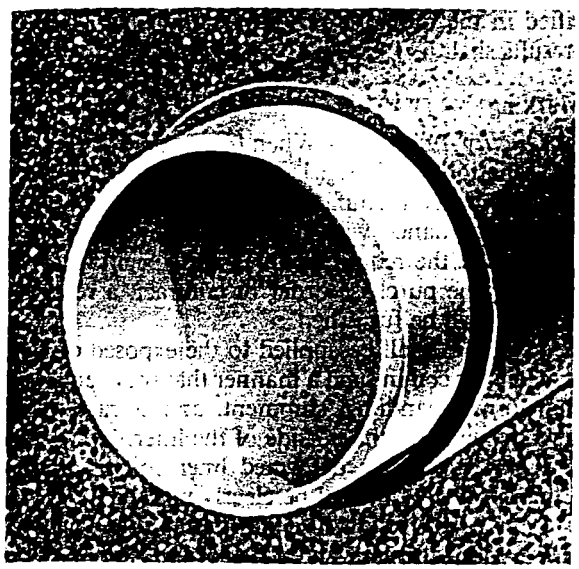


(a) *Deformed Pipe*



(b) *Reformed Pipe*

NOTE—This figure is intended only for clarification of terms specific to this specification and shows representative deformed and reformed pipe shapes. Other deformed pipe shapes may meet the general requirements of this specification.

FIG. 1 Deformed Pipe and Reformed Pipe—Clarification of Terms

applying steam with a pressure gage having steam discharge piping. The assembly shall be placed in an enclosed chamber for heating. Ambient pressure steam shall be applied to the chamber for at least a 15-min period at a minimum temperature of 200°F. The temperature shall be elevated to 250°F and the pipe shall be reformed by applying 14.5 psig

TABLE 1 Hydrostatic Design Basis of Pipe Materials

Thermoplastic Pipe Material Designation Code	Required Hydrostatic Design Basis
Pipe Designation	HDB, psi (MPa)
PE 3408	1600 psi at 73°F (11.03 MPa at 23°C)
PE 2406	1250 psi at 73°F (8.62 MPa at 23°C)

TABLE 2 Minimum D 3350 Cell Classification Limits for Liner Materials[A]

Property Material	PE 2406	PE 3408
Density	2	3
Melt	3	4
Flexural modulus	4	5
Tensile strength	3	4
ESCR	3	3
HDB	3	4
Color and UV stabilizer	C or E	C or E

[A] Cell classification should be certified by the resin manufacturer per lot, as shipped to the pipe manufacturer.

TABLE 3 Dimensions and Tolerances

Nominal Outside Diameter, in.[A]	Outside Diameter Tolerances[B]	Minimum Wall Thickness, in.			
		DR17	DR24	DR26	DR32.5
3.00	+0.00, −0.015	0.176	0.124	0.115	...
4.00	+0.00, −0.015	0.234	0.166	0.153	...
6.00	+0.00, −0.015	0.352	0.249	0.230	0.184
8.00	+0.00, −0.020	0.469	0.332	0.306	0.245
10.00	+0.00, −0.020	0.587	0.416	0.384	0.307
12.00	+0.00, −0.025	0.704	0.499	0.461	0.368
15.00	+0.00, −0.050	0.879	0.623	0.575	0.460
18.00	+0.00, −0.060	1.055	0.748	0.690	0.552

[A] The reformed pipe permits variance of nominal outside diameter during installation of −0.4 to +3.4 % to match existing pipe inside diameter. The larger variance may increase the DR value. Existing inside pipe diameters outside this range will necessitate special sizes.

[B] The listed outside diameter tolerances are provided for manufactured liner pipe.

for a period of 2 min. The pressure shall be increased to a maximum of 26 psig for an additional period of 2 min. While maintaining the 26-psig internal pressure, transition to air pressure and cool to 100°F or less. Remove the reformed sample from the mold for testing. Safety precautions shall be provided during the test procedure, that is, during application of steam and pressure.

5.2 The frequency of sampling shall be agreed upon between the purchaser and the seller.

6. Requirements and Test Methods

6.1 *Workmanship*—The deformed liner shall be essentially uniform in color, opacity, and other properties. There shall be no evidence of splits, cracks, crazing, kinks, or breaks.

6.2 *Dimensions:*

6.2.1 *Outside Diameter*—The outside diameter shall be as shown in Table 3 when measured in accordance with Test Method D 2122 on liner samples taken from the production line before deforming. A dimensional check shall be made at least once every 12 h during production.

6.2.2 *Wall Thicknesses*—The wall thickness shall be as shown in Table 3 when measured in accordance with Test Method D 2122. Use of a properly calibrated ultrasonic thickness tester is also permitted under this specification. Make sufficient readings, a minimum of eight, equally spaced around the circumference to ensure that the thickness has been determined.

6.3 *Special Sizes*—Where existing system conditions or special local requirements make other diameters or dimensions necessary, other sizes or dimension ratios, or both, shall be acceptable for engineered applications when mutually

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agreed upon between the purchaser and manufacturer, if the deformed liner is manufactured from plastic compounds meeting the material requirements of this specification, and the strength and design requirements are calculated on the same basis as those used in the specification. For diameters not shown in Table 3, the tolerance shall be the same percentage as used for diameters shown in Table 3. Minimum wall thickness shall be calculated by dividing the minimum diameter by the dimension ratio.

6.4 Environmental stress crack resistance (ESCR) materials allowable for use in the manufacture of liner under this specification shall meet the minimum requirements specified in Table 2. Test specimens required for testing in accordance with Test Method D 1693 shall be prepared from material meeting the requirements of 4.2 or 4.3 in any combination.

6.5 *Tensile Strength and Tensile Elongation*—Samples shall be tested for tensile strength at yield and elongation at break per cell classification values. Tests shall be performed in accordance with Test Method D 638 on a Type IV tensile test specimen cut from the production liner sample. Test the specimen at a speed of 2 in./min. Tensile strength and elongation shall be checked at least once per production lot run.

6.6 *Flexural Modulus*—Samples shall be tested for flexural modulus in accordance with Test Methods D 790 using Method 1, Procedure B, and a 2-in. (50-mm) test span. Test specimens shall be machined from the wall of the resin lot run, in accordance with the requirements of 5.1 and tested for cell classification values. Flexural modulus shall be checked at least once per production lot run.

6.7 *Conditioning:*

6.7.1 *Referee Testing*—When conditioning is required for referee tests, condition the specimens in accordance with Procedure A of Practice D 618 at 73.4 ± 3.6°F (23 ± 2°C) and 50 ± 5 % relative humidity for not less than 40 h prior to test. Conduct tests under the same conditions of temperature and humidity, unless otherwise specified.

6.7.2 *Quality Control Testing*—Unless otherwise specified, condition the specimens for a minimum of 24 h prior to test in air or 4 h in water at 73.4 ± 3.6°F (23 ± 2°C). Test the specimens at 73.4 ± 3.6°F without regard to relative humidity.

6.8 *Test Conditions*—Conduct tests other than those for routine quality control purposes in the Standard Laboratory Atmosphere of 73.4 ± 3.6°F (23 ± 2°C) and 50 ± 5 % relative humidity, unless otherwise specified in the referenced test method or in this specification. In cases of disagreement, retesting shall be conducted with the temperature and relative humidity tolerances limited to ±1.8°F (1°C) and ±2 % respectively.

6.9 *Retest and Rejection*—If the results of any test(s) do not meet the requirements of this specification, the test(s) may be conducted again in accordance with an agreement between the purchaser and the seller. There shall be no agreement to lower the minimum requirement of the specification by such means as omitting tests that are a part of the specification, substituting or modifying a test method, or by changing the specification limits. In retesting, the product requirements of this specification shall be followed. If upon retest failure occurs, the quantity of product represented by the test(s) shall be rejected.

6.10 The requirements in 6.1, 6.2, 6.5, and 6.6 are intended for initial product qualification, and as routine quality control requirements to be performed during every production run and shall meet Table 2 value range. The requirements in 6.4 are intended to qualify product as meeting this specification, and are to be performed by the pipe supplier, and certified accordingly. All testing shall be made in accordance with 5.1.

7. Certification

7.1 When specified in the purchase order or contract, the pipe producer's certification shall be furnished to the purchaser that the deformed liner was manufactured, sampled, tested, and inspected in accordance with this specification and has been found to meet the requirements. When specified in the purchase order or contract, a report of the test results shall be furnished.

8. Marking

8.1 *Quality Assurance*—When the product is marked with this designation, ASTM F 1533, the producer affirms that the product was manufactured, inspected, sampled, and tested in accordance with this specification and has been found to meet the requirements of this specification. When specified in the purchase order or contract, a report of the test results shall be furnished.

8.2 Markings shall be applied to the exposed end of each deformed liner coil in such a manner that they remain legible during normal handling, shipment, and storage. Markings may be stenciled on the outside of the liner.

8.3 *Markings*—Each deformed liner coil in compliance with this specification shall be clearly marked by the manufacturer with the following information: this designation, ASTM F 1533; the nominal outside diameter in inches or special size in inches, DR-XX, and approximate coil length; the standard material designation code (PE3408 or PE2406); the manufacturer's name, trade name, or trademark; and the manufacturer's production code, from which plant location, machine, and date of manufacture can be identified.

9. Packaging

9.1 Unless otherwise specified, deformed liner shall be coiled. Coil lengths shall be specified by the purchaser. Coils shall be securely banded in layers, and layer to layer. Only nonmetallic banding shall come in contact with the liner. Metallic banding may be used, provided a protective material is placed between the metallic banding and the liner. Liner coils shall be packaged for shipment by commercial carrier.

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GOVERNMENT/MILITARY PROCUREMENT

These requirements apply *only* to Federal/Military procurement, not domestic sales or transfers.

S1. *Responsibility for Inspection*—Unless otherwise specified in the contract or purchase order, the producer is responsible for the performance of all inspection and test requirements specified herein. The producer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless the purchaser disapproves. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to ensure that material conforms to prescribed requirements.

NOTE S1.1—In U.S. federal contracts, the contractor is responsible for inspection.

S2. *Packaging and Marking for U.S. Government Procurement:*

S2.1 *Packaging*—Unless otherwise specified in the contract, the materials shall be packaged in accordance with the supplier's standard practice in a manner ensuring arrival at destination in satisfactory condition and which will be acceptable to the carrier at lowest rates. Containers and packing shall comply with Uniform Freight Classification rules or National Motor Freight Classification rules.

S2.2 *Marking*—Marking for shipment shall be in accordance with Fed. Std. No. 123 for civil agencies and MIL-STD-129 for military agencies.

NOTE S2.1—The inclusion of U.S. Government procurement requirements should not be construed as an indication that the U.S. Government uses or endorses the products described in this specification.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, PA 19103.

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APPENDIX I

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APPENDIX I
RECOMMENDED PROCEDURES FOR PIPE JOINING

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Pneumatic Pipe Test Procedure

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PNEUMATIC PIPE TEST PROCEDURE
LEACHATE CONVEYANCE SYSTEM
ON-SITE DISPOSAL FACILITY
FERNALD, OHIO

Hydrostatic testing is the approved testing procedure for the piping systems. However, if approved in writing by the Construction Manager as indicated in Section 02605, Part 3.07.D, a pneumatic test procedure may be used as an alternative or as a preliminary test for the pipes. If used as an alternative test, a written approval from the Engineer-of-Record must also be obtained. Regardless of the approval of the Construction Manager and Engineer-of-Record, these procedures are to be reviewed and accepted by the pipe supplier prior to implementation.

Carrier Pipe

The steps to be followed during pneumatic pressure testing of the 6-in. diameter gravity carrier pipe component of the leachate conveyance system for the On-Site Disposal Facility are presented below. In addition, all FDF, Contractor, and OSHA safety protocols (e.g., trench stability, pipe supports, equipment verifications, valve opening/closing warning, worker protection, danger zones, etc.) are to be followed. FDF Construction, Safety, and Quality Assurance shall verify all site safety protocols. Extra care shall be exercised when performing this test since compressed air (or the pressurized gas used as the test medium) may present hazards to workers in the vicinity of the pipelines being tested. The test medium shall be nonflammable and nontoxic. For an approved test at Fernald, the test medium shall be air.

- Install blind flanges at cleanouts along the section of carrier pipe to be tested.
- Attach all necessary blind flanges, low-point drain valve, high-point drain valve, pressure gauge and fill hose connections to the section of carrier pipe to be tested. Note, the pressure gauge must be installed upgradient of the low-point drain valve. Position the pressure gauge such that it is in full view of the testing operator when the valve is being turned on or off.

- Close all high-point drain valves and low-point drain valves of both the carrier and containment piping systems. Make sure these valves are definitely closed.
- Attach a pneumatic pressure source (i.e., air compressor with pressure regulator valve) to the overall low-point drain valve of the carrier pipe.
- Turn on the pneumatic pressure source and open the carrier pipe low-point drain valve to the pressure source. Allow the pressure to rise in a gradual, step-wise manner.
- Apply a 10-psi pressure as a preliminary test to detect any possible major leaks. Detect leaks by means of soap bubble or monitoring of test gauge as described below.
- Gradually increase the pressure to one-half of the full 50-psi pneumatic test pressure. The test pressure must not exceed the pneumatic test pressure of any component (e.g., valve, blind flange, etc.) of the piping system. Pause to allow the piping strains to become somewhat equalized and to detect any possible major leaks.
- Gradually increase the pressure to the full 50-psi pneumatic test pressure. Close the low-point valve.
- Allow 1 to 3 hours (minimum 1 hour) for pipe stabilization. Pipe stabilization is achieved if there is <u>no</u> drop in pressure over a one-hour period.
- After completion of stabilization period, perform test for one hour if the pipe is not buried, and 3 hours if the pipe is buried. A passing test is considered to have no pressure loss over the test period.
- If the internal gauge pressure of the carrier pipe does not drop below the full pneumatic test pressure, and no leaks are detected, the carrier pipe is considered to have passed the pressure/leak test.

- At the completion of the test and if testing of containment pipe is not to be performed at this time, verify the low-point drain valve is closed and disconnect the pressure source from the low-point drain valve.

- Open the high-point vent valve and slowly allow the pressure to be reduced to atmospheric pressure.

Containment Pipe

The steps to be followed during pneumatic pressure testing of the 10-in. diameter gravity containment pipe component of the leachate conveyance system for the On-Site Disposal Facility are presented below. In addition, all FDF, Contractor, and OSHA safety protocols (e.g., trench stability, pipe supports, equipment verifications, valve opening/closing warning, worker protection, danger zones, etc.) are to be followed. FDF Construction, Safety, and Quality Assurance shall verify all site safety protocols. Extra care shall be exercised when performing this test since compressed air (or the pressurized gas used as the test medium) may present hazards to workers in the vicinity of the pipelines being tested. The test medium shall be nonflammable and nontoxic. For an approved test at Fernald, the test medium shall be air. Each step is to be checked off as it is performed.

- Pressurize the carrier pipe to 15 psi according to the procedures described previously.

- Close the carrier pipe system low-point drain valve, and remove the pressure source to the low-point drain valve. Note that the carrier pipe system is now a closed system, filled with compressible gas (i.e., air), under the same pressure that the containment pipe will be pneumatically tested.

- Recheck all high-point vent valves and low-point drain valves of the containment piping system. Make sure that these valves are definitely closed. Close all vent plugs at the cleanouts along the section of pipe to be tested.

- Attach a source of pneumatic pressure (i.e., air compressor with pressure regulator valve) to the overall low-point drain valve of the containment pipe.

- Turn on the pneumatic pressure source and open the containment pipe low-point drain valve to the pressure source. Allow the pressure to rise in a gradual, step-wise manner.

- Raise the pressure in increments of 5 psi in a slow, gradual manner. Apply soapy solution to each weld, joint, or flange to detect bubbles if there are any leaks. Randomly inspect other points or sections of pipes for the presence of water.

- Increase the pressure gradually to the full pneumatic test pressure of 15 psi and close the containment system low-point valve.

- Allow 1 to 3 hours (minimum 1 hour) for pipe stabilization. Pipe stabilization is achieved if there is no drop in pressure over a one-hour period.

- After completion of stabilization period, perform test for one hour if the pipe is not buried, and 3 hours if the pipe is buried. A passing test is considered to have no pressure loss over the test period.

- If the internal gauge pressure of the carrier pipe does not drop below the full pneumatic test pressure, and no leaks are detected using soap bubble, the containment pipe would have passed the pressure/leak test.

- When the test is complete, disconnect the pressure source from the low-point drain valve.

- Open the containment system high-point vent valve and slowly allow the pressure to be reduced to atmospheric pressure. Note, always release pressure from the containment pipe before releasing pressure from carrier pipe.

- Close off the high-point vent valve of the containment pipe system that was opened, and any other valves that were opened to accelerate the venting process.

- Open the carrier system high-point vent valve and carefully allow the pressure to be reduced to atmospheric pressure. Open other valves as necessary to accelerate this process.

- Close off the high-point vent valve of the carrier pipe system that was opened, and any other valves that were opened to accelerate the venting process.

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Hydrostatic Pipe Test Procedure

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HYDROSTATIC PIPE TEST PROCEDURE
LEACHATE CONVEYANCE SYSTEM
ON-SITE DISPOSAL FACILITY
FERNALD, OHIO

The following procedures are intended to supplement the requirements of Section 02605: High Density Polyethylene (HDPE) Pipes and Fittings of the Technical Specifications for the OSDF project. The procedures are applicable to the currently used SDR 26 pipe. If a different SDR pipe is used in subsequent phases of work, the applicability and appropriateness of these procedures need to be reviewed. Refer to Part 3.07.C and Part 3.07.D of Section 02605 of the Leachate Conveyance System Technical Specifications [FEMP LCS-SPEC-REV 0] and any applicable DCNs. The procedures are to be reviewed and accepted by the pipe supplier prior to implementation. Bring any conflicts between the following procedures and Section 02605 and any applicable DCN, to the immediate attention of the Construction Manager.

Carrier Pipe

The steps to be followed during hydrostatic pressure testing of the 6-in. diameter gravity carrier pipe component of the leachate conveyance system for the On-Site Disposal Facility are presented below. In addition, all FDF, Contractor, and OSHA safety protocols (e.g., trench stability, pipe supports, equipment verifications, valve opening/closing warning, worker protection, etc.) are to be followed. Each step is to be checked off as it is performed.

- Remove all blind flanges from cleanouts of the section of carrier pipe to be tested.

- Attach all necessary blind flanges, low-point drain valve, high-point drain valve, pressure gauge and fill hose connections to the section of carrier pipe to be tested. Low-point refers to the end of pipe section being tested with the lowest elevation; while high-point refers to the end with the highest elevation. Note, the pressure gauge must be installed upgradient of the low-point drain valve. Position the pressure gauge such that it is in full view of the testing operator when the valve is being turned on or off.

- Attach a fill hose to the low-point of the drain valve.
- Slowly fill the carrier pipe with water until water flows from the high-point drain valve and over top the cleanouts.
- Make sure any air in the pipe is completely vented, by shaking or tapping pipes gently. When all air is out of the system, shut-off high-point drain valve, replace the cleanout blind flanges, close the low-point drain valve, shut-off water source at low-point drain valve, and remove fill hose.
- Open any low-point drain valves or weep holes in the containment pipe to allow visual leak detection monitoring during the carrier pipe testing.
- Attach pressure source to the low-point drain valve of the carrier pipe, and open low-point drain valve.
- Gradually increase pressure to the 50-psi test pressure. This test pressure applied to SDR 26 only. The 50-psi pressure is the maximum pressure applied as measured at the low-point drain-valve and includes the pressure due to the hydrostatic head of water in the pipe. Close low-point valve and remove pressure source connection.
- Allow 1 to 3 hours (minimum 1 hour) for pipe stabilization. Pipe stabilization is achieved if there is <u>no</u> drop in pressure over a one-hour period.
- After completion of stabilization period, perform test for one hour if the pipe is not buried, and 3 hours if the pipe is buried. A passing test is considered to have no pressure loss over the test period.
- Slowly relieve pressure by opening the high-point drain valve.
- If test was successful (i.e. passed) and testing of containment pipe is not desired at this time, connect a drain hose to the low-point drain valve and drain the system to an appropriate location (e.g., tank, storm sewer, etc.).

Containment Pipe

The steps to be followed during hydrostatic pressure testing of the 10-in. diameter containment pipe are presented below. In addition, all FDF, Contractor, and OSHA safety protocols (e.g., trench stability, pipe supports, equipment verifications, valve opening/closing warning, worker protection, etc.) are to be followed. Each step is to be checked off as it is performed.

- Remove vent plugs from fixed end seals at all cleanouts of the section to be tested. Drill holes in any fixed-end seals which do not have vent plugs. Tap the hole for subsequent installation of a vent plug.

- Attach all necessary blind flanges, low-point drain valve, high-point drain valve, pressure gauge and fill hose connections to the section of containment pipe to be tested. Low-point refers to the end to the end of pipe section being tested with the lowest elevation; while high-point refers to the end with the highest elevation. Note, the pressure gauge must be installed upgradient of the low-point drain valve. Position the pressure gauge such that it is in full view of the testing operator when the valve is being turned on or off.

- Open all high-point vent valves of the containment piping system.

- Attach a fill hose to the low-point drain valve.

- Slowly fill the containment pipe with water until water flows from the high-point drain valve and over top the cleanouts.

- Make sure that any air in the pipe is completely vented, by shaking or tapping the pipe gently. When all air is out of the system, shut-off high-point drain valve, replace the vent plugs at the cleanout location, close the low-point drain valve, shut-off water source at low-point drain valve, and remove fill hose.

- Fill carrier pipe and pressurize to 15 psi according to the procedures described previously.

- Attach pressure source to the low-point drain valve of the containment pipe, and open the containment low-point drain valve.
- Gradually increase pressure to the 15-psi test pressure. This test pressure is the maximum pressure applied to the containment pipe is measured at the low-point drain valve and includes the pressure due to the hydrostatic head in the pipe.
- Visually inspect containment pipe welds, joints, and fittings as pressure is applied. Inspect other pipe sections for any signs of water. Apply soap to welds, joints, or fittings as needed.
- Close low-point valve and remove pressure source connection.
- Allow 1 to 3 hours (minimum 1 hour) for pipe stabilization. Pipe stabilization is achieved if there is no drop in pressure over a one-hour period.
- After completion of stabilization period, perform test for 1 hour if pipe system is not buried or 3 hours if pipe system is buried.
- Slowly relieve pressure from the containment pipe by opening the high-point drain valve, slowly relieve pressure from the carrier pipe by opening the high-point drain valve. Note, always remove pressure from the containment pipe before removing pressure from the carrier pipe.
- If test was successful (i.e. passed), connect a drain hose to the low-point drain valves of both carrier and containment piping system. Drain the containment pipe system first and then the carrier pipe system to an appropriate location (e.g., tank, storm sewer, etc.).

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APPENDIX J
RECOMMENDED PROCEDURES FOR LTS PRESSURE TESTING

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Joining with Electrofusion Couplings

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PROCEDURE FOR JOINING PIPE USING ELECTROFUSION COUPLINGS LEACHATE CONVEYANCE SYSTEM ON-SITE DISPOSAL FACILITY

FERNALD, OHIO

The general procedures for joining pipe with electrofusion couplings are summarized below. These procedures are to be reviewed by both the pipe supplier and electrofusion coupling manufacturer prior to the start of installation. The pipe supplier and electrofusion coupling manufacturer are to modify the general procedures to be specific to their products. The pipe installer will submit for approval quality control and documentation procedures which will be used to demonstrate the required procedures are followed. All joining work will be performed by pipe fitters meeting all training requirements of the pipe supplier and electrofusion coupling manufacturer.

- The pipes to be joined must have square ends. Cut the pipes if needed to achieve a proper end.

- Removal any burrs or shavings from the pipe ends that may have developed during the cutting process.

- Clean pipe ends inside and out with a clean cloth to remove any dirt or contaminants.

- Scrape exterior surface of the pipe ends to remove any oxidation or surface contamination. The scraping shall be performed with a tool approved by the pipe supplier and electrofusion coupling manufacturer. Do not remove more than 10 percent of wall thickness when scrapping, trying not to create nicks or gouges. The area to be scraped includes the segment of pipe to be joined to the electrofusion coupling and any segment of pipe the coupling may be temporarily slid over during the alignment process.

  Remove scraping tools and clean blade area with a clean, dry cloth. Repeat this procedure several times during the scraping operation to remove build-up of material. Pipe preparation and contamination are very important considerations in the electrofusion process. Therefore, careful attention should be given to

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proper scraping and cleaning procedures. Continue scraping until only a virgin surface remains. In the event of out-of-round pipe, it is important to assure an adequate and even scrape is achieved around the entire circumference of the pipe. A rubber pipe stopper can be placed in the end of the pipe to aid in rounding the area to be scraped.

- Do not touch inside of fitting or scraped pipe surfaces with hands as perspiration and body oils can contaminate jointing areas and affect joint performance. Rescrape any areas which are touched or suspected of being dirty.

- Mark the surface of each pipe at a distance from the pipe end equal to half the length of the coupling.

- Keep coupling in sealed bag until it is ready to use. Slide coupling onto pipe until coupling end meets measurement marks. Note, couplings maybe have internal stops at center of coupling. Slide coupling only onto surface which was scraped and is clean and dry. If stops are provided, slide pipe until stops are met. Repeat with other pipe to be joined.

- Maintaining insertion depth of pipe into coupling, place pipe into the proper clamping tool to align pipe and coupling and to prevent movement during the fusion cycle. For best results, alignment clamps should be placed as close to the fitting as possible.

- Start electrofusion procedures immediately after set up is complete. All pipe scraping, pipe cleaning and electrofusion welding must be completed on the same day.

- Connect the sequence processor to an adequate AC power source. Refer to coupling manufacturer's electrical requirements for size and type of fitting being joined. Requirements may be dependent on pipe SDR.

- Run any diagnostic check programmed in the sequence processor. Proceed when diagnostic check is achieved.

- Attach leads from the sequence processor to the fitting terminals. Check sequence processor to ensure proper connection is made.

- Press start button or sequence processor to begin fusion cycle. Voltage readout should remain between limits set by manufacturer.

- When the fusion cycle is complete disconnect leads from fitting.

- Clamping device should remain in place to secure pipe and fitting during the electrofusion coupling manufacturer's recommended cooling time. After removing clamp, additional cooling time should be allowed before subjecting the joint to bending, burying, pressure testing, or similar handling and backfill stresses.

- Extrusion welding of the coupling to the pipe will only be allowed if approved in writing by the coupling manufacturer. If allowed, extrusion welding can not be performed until all of the above steps are complete. In no case, shall an extrusion weld be allowed on a coupling which fails any of the above steps.

Joining with Extrusion Weld Sleeves

PROCEDURES FOR JOINING PIPE USING EXTRUSION WELDED SLEEVES LEACHATE CONVEYANCE SYSTEM ON-SITE DISPOSAL FACILITY

FERNALD, OHIO

The general procedures for joining two fixed lengths of containment pipe using an extrusion weld HDPE sleeve are presented below. The pipe supplier is to review these installation procedures. The pipe supplier is to modify the general procedures to be specific to its products. The pipe installer will submit for approval quality control and documentation procedures which will be used to demonstrate the required procedures are followed.

The extrusion welding of pipe will be performed in a controlled environment under clean, dry conditions by trained operators. A properly made extrusion weld is reported by pipe manufacturers to be capable of holding a 15 psi pressure. Therefore, the use extrusion welded sleeves is appropriate only for the containment pipe, which is not expected to be subjected to hydrostatic pressure during operation, and subjected to a pressure of 15 psi only during hydrostatic testing.

The sleeve is made from a larger diameter pipe than that of the containment pipe. A pipe with a minimum inside diameter which will just slide over the containment pipe is to be used. The maximum difference between the inside diameter of the sleeve and the outside diameter of the containment pipe is 0.25 in. Horizontally split sleeves can be used in areas where obstructions (e.g., cleanout, manholes, etc.) on either side of the pipe ends to be joined prevent the sleeve from being slid back and forth. Use of split sleeves in obstructed area requires the written approval of the Construction Manager. Note, every effort is to be made to stage work to avoid the need for split sleeves in obstructed areas. Under no circumstances will split sleeves be allowed in areas where the geometry of the pipe or sleeve prevents the sliding of the sleeve onto the pipe.

The following joining procedures shall be followed:

- At least one pipe length on either side of the joint location will be free (i.e., not backfilled).

- An excavation under the joint location will be made to allow access for extrusion welding. The excavation will be approximately 3-ft deep, however, in no case will an excavation deeper than 4-ft be allowed.

- Prior to joining the inner carrier pipe, measure the gap between the outer containment pipe ends (i.e., of the distance between the ends of the two pipes to be joined). Cut the sleeve of sufficient length to allow for a 6-in. overlap at each end (i.e., the length of gap plus 12 in.). Cut the sleeve such that the ends are square. Cut a 45 degree bevel around the circumference of the inside edge of the sleeve.

- Place the sleeve on the containment pipe and slide along the pipe to allow clearance for joining the carrier pipe.

- Join the inner carrier pipe using either the butt fusion or electrofusion methods.

- With a clean rag, wipe both the inside and outside surfaces of the containment pipe and sleeve. Grind the surfaces to be welded (i.e., sleeve ends and outer containment pipe surface) using a hand held grinder with No. 60 grit paper or in accordance with manufacturer's recommendation. Wipe the surface with a clean rag to remove any grit or cuttings. The cleaning and scraping are to be performed in a manner which prevents a clean surface from coming in contact with a dirty surface.

- Slide and center the sleeve over the gap in the containment pipe and insert shims to center the outer containment pipe inside the sleeve, if necessary. Verify the sleeve and both containment pipes are aligned both vertically and horizontally.

- Prior to welding sleeve, the fitter will prepare a trial weld on a section of scrap pipe with the equipment to be used for the production weld. The trial weld will pass the criteria established by the pipe supplier prior to commencement of the production weld.

- To eliminate moisture, heat the weld area using hot air, greater than 120 degrees F, until surfaces are visibly dry.

- Extrusion weld along the notched annular space formed by the bevel edge of the sleeve and the containment pipe. Note, multiple passes around the circumference may be required to establish a weld consistent with the manufacturer's recommended dimension.

- Allow the tie-in to cool down for 30 minutes before backfilling or performing any other activities which may cause movement of the pipe.

APPENDIX K
RECOMMENDED PROCEDURES FOR LTS CQC/CQA

HDPE Pipe Joining

CONSTRUCTION QUALITY ASSURANCE MONITORING
HDPE PIPE JOINING
LEACHATE CONVEYANCE SYSTEM
ON-SITE DISPOSAL FACILITY

FERNALD, OHIO

OVERVIEW

The following general procedures are part of the Construction Quality Assurance (CQA) Plan for the On-Site Disposal Facility (OSDF) project. The procedures specifically address CQA procedures to be followed during joining of pipe by either butt-fusion welding electrofusion welding, or with an extrusion welded sleeve. In all cases the CQA technician monitoring pipe joining is to be familiar with the approved installation procedures submitted by the pipe installer. Any conflicts between the approved installation procedures and these CQA procedures are to be brought to the immediate attention of the Construction Manager.

BUTT FUSION WELDING

The CQA procedures to be following during butt fusion of HDPE pipe are summarized below.

- Each butt fusion joint will be assigned a number. The number will be recorded on the pipe using either a crayon or other approved marker. The number will be recorded on both sides of the joint.

- The welding of all butt fusion joints does not have to be observed. For welds which are observed the following information will be recorded on the form attached to this document:

  - pipe diameter and SDR;

  - machine identification;

  - operator identification;

- gauge pressure during welding;
- gauge pressure during cool down;
- welding plate temperature;
- alignment of pipes; and
- approximate amount of "roll-back".

- For butt fusion joints which the welding is not observed only the pipe alignment and amount of roll-back will be recorded.
- Any joints that are not acceptable will be cut out and rewelded. Documentation of the rewelding procedures will be recorded on the form attached to this document.
- The approximate location of the butt-fusion joints relative to bounding structures such as manholes or clean outs will be recorded. The approximate of the locations will be shown on the record drawings for the pipe.

ELECTROFUSION WELDING

The CQA procedures to be following during extrusion welding of HDPE pipe sleeves are summarized below.

- All extrusion welds will be fully monitored.
- The technician monitoring the welding will review and be familiar with the approved installation procedures submitted by the pipe installer.
- All extrusion welds will be assigned a number. The number will be recorded using a crayon or other approved marker on the coupling.
- The technician will document the pipe is fully installed into the coupling before welding commences.

- The following welding information will be recorded on the form attached to this document:
  - pipe diameter and SDR;
  - machine identification number;
  - operator identifier;
  - serial and model number on coupling;
  - joint preparation including scraping, graining and cleaning;
  - seating of pipe at center of coupling;
  - alignment of pie;
  - heating time
  - cool down time;
  - joint not disturbed during cool down time; and
  - acceptability of weld as shown on computer output (i.e., Weld OK, Abort, etc.)
- Any extrusion welding of the coupling to the pipe will be noted on the form.
- The approximate location of the electrofusion joints relative to bounding structures such as manholes or clean outs will be recorded. The approximate locations will be shown on the record drawings for the pipe.

EXTRUSION WELDED SLEEVES

The CQA procedures to be following during extrusion welding of HDPE pipe sleeves are summarized below:

- All extrusion welds will be fully monitored.

- The technician monitoring the welding will review and be familiar with the approved installation procedures.
- All extrusion welds will be assigned a number. The number will be recorded using a crayon or other approved marker on the sleeve and adjoining pipe.
- Check to see the pipe ends are free and sufficient space beneath pipe has been excavated.
- Document diameter and SDR of sleeve.
- Check the length of sleeve and beveling of sleeve ends.
- Document pipe has been cleaned, properly ground and cleaned again.
- Check to see sleeve is centered and aligned vertically and horizontally.
- Check to see moisture is removed and observe welding procedure.
- The technician will document the pipe is fully installed into the coupling before welding commences.
- The following welding information will be recorded on the form attached to this document:
    - pipe diameter and SDR;
    - machine identification number;
    - operator identification;
    - serial and model number on coupling;
    - joint preparation including scraping, grinding and cleaning;
    - seating of pipe at center of coupling;
    - heating time;

- cool down time;
- joint not disturbed during cool down time; and
- acceptability of weld as shown on computer output (i.e., Weld OK, Abort, etc.).

- The approximate location of the sleeve relative to bounding structures such as manholes or clean outs will be recorded. The approximate locations will be shown on the record drawings for the pipe.

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BUTT FUSION WELDING LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 4.1

DESCRIPTION: YEAR:

CONTRACTOR:

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ CARRIER: ☐ OTHER: ☐

PIPE DIAMETER: SDR:

JOINT NO.	DATE (day/mo)	OPER. ID	MACH. ID	GAUGE PRESSURE ( )		PLATE TEMPERATURE (°F)	PIPE ALIGNMENT ACCEPT/REJECT	ROLL BACK DIMENSION	PASS/ FAIL	QA ID
				WELDING	COOL DOWN					

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FLUOR DANIEL FERNALD

ELECTROFUSION WELDING LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 4.1

DESCRIPTION: YEAR:

CONTRACTOR:

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ CARRIER: ☐ OTHER:

PIPE DIAMETER: SDR:

JOINT NO.	DATE (day/mo)	OPERATOR ID	COUPLING SERIAL/MODEL NUMBER	SURFACE PREPARATION		JOINT SEATED	JOINT CENTERED	PROCESSOR ID	COMPUTER READOUT		COMPUTER READOUT WELD ACCEPTANCE	ACCEPT/ REJECT	QA ID
				GRIND/SCRAPE	ACCEPTANCE				HEAT/ TIME	COOL DOWN TIME			

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

EXTRUSION WELDED SLEEVE LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 4.1

DESCRIPTION: DATE: _____ day _____ month _____ year

CONTRACTOR:

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT ☐ CARRIER: ☐ OTHER:

PIPE DIAMETER: SDR:

JOINT NO.	DATE (day/mo)	CAP LENGTH	SLEEVE LENGTH	SURFACE PREPARATION		SLEEVE CENTERED	SLEEVE ALIGNED	TRIAL WELD P/F	PERFORM HOT AIR DRYING	OPERATOR ID	MACHINE ID	EXTRUSION WELD COMPLETED	ACCEPT/ REJECT	QA ID
				GRIND/CLEAN	ACCEPTANCE									

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HDPE Pipe Pressure Testing

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CONSTRUCTION QUALITY ASSURANCE MONITORING
HDPE PIPE PRESSURE TESTING
LEACHATE CONVEYANCE SYSTEM
ON-SITE DISPOSAL FACILITY

FERNALD, OHIO

OVERVIEW

The following general procedures are part of the Construction Quality Assurance (CQA) Plan for the On-Site Disposal Facility (OSDF) project. The procedures specifically address CQA procedures to be followed during pressure testing of the HDPE pipe.

- Prior to testing, the CQA technician will become familiar with all of the testing requirements.
- A separate pressure test log will be completed for each section of pipe to be tested.
- Prior to filling, make sure all valves are closed and fittings are in place.
- Observe location of pressure gauge.
- Observe pressure build-up in pipe.
- Check to see that target pressure is applied.
- Observe and document that pressure is stable.
- Record pressure at least every 30 minutes during course of test.
- Indicate on form if pipe section passed or failed.

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PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 4.1

DESCRIPTION: YEAR:

CONTRACTOR:

TEST DESCRIPTION: HYDROSTATIC: ☐ PNEUMATIC (ATTACH WRITTEN AUTHORIZATION): ☐

PASS/FAIL CRITERION:

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ CARRIER ☐ OTHER: ☐

TARGET PRESSURE: TEST DURATION: GAUGE NO.: GAUGE LOCATION:

TEST LOCATION: TO

FOR CONTAINMENT PIPE TESTING, CARRIER PIPE PRESSURIZED FIRST: ☐ YES ☐ NO

READING NO.	STABILIZATION TEST PERIOD	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID

PASS: ☐

FAIL: ☐

VISUAL MONITORING:

CONTRACTOR'S REPRESENTATIVE day/mo/yr CQA REPRESENTATIVE day/mo/yr

LS3

FINAL APPROVAL:

CONTRACTOR'S REPRESENTATIVE day/mo/yr CQA REPRESENTATIVE day/mo/yr

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