4654

SILOS 1 AND 2 REMEDIATION FACILITY DRAFT REMEDIAL DESIGN PACKAGE

40750-RP-0028, REV. 0
NOVEMBER 2002

FERNALD
Environmental Management Project

Prepared Under DOE
Contract No. DE-AC24-01OH20115

Prepared by: **William Candy**
Engineer

Reviewed by: _____
Jack Hughes
Engineering Manager

Approved by: _____
John North
Silos 1 and 2 Project Manager

4654

SILOS 1 AND 2 REMEDIATION FACILITY DRAFT REMEDIAL DESIGN PACKAGE

40750-RP-0028, REV. 0
NOVEMBER 2002

FERNALD
Environmental Management Project

Prepared Under DOE
Contract No. DE-AC24-01OH20115

Prepared by: **William Candy**
Engineer

Reviewed by: _____
Jack Hughes
Engineering Manager

Approved by: _____
John North
Silos 1 and 2 Project Manager

4654

RECORD OF REVISION

Revision Sheet			
Revision	**Date**	**Pages Affected**	**Reason for Revision**
0	**November 2002**		**Initial document for DOE review and approval before being finalized.**

000003

4654

1
2
3

TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	SILOS 1 AND 2 REMEDIAL DESIGN (RD) PACKAGE SCOPE AND PURPOSE	1
1.2	BACKGROUND	2
1.3	PROCESS OVERVIEW	5
2.0	SYSTEMS DESIGN DESCRIPTION	8
2.1	CHEMICAL STABILIZATION PROCESS SYSTEMS	8
2.1.1	TTA Waste Retrieval System (System 13)	9
2.1.2	Feed Preparation System (System 15)	12
2.1.3	Processor Feed System (System 16)	14
2.1.4	Product Additive System (System 44)	17
2.1.5	Processor System (System 17)	19
2.1.6	Supernatant Water System (System 55)	19
2.1.7	Sluice/Flush Water (System 62)	21
2.1.8	Vessel Vent System (System 19)	21
2.1.9	Sampling System (System 84)	22
2.2	CONTAINER HANDLING SYSTEMS	22
2.2.1	Container Receipt and Preparation System (System 23)	22
2.2.2	Container Filling System (System 24)	25
2.2.3	Container Shipping System (System 25)	27
2.3	HVAC SYSTEMS (SYSTEMS 70, 71, AND 77)	28
2.3.1	Overview	28
2.3.2	Remediation Building HVAC System	28
2.4	INFRASTRUCTURE	32
2.4.1	Logistical Support	32
2.4.2	Site Facilities and Functions	33
2.5	SUPPORT SYSTEMS	34
2.5.1	Electrical Systems	34
2.5.2	Air Utilities	35
2.5.3	Water Systems	35
2.5.4	HEALTH PROTECTION SYSTEM (SYSTEM 93)	37
3.0	PROCESS CONTROL PLAN	39
3.1	PROCESS OBJECTIVE	39
3.2	PROCESS METHOD	40
3.3	PROCESS CONTROLS	40
3.3.1	Administrative Controls	41
3.3.2	Hardware/Software Controls	43
3.3.3	Automatic Data Collection	45
3.4	SYSTEM AND CONTROL DESCRIPTIONS	45
3.4.1	TTA Waste Retrieval System	46

 4654

3.4.2	Feed Preparation System	46
3.4.3	Processor Feed System	47
3.4.4	Product Additive System	47
3.4.5	Processor System	47
3.4.6	Supernatant and Flush/Sluice Water Systems	48
3.4.7	Container Receipt and Preparation System	48
3.4.8	Container Filling System	49
3.4.9	Container Shipping System	49
4.0	TECHNOLOGY OVERVIEW	50
4.1	SITE BACKGROUND	50
4.2	FLOCCULATION STUDIES	51
4.3	STABILIZATION TREATABILITY STUDY	53
5.0	INTERFACES WITH AWR	57
5.1	AWR PROJECT DESIGN CHANGES IMPACTING SILOS 1 AND 2	57
5.2	BASELINE SCHEDULE MODIFICATIONS	57
5.2.1	Design Basis Changes	57
5.2.2	Physical Design Changes	57
5.3	AWR WASTEWATER MANAGEMENT STRATEGY	58
5.3.1	Design Basis Changes	58
5.4	RCS DESIGN CAPACITY	58
5.4.1	Design Basis Changes	58
5.4.2	Physical Design Changes	58
5.5	AWR SYSTEMS INTERFACE WITH SILOS 1 AND 2	59
5.5.1	Waste Retrieval Operating Modes	59
5.5.2	SWRS Operating Mode	59
5.5.3	TWRS Operating Mode	61
5.5.4	Concurrent SWRS and TWRS Operating Modes	61
5.6	PROCESS WATER SYSTEM (SYSTEM 50)	61
5.7	RADON CONTROL SYSTEM (SYSTEM 20)	64
5.7.1	RCS Requirements	64
5.7.2	Radon Control System Description	65
6.0	ENVIRONMENTAL CONTROL PLAN	68
6.1	AIR EMISSIONS CONTROL PLAN	68
6.1.1	Air Emissions Controls	69
6.1.2	Estimated Point Source Air Emission Data	71
6.2	EROSION AND STORMWATER CONTROL PLAN	72
6.2.1	Functional Requirements	73
6.2.2	Run-on/Run-off Control Structural Practices	74
6.3	FUGITIVE DUST CONTROL PLAN	77
6.3.1	Site-Specific Limits	77
6.3.2	Suppression Equipment	78
6.3.3	Methods and Materials	78

6.3.4	Work Practices	79
6.3.5	Monitoring	80
6.3.6	Recordkeeping	80
6.3.7	Off-Hours Fugitive Dust Alert Notification	80
6.4	WASTE MANAGEMENT PLAN	81
6.4.1	Waste Types	81
6.4.2	Waste Minimization	82
6.4.3	Construction Debris Management	83
6.4.4	Soil Management	83
6.4.5	Unknown Debris Management	84
6.4.6	Waste Container Management	84
6.4.7	Wastewater Control	85
6.5	REFERENCES	85
7.0	APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS MATRIX	87
8.0	HEALTH AND SAFETY PLAN	88
9.0	DRAWINGS	109
	Process Flow Diagrams/ Material Balance	
	Heating Ventilating and Air Conditioning	
	General Arrangement	
	Site Plans, Excavation Drainage Erosion Protection and Stormwater	

TABLES

1-1	OU4 Silos 1 and 2 Remedy Components	3
3-1	Sampling and Analysis	42
3-2	Valve Types and Service	44
4-1	Characteristics of Settled and Supernatant Layers	52
6-1	Estimate of Release from the Silos 1 and 2 Remediation Building Air	71
6-2	Results of Dispersion Modeling for Releases from Silos 1 and 2 Remediation Facility Air	72
6-3	Silos 1 and 2 AWR Design Basis Exposure, ^{222}-Rn	72
8-1	Health and Safety Controls Based on the Silos Project Health and Safety Plan	90

000006

4654

FIGURES

1-1	Chemical Stabilization Process Flow	**6**
5-1	Silo Waste Retrieval System (SWRS) Operating Mode	**60**
5-2	Transfer Storage Tank Waste Retrieval System (TWRS) Operating Mode	**62**
5-3	Concurrent Silo Waste Retrieval System (SWRS) and Transfer Storage Tank Waste Retrieval System (TWRS) Modes	**63**
8-1	Occupational Hazards Identified in the Silos Project Health and Safety Plan	**89**

4654

APPENDICES

A	Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Requirements
A-1	Chemical-Specific ARARs and TBC Requirements
A-2	Location-Specific ARARs and TBC Requirements
A-3	Action-Specific ARARs and TBC Requirements
B	Appendices From Silos 1 and 2 Environmental Control Plan (40750-PL-0005)
B-1	Erosion and Stormwater Control Features Details
B-2	Daily Records of Fugitive Emission Control
B-3	Off-Hours Dust Control Procedure
B-4	Material Segregation and Containerization Criteria
B-5	Estimated Amounts of Each Type of Waste Stream
C	Sampling and Analysis Plan

1
2

4654

ACRONYMS AND ABBREVIATIONS	
ACU	Air conditioning units
ALTER	Accelerated Life Testing and Environmental Research
AWWT	Advanced Waste Water Treatment
ALARA	As Low As Reasonably Achievable
ARARs	Applicable or relevant and appropriate requirements
AWR	Accelerated Waste Retrieval
BAT	Best Available Technology
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act, as amended
CFR	Code of Federal Regulations
D&D	Decontamination and demolition
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DPC	Designated Primary Contact
ECP	Environmental Control Plan
EDE	Effective dose equivalent
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FS/PP	Feasibility Study/ Proposed Plan
ft^3	Cubic feet
FTL	Field Tracking Log
FWENC	Foster Wheeler Environmental Corporation
g/cm^3	Grams per cubic centimeter
gpm	Gallons per minute
HEPA	High Efficiency Particulate Air
HMI	human machine interface
HVAC	Heating, ventilation and air conditioning
IEMP	Integrated Environmental Monitoring Plan
IP-2	Industrial Packaging Type-2
ISO	International Standards Organization

000009

4654

ACRONYMS AND ABBREVIATIONS	
lb/ft^3	Pound per cubic foot
LSA-II	Low Specific Activity-II
mrem	Millirem
MSCC	Material Segregation and Containerization
MTL	Material Tracking Location
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NESHAP	National Emission Standards for Hazardous Air Pollutants
NTS	Nevada Test Site
OAC	Ohio Administrative Code
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
O&M	Operations and Maintenance
OSDF	On-Site Disposal Facility
OU	Operable Unit
PCDF	Permitted Commercial Disposal Facility
pCi/g	pico Curies per gram
pCi/L	pico Curies per liter
PFD	Process Flow Diagram
PLC	programmable logic controller
PPE	Personal protective equipment
ppm	Parts per million
psig	Pounds per square inch (gauge)
QC	Quality Control
RA	Remedial Action
RAZ	Radiation Access Zone
RCRA	Resource Conservation and Recovery Act, as amended
RCS	Radon Control System
RCT	Radiological Control Technician
RD	Remedial Design
ROD	Record of Decision
RWP	Radiation Work Permit

000010

-4654

ACRONYMS AND ABBREVIATIONS	
scfm	Standard cubic feet per minute
SWRS	Silo Waste Retrieval System
TBC	To Be Considered
TCLP	Toxicity Characteristic Leaching Procedure
TLD	Thermoluminescent dosimeter
TRD	Technical Requirements Document
TTA	Transfer Tank Area
TWRS	Transfer Storage Tank Waste Retrieval System
UC	University of Cincinnati
U.S. EPA	United States Environmental Protection Agency
WAC	waste acceptance criteria
WAO	Waste Acceptance Organization
wt %	weight percent

4654

1.0 INTRODUCTION

1.1 SILOS 1 AND 2 REMEDIAL DESIGN (RD) PACKAGE SCOPE AND PURPOSE

This RD Package documents the preliminary engineering and design of the selected remedy to treat Operable Unit (OU) 4 Silos 1 and 2 material. This RD Package describes the facilities and process for receipt of Silos 1 and 2 material from the Transfer Tank Area (TTA), followed by treatment using a chemical stabilization technology and packaging for shipment and disposal.

The selected remedy for the Silos 1 and 2 material as defined in the Record of Decision (ROD) Amendment for Silos 1 and 2 consists of:

- Complete removal of the contents of Silos 1 and 2 and the Decant Sump Tank System sludge from the TTA, followed by treatment using chemical stabilization to stabilize characteristic metals to meet Resource Conservation Recovery Act (RCRA), as amended, toxicity characteristic limits, and attain the Nevada Test Site (NTS), waste acceptance criteria (WAC).

- Gross decontamination, demolition, size reduction, and packaging of concrete from Silos 1 and 2 structures, followed by shipment for off-site disposal at the NTS or an appropriately permitted commercial disposal facility (PCDF).

- Disposal of contaminated soil and debris, excluding concrete from Silos 1 and 2 structures, in accordance with the Fernald Environmental Management Project (FEMP) On-site Disposal Facility (OSDF) WAC or an appropriate off-site disposal facility, such as the NTS or a PCDF.

- Off-site shipment and disposal of the chemically stabilized waste at the NTS.

- Decontamination and demolition (D&D) of all structures and remediation facilities.

- Removal of the earthen berms and excavation of the contaminated soils within the OU4 boundary, to achieve remediation levels in the OU5 ROD.

- Appropriate treatment and disposal of all secondary wastes at either the NTS or an appropriate PCDF.

- Collection of perched water encountered during remedial activities for treatment at OU5 water treatment facilities.

- Continued access controls and maintenance and monitoring of the stored waste inventories.

- Institutional controls of the OU4 area such as deed and land-use restrictions.

Only the design and construction of the facilities for treatment and packaging of Silos 1 and 2 material is addressed in this RD Package. The remaining portions of the OU4 remedy are included in other remedial packages as shown in Table 1-1.

4654

The contents of the Silos 1 and 2 RD Package is as specified in the Revised Remedial Design Work Plan for Operable Unit 4 Silos 1 and 2 Project, dated September 13, 2001. This RD Package also includes design information for the Silos 1 and 2 Warehouse, Railroad Spurs, and Remediation Building Mat Foundation Design Package submitted to the United States Environmental Protection Agency (U.S. EPA) and Ohio Environmental Protection Agency (OEPA) in July 2002.

1.2 BACKGROUND

Silos 1 and 2, known as the K-65 silos, contain approximately 240,000 ft^3 of residues generated from the processing of high-grade uranium ores. The K-65 residues contain high activity concentrations of naturally occurring radionuclides, including radium, and thorium. These radionuclides contribute (1) to an elevated direct penetrating radiation field in the vicinity of the silos and (2) to the chronic emission of significant quantities of radon gas to the atmosphere.

Completion of the cleanup of Silos 1 and 2 involves two separate, but related, major projects, the Accelerated Waste Retrieval (AWR) Project and the Silos 1 and 2 Remediation Facility Project. The Silos 1 and 2 Remediation Facility Project, the subject of this RD Package, follows the implementation of the AWR Project.

The main objective of the AWR Project is the retrieval of the materials in Silos 1 and 2 as slurry for staging in a new TTA to be designed and constructed as part of the AWR Project. Also, the AWR Project involves the design, construction, and operation of a new Radon Control System (RCS) to lower the concentration of radon in the silos' headspace and provide radon control throughout the retrieval and storage phases of the AWR. The Silos 1 and 2 materials will be staged in the TTA until the new Remediation Facility, outlined in this RD Package, is operational. Upon start-up of the Remediation Facility, stored Silos 1 and 2 materials will be retrieved from the TTA and delivered as slurry to the Remediation Facility where chemical stabilization and packaging for shipment to the NTS or an appropriately permitted off-site disposal facility, are accomplished. The Silos 1 and 2 Remediation Facility includes the design, construction, operations and maintenance of the remediation facility. The project also includes extension of Rail Track 12 to the new remediation facility and the construction of the Silos 1 and 2 North Warehouse. The remediation facility will interface with the RCS and TTA facilities constructed under the AWR Project.

1

TABLE 1-1, OU4 SILOS 1 AND 2 REMEDY COMPONENTS		
Operable Unit 4 Remedy Components per ROD	**Remedial Plan for Remedy Component**	**Comments**
Complete removal of the contents of Silos 1 and 2 and the Decant Sump Tank system sludge from the TTA, followed by treatment using chemical stabilization to stabilize characteristic metals to meet Resource Conservation Recovery Act, as amended, toxicity limits and attain the Nevada Test Site (NTS) WAC.	Silos 1 and 2 Remediation Facility Remedial Design Package	Installation of the Remediation Facility, including Slurry Receipt Tanks, Chemical Feed Systems, Clarifier, Slurry Feed Tanks, Cement and Fly Ash Additive Systems, Product Mixers and Container handling and filling systems, are the subject of this Remedial Design Plan. Infrastructure additions including the Remediation Building, Warehouse, and Railroad spur expansions are also included.
Gross decontamination, demolition, size reduction, and packaging of concrete from Silos 1 and 2 structures, followed by shipment for off-site disposal at the NTS or a PCDF.	Silos 1 and 2 Remedial Action Plan. Decontamination and Demolition Plan.	The Remedial Action Work Plan for Silos 1 and 2 will be submitted by June 30, 2004. A milestone date for the Decontamination and Demolition Plan will be established at that time.
Disposal of contaminated soil and debris, excluding concrete from Silos 1 and 2 structures, in accordance with the FEMP OSDF WAC or an appropriate off-site disposal facility, such as the NTS or a PCDF.	Onsite Disposal where feasible. Other debris will be addressed in the Silos 1 and 2 Remedial Action Plan - Decontamination and Demolition Plan.	Soil meeting FEMP WAC will be disposed of on site. Remaining soils and other debris not meeting onsite WAC will be addressed in the Decontamination and Demolition Plan.
Off-site shipment and disposal of the chemically stabilized waste at the NTS	Silos 1 and 2 Remedial Action Plan – Transportation and Disposal Plan.	The date for the Draft Transportation and Disposal Plan will be established in the Remedial Action Work Plan in June 2004.
Decontamination and Demolition (D&D) of all structures and remediation facilities.	Silos 1 and 2 Remedial Action Plan – Decontamination and Demolition Plan.	Submitted with the Decontamination and Demolition Plan. May be incorporated into the Decontamination and Demolition Plan.

000014

4654

TABLE 1-1, OU4 SILOS 1 AND 2 REMEDY COMPONENTS		
Operable Unit 4 Remedy Components per ROD	**Remedial Plan for Remedy Component**	**Comments**
Removal of the earthen Berms and excavation of the contaminated soils within the OU4 boundary, to achieve remediation levels in the OU5 ROD.	No Remedial Action Plan Required.	Soil meeting FEMP WAC will be disposed of on site.
Appropriate treatment and disposal of all secondary wastes at either the NTS or an appropriate PCDF.	Silos 1 and 2 Remedial Action Plan - Decontamination and Demolition Plan	The Remedial Action Work Plan for Silos 1 and 2 will be submitted by June 30, 2004. A milestone date for the Decontamination and Demolition Plan will be established at that time.
Collection of perched water encountered during remedial activities for treatment at OU5 water treatment facilities	No Remedial Plan Required	Perched water if encountered will be directed to the OU5 Advanced Wastewater Treatment system.
Continued access controls and maintenance and monitoring of the stored waste inventories.	No Remedial Action Plan Required	Ongoing Site Access and Maintenance is addressed under the OU3 Remedy.
Institutional controls of the OU4 area such as deed and land-use restrictions.	No Remedial Action Plan Required	Institutional controls if required will be addressed in OU3 Remedy.

000015

7-4654

1.3 PROCESS OVERVIEW

4654

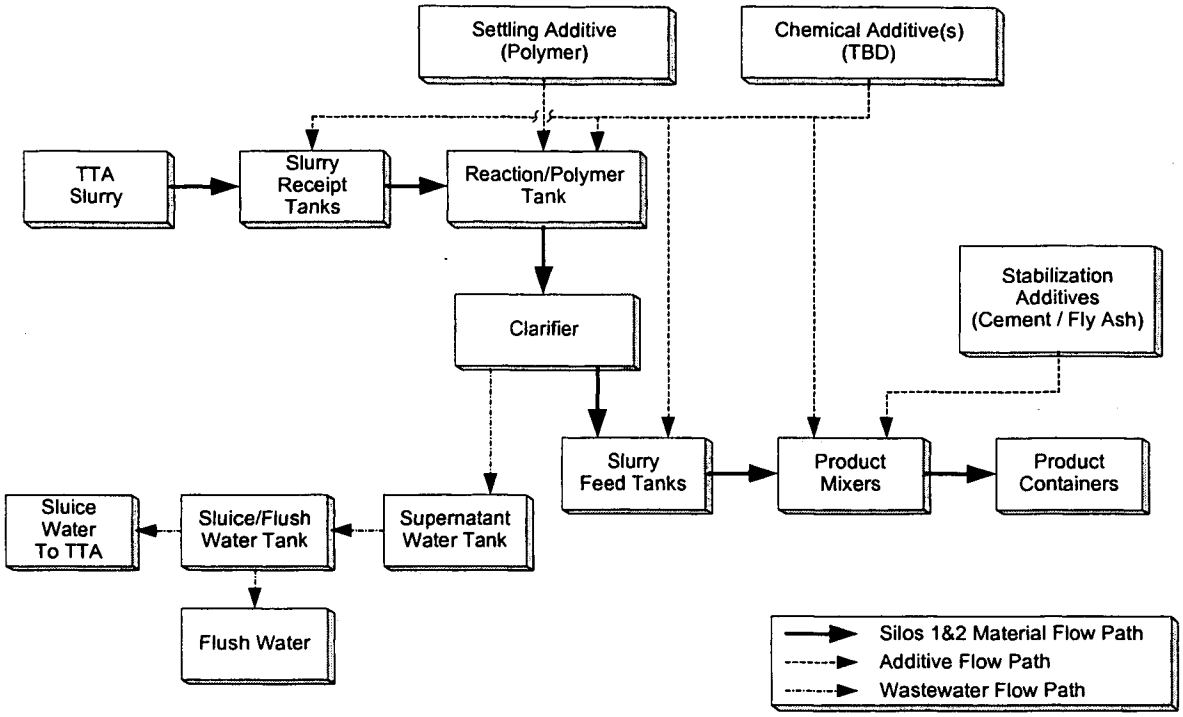
The Silos 1 and 2 Remediation Facility will consist of a Remediation Building, warehouse, office trailers, personal protective equipment (PPE) change facilities, and rail spurs. The Remediation Building will contain the control room, process and support systems for the slurry receipt, feed preparation, chemical stabilization/product forming, containerization and loading of the treated K-65 materials for shipment to an off-site disposal facility.

Silos 1 and 2 materials will be treated using a chemical stabilization process where chemical formulations (e.g., Portland cement, and fly ash) chemically and physically bind the silo materials. A thickening step will be included in the process to increase the waste loading in the final product. This will be accomplished using a combination of mixing tanks for chemical addition and a clarifier for gravity thickening. Addition of polymer will be used to improve settling. Filled waste containers will be staged, both indoors and outdoors, before being shipped off-site for disposal. The infrastructure described in this RD document assumes transportation by rail. If transportation by truck is chosen as the final transportation mode, the infrastructure provided by this RD package would be unaffected. The railcar loading facility is designed to accommodate both railcars and trucks. Customized railcars and trucks are currently under design for container transport. Container Loading is further addressed in Section 2.2.3 of this package. The details of the transportation and disposal of treated Silos 1 and 2 material will be documented in the Transportation and Disposal Plan, which will be submitted in accordance with the Remedial Action Workplan.

The chemical stabilization process flow diagram, Figure 1-1, shows the basic flow of materials through the facility. The treatment process will continuously produce a stabilized product using several systems, some that will operate in a batch fashion, and others that will operate continuously. Multiple lines of equipment will be used to ensure that batch operations performed sequentially result in a continuous overall operation.

4654

FIGURE 1-1
CHEMICAL STABILIZATION PROCESS FLOW



Treatability studies have shown that only polymer is required for settling, and only cement and fly ash are required for stabilization. However, piping systems are being included in the facility to allow addition of other chemicals (TBD) at various points in the process, if the need arises during operations. These contingency systems are being installed to address potential unknowns in the K-65 material and reduce project risks (Section 4.0).

The Remediation Facility will include the following six major process systems.

TTA Waste Retrieval System

In the TTA Waste Retrieval System, Silos 1 and 2 materials will be pumped as a slurry at approximately 350 gallons per minute (gpm) and 15 wt % solids from the TTA to the Remediation Building via one of two elevated, double-walled transfer lines. The material will be delivered to one of three carbon steel slurry receipt tanks. From the slurry receipt tanks, the material will be transferred to the reaction and polymer addition tank in the Feed Preparation System.

Feed Preparation System

In the feed preparation system, slurry from the receipt tanks can be mixed together with chemical additives. Based on bench-scale treatability studies (Section 4.0), the only additive required to enhance settling of suspended solids, is a polymer flocculating agent. Other chemicals could be added, if necessary, through a spare chemical additive system.

4654

The additives, if necessary, would be added in the reaction tank, polymer would be added in the polymer addition tank. The contents of the reaction and polymer addition tank will overflow to a clarifier to thicken the slurry to approximately 30 wt % solids in preparation for product mixing.

The remaining portions of this RD Package provide the details of the design and process controls of the above systems. The results of treatability testing to define the settling and stabilization technologies and the interfaces between this new Remediation Facility and the previously constructed AWR system are also discussed. Environmental, health, and safety considerations for this project are included in Section 8. Applicable or relevant and appropriate regulations and selected design drawings for this project are included in the appendices.

000018

4654

2.0 SYSTEMS DESIGN DESCRIPTION (40750-RP-0001)

As part of the remediation strategy, the silos material will first be removed and staged into four tanks constructed in a shielded TTA as part of the AWR Project. The material is then transferred to the chemical stabilization process. Due to the radiological characteristics of the silo material, certain operations conducted within the stabilization process are required to be operated remotely, with personnel kept at a safe distance and shielded to meet specific as-low-as-reasonably achievable (ALARA) guidelines. The stabilized product will be packaged in containers and shipped by rail to an appropriately licensed off-site disposal facility. Shipment by truck could also be used, if necessary.

The Silos 1 and 2 System Design Description details each of the systems in terms of the processes and equipment required to meet the applicable scope of work requirements.

The following systems are described herein:

- Chemical Stabilization Process Systems,
- Container Handling Systems,
- HVAC Systems,
- Infrastructure, and
- Support Systems.

2.1 CHEMICAL STABILIZATION PROCESS SYSTEMS

This section describes the process that will be used to chemically stabilize the Silos 1 and 2 material, comprised of K-65 residues and Bentogrout™, after it has been transferred from the TTA. The stabilization process will be comprised of three main process steps:

1. Batch transfer of TTA slurry into three slurry receipt tanks.

2. Continuous feed from the slurry receipt tanks to a clarifier system where chemicals can be added, solids will be settled and separated (clarified), and water will be recycled back to the TTA. The settled solids will be continuously fed to three slurry feed tanks.

3. Batch transfer of thickened slurry from three slurry feed tanks to three product mixers in which cement and fly ash will be added to stabilize the slurry. Disposal containers will be filled with the product and shipped to an off-site disposal facility.

To safely handle and contain the slurry from the silos, the following general design guidelines are being used:

1. All tanks and equipment containing Silos 1 and 2 material will be vented to the RCS.

2. Heavy-walled pipe and long-sweep elbows (e.g., a bend radius of five pipe diameters) are specified for piping used to transfer the abrasive slurry. Lines will be sized to provide a critical transport velocity of 5–10 ft/sec to prevent settling problems. Double-contained pipe is specified in outdoor areas.

3. Positive displacement pumps are specified for transferring thickened slurry. Centrifugal pumps are specified for transferring wastewater and slurry. Diaphragm pumps are specified for use as sump pumps.

4654

4. Three-way diverter valves and pinch valves will be used on slurry lines to minimize plugging. The three-way valves will have abrasion-resistant internals.

The Process Control Plan (40750-PL-0003, Section 3) provides a general description of how the Remediation Facility will be operated and controlled to accomplish the process objectives. A description of controls is provided within each individual system description. If the process is interrupted, such as from a power failure, all lines and pumps will be flushed using back-up power before being shut down.

2.1.1 TTA Waste Retrieval System (System 13)

(Refer to Drawing 94X-3900-F-01153.)

In the TTA Waste Retrieval System (System 13), Silos 1 and 2 slurry material will be pumped at approximately 350 gpm and 5 to 15 wt% solids from the TTA via two lines into one of three slurry receipt tanks. Slurry will then be transferred out of the slurry receipt tanks in System 13 and into the reaction/polymer addition tank in System 15.

The slurry receipt tanks will be contained in a shielded enclosure, not intended for personnel access, with 2-ft-thick concrete walls and a concrete roof to minimize radiological exposure from the Silos 1 and 2 material. The slurry receipt tanks will be vented to an off-gas header and subsequently to the RCS to control radon emissions. To minimize slurry settling, the slurry receipt tanks will be mixed continuously. Each slurry receipt tank will have a maximum capacity of 83,800 gallons and dimensions of approximately 23 ft in diameter by 27 ft high. The operating volume of each tank will be the top two-thirds of the total volume of the tank. The bottom third of each tank will remain full of slurry during operations so that the level of the slurry does not drop below the mixer/agitator impeller, allowing continuous agitation.

During normal operations, one of the slurry receipt tanks will be being filled from the TTA, one tank will be undergoing analysis, and one tank will be feeding the reaction/polymer addition tank. Each tank, operating is series, will complete one filling and emptying cycle in 36 hours. The slurry receipt tank system is designed to provide sufficient slurry for a 24-hour shift using the volume contained in two of the three tanks. The design includes the capability of filling two of the three slurry receipt tanks in less than 5 hours and pumping slurry from any of the tanks to another tank when required.

Slurry and washwater from the slurry receipt tank sumps and the slurry feed tank sumps that are within the shielded enclosures will be transferred to the slurry receipt tanks.

2.1.1.1 Tanks

The slurry receipt tanks (TNK-13-1000A, B, and C) are constructed of carbon steel. Each contains four baffles located along the walls 90° apart. The baffles will be slightly offset from the tank walls to prevent buildup of solids. The tanks will have flat roofs and sloped bottoms with artificial fillets welded around the tank bottoms to minimize the build-up of solids around the tank perimeter. The bottoms will slope to a side discharge outlet. The slurry receipt tanks will also have cooling water jackets to remove the heat resulting from

4654

agitation. A manway to each tank with an entry point through the shield roof will be available for maintenance if needed. The slurry receipt tanks will be connected to each other with piping to contain overflows. The overflow lines will be located inside the shield enclosure. In addition, the tanks will be equipped with redundant level indicators. The slurry receipt tanks will be contained in a concrete vault. The concrete vault serves two functions. It provides protection to workers by shielding them from gamma radiation emitted by Silos 1 and 2 material. It also provides secondary containment in the event of a tank failure. Sumps in the containment area will recycle any spilled material back to the process.

2.1.1.2 Mixer/Agitators

Top-entering turbine mixer/agitators (MXA-13-1000A, B, and C) are used to mix the slurry in the receipt tanks to maintain relatively uniform suspension of the solids. To minimize settling of the slurry between batches, the receipt tanks have been sized to maintain an adequate liquid level above the impeller so that the material remaining in each tank at the end of the transfer operations can be continually mixed to prevent particle settling. In the event of an agitator failure, the impeller is located out of the settled solids, which allows the repaired or replaced agitator to be restarted. The agitators are supported by the concrete shield vault structure rather than by the slurry receipt tanks. To minimize entry into the shield vault for maintenance, the shaft seals for the agitators are located outside the shield vault. The agitator seals use conventional packing for ease of maintenance.

2.1.1.3 Pumps

Three centrifugal slurry pumps (PMP-13-1001A, B, and C) with variable speed motors are used to recycle the slurry in the receipt tanks, transfer the slurry from one receipt tank to another receipt tank (if needed), and transfer the slurry to the reaction/polymer addition tank. In addition, slurry can be received back from any slurry feed tank. The slurry transfer pumps have recessed impellers and are constructed of an abrasion-resistant alloy. The pumps have water-lubricated mechanical seals. The slurry transfer pumps are located in a receipt pump gallery adjacent to the slurry receipt tank vault, with limited personnel access for monitoring and maintenance.

2.1.1.4 Valves

Three-way diverter valves are used to direct the slurry flow during transfer and sampling operations. Each three-way valve has a carbon steel body and abrasion-resistant internals. Three-way diverter valves are electrically actuated to facilitate remote operations. Each valve has a "hand-off-auto" local switch to bypass the control room, if necessary. Additionally, under manual operation, a manual position switch is installed for correct valve alignment. Under remote operations, the valve sends a position signal to the control room that confirms valve alignment in one of the three positions.

Pinch valves are used on primary slurry lines to minimize pluggage and flow restrictions. Pinch valves are constructed of a cast iron body surrounding a double-walled elastomer sleeve. Pinch valves are a full-port design and are capable of bi-directional, bubble-tight

shutoff. A combination of manual and electric actuators is specified for operation. Manually operated pinch valves are positioned in slurry lines for double isolation to facilitate maintenance on process equipment. Electrically actuated pinch valves are installed to facilitate line flushing from the control room.

Ball valves are constructed of a carbon steel housing with a stainless steel ball and are used on process and flush water lines. The flush water ball valves are equipped with electric actuators to facilitate remote line flushing from the control room. Additionally, full-port ball valves are installed in a locked-open position on all lines entering the tanks. These valves are used to isolate the tanks during maintenance operations, if necessary.

2.1.1.5 Piping

All piping from the tanks exiting the vault is flanged outside the shielded enclosure. Overflow lines between the three slurry receipt tanks are located inside the shielded enclosure. The transfer piping from the TTA to the Silos 1 and 2 Remediation Facility is double-walled with sensors to detect leaks.

2.1.1.6 Sampling

The slurry is sampled from a point in the slurry recycle loop, and an isolock-type sampler is used to collect samples of the slurry. This sampler is pushed into the slurry stream and collects a small amount of material, which is withdrawn and placed in a sample container. Several pulls of material may be necessary depending on sample volume requirements. The slurry sampling equipment is contained within glove boxes to control radon emissions and prevent the spread of contamination. The samples undergo tests to determine the total percent solids in order to determine additive requirements. A loss-in-weight test will be performed to determine percent solids content, which is needed to determine the amount of polymer to add for clarification. Equipment for sampling is included as part of the sampling system (System 84). The slurry receipt tank recycle loops are equipped with slurry samplers.

2.1.1.7 Instrumentation

The slurry receipt tanks are equipped with level indicators and redundant high-high level sensors. Each tank also has a separate vacuum relief valve to prevent vacuums above the tank design levels. High-pressure relief has been provided on the RCS vessel venting system.

Temperature is monitored using a thermocouple-type sensor.

Pressure in the slurry line is determined using a diaphragm-type pressure sensor. The diaphragm is flush-mounted to the inner pipe surface.

Density of the slurry is measured at a point in the recycle loop using a densitometer.

As the slurry is transferred, flow is measured and totalized using a magnetic flow meter. Turbine flow meters are also used to measure flush water.

The types of instruments to be used will be finalized based on results of cold loop testing of the instrumentation at Oak Ridge National Laboratory. The instruments will be tested on various concentrations of a Silos 1 and 2 material simulant slurry.

2.1.1.8 Flushing Lines

The system is designed to provide automated line flushing. Flush water is supplied by one of two flush water pumps connected to the sluice/flush water tank. A flush water line is routed to the suction side of each slurry pump to flush the tank discharge line and flush through the pump. A second flush water line is routed to the pump discharge side to flush slurry transfer and sampling lines. A third flush water line is routed to the top of each slurry receipt tank to dilute the slurry, if necessary.

2.1.2 Feed Preparation System (System 15)

(Refer to Drawings 94X-3900-F-01154, 94X-3900-F-01155, and 94X-3900-F-01156.)

In the Feed Preparation System, slurry from the slurry receipt tanks and a polymer additive are mixed together in a reaction/polymer addition tank. Other chemical additives, if needed, can be added to the reaction/polymer addition tank or to the slurry receipt tanks, slurry feed tanks, or product mixers. The contents of the reaction/polymer addition tank flow to the clarifier where the slurry is thickened to approximately 30 wt% solids in preparation for product mixing.

2.1.2.1 Chemical Additives Equipment

All chemical additive equipment is located in a cold chemical make-up room, which is separated from the potentially contaminated portions of the treatment facility. Polymer is added to the polymer addition tank to promote flocculation and settling. Other chemical additives, if needed, can be added to the reaction tank or to the slurry receipt tanks, slurry feed tanks, or product mixers through a spare chemical additive system.

2.1.2.1.1 Polymer

Polymer additive (neat polymer, 29 percent active) is received in totes and is transferred by an unloading pump (PMP-15-1011C) into two 500-gal polymer feed tanks (TNK-15-1000A and B), which are approximately 4 ft in diameter and 5 ft high. The polymer tote is weighed using weigh cells to determine the quantity of polymer added to the polymer feed tanks. The polymer is mixed with process water by two polymer feed tank mixer/agitators (MXA-15-1000A and-B). Addition of process water is controlled by a flow meter. Approximately 12 gal/day of neat polymer is added to 1,800 gal/day of water. The polymer is then allowed to age for a minimum of one hour before it is blended with slurry in the polymer addition tank. Redundant metering pumps (PMP-15-1010A and -B) feed the polymer into the flash mixer through a perforated pipe located at the bottom of

the polymer addition tank. A polymer calibration gage glass (CAL-15-1000) is used to calibrate the metering pumps so that the amount of polymer added is accurately measured. The polymer feed tanks are equipped with level indicators and any overflow is contained within the polymer containment dike.

2.1.2.1.2 Other Chemical Additives

Other chemical additives, if needed, are received as solutions in tote bins or drums. If the chemical solutions are added to the reaction tank, they are pumped from the tote bins/drums using one of two metering pumps (PMP-15-1002A and -B). If the chemical solutions are added to the slurry receipt tanks, slurry feed tanks, or product mixers, they are pumped from the tote bins/drums using a centrifugal pump (PMP-15-1001A). Addition of the chemical solutions is controlled by a flow meter in the discharge line from the centrifugal pumps. The centrifugal pumps have water-lubricated mechanical seals. Any leaks or spills from the pumps and piping are contained within the chemical solution containment dike.

2.1.2.2 Reaction/Polymer Addition Tank

The reaction/polymer addition tank (TNK-15-1003A and -B) is divided into two sections with a baffle between them. The reaction section of the tank has a nominal 1,100-gal capacity with a variable-speed mixer/agitator (MXA-15-1003A). The reaction tank has a manway for maintenance access, if needed. The polymer addition section of the tank has a nominal 400-gal capacity and a variable-speed mixer/agitator (MXA-15-1003B). The agitator seals are conventional packing. The reaction/polymer addition tank is enclosed in a shielded barrier and is vented to an off-gas header and subsequently to the RCS to control radon emissions. Piping is provided to transfer slurry from the three slurry receipt tanks and supernatant water (containing solids) from the bottom of the supernatant tank to the reaction/polymer addition tank. The addition of supernatant water is controlled by a flow meter. The reaction/polymer addition tank has level indicators (redundant high-high level), and slurry from the polymer addition section of the tank flows into the top of the clarifier.

2.1.2.3 Clarifier

The reaction/polymer addition tank is positioned above the clarifier (TNK-15-1004). The mixture of slurry and chemical additives is transferred by gravity flow to the clarifier, which is a gravity thickener that facilitates solids settling and separation. The clarifier has a 32,000-gallon capacity. The clarifier is enclosed in a shielded barrier and is vented to the RCS for radon control through an off-gas header. The slurry is fed into the center well of the clarifier. As the solids settle to the bottom of the clarifier, material is collected in a central sludge sump. Multiple density/level measurement devices are located in the clarifier to monitor the settling process. A variable-speed, electrically-driven rake assembly (MXA-15-1004) scrapes sludge from the sloped bottom of the clarifier and directs the flow of sludge to the central sump. Thickened slurry (approximately 30 wt% solids) is removed from the clarifier sump using one of three variable speed, lobe-type clarifier underflow pumps (PMP-15-1004A, B, and C) and transferred to one of three slurry feed tanks

4654

(TNK-16-1000A, B, and C). Thickened slurry is monitored for density and radiation level as it is transferred. Flush water from the sluice/flush water tank is available to the clarifier and to flush piping from either side of each clarifier underflow pump. The clarifier is equipped with level sensors to monitor the liquid level in the clarifier and to ensure that overflow piping is not plugged. Supernatant liquid overflows the clarifier and is gravity-fed to the supernatant tank. A three-way valve can be used to bypass the supernatant tank and transfer supernatant liquid directly to the sluice/flush tank. Turbidity of the supernatant liquid is monitored as it exits the clarifier.

In the event of a power outage, the clarifier rake and underflow pumps are supplied with backup power by the diesel generator for approximately 6 hours, until settled slurry is pumped out of the clarifier.

2.1.3 Processor Feed System (System 16)

(Refer to Drawing 94X-3900-F-01156.)

The Processor Feed System is comprised of three slurry feed tanks that contain thickened slurry (nominally 30 wt % solids). The clarifier continuously feeds thickened slurry to the slurry feed tanks, and thickened slurry is then transferred by batches to the product mixers. The slurry feed tanks are contained in a shielded vault not intended for personnel access with 2-ft-thick concrete walls and concrete roof to minimize radiological exposure from the Silos 1 and 2 material. The slurry feed tanks are vented to an off-gas header and subsequently to the RCS to control radon emissions. To minimize slurry settling, the slurry feed tanks are continuously mixed. Each slurry feed tank has a maximum capacity of 24,100 gal. The operating volume of each tank is the top two-thirds of the total volume of the tank. The bottom third of each tank remains full of slurry during operations so that the slurry level does not drop below the mixer/agitator impeller, allowing continuous agitation.

During normal operations, one of the slurry feed tanks is filling from the clarifier, and two of the slurry feed tanks are continuously feeding the product mixers except when one of the tanks is undergoing analysis. The Processor Feed System is designed to provide sufficient slurry for a 24-hour shift using the volume contained in two of the three tanks. For slurry with a nominal 30 wt % solids content, the slurry feed tanks contain 15 product batches within the operating volume of each tank.

2.1.3.1 Tanks

The three slurry feed tanks (TNK-16-1000A, B, and C) are constructed of carbon steel. Each tank contains four baffles located along the walls. The baffles are slightly offset from the tank walls to prevent buildup of solids. The tanks have flat roofs and sloped bottoms with artificial fillets welded around the tank bottom to minimize build-up of solids around the tank perimeter. The bottoms are sloped to a side discharge outlet. The slurry feed tanks have cooling water jackets to remove the heat resulting from agitation. A manway to each tank, with an entry point through the shield roof, is available for maintenance when needed. The slurry feed tanks are connected to each other with piping

4654

to contain overflows. In addition, the tanks are equipped with level indicators and controls. These tanks are contained in a concrete vault. The vault serves two functions. It provides protection to workers by shielding them from gamma radiation emitted by Silos 1 and 2 material. It also serves as secondary containment in the event of a tank failure. Sumps in the shielded containment area will recycle any spilled material back to the process. The shielded area is monitored by video camera.

2.1.3.2 Mixer/Agitators

Top-entering turbine mixer/agitators (MXA-16-1000A, B, and C) are used to mix the slurry in the feed tanks to maintain relatively uniform suspension of the solids. To minimize settling of the slurry between batches, the feed tanks have been sized to maintain an adequate liquid level above the agitators so that the material remaining in each tank at the end of the transfer can be continually mixed to prevent particle settling. The agitators are supported by the concrete shield vault structure rather than by the slurry feed tanks. To minimize entry into the shield vault for maintenance, the shaft seals for the agitators are located outside the shield vault. The agitator seals are conventional packing.

2.1.3.3 Pumps

Three pumps (PMP-16-1001A, B, and C) are used to transfer the thickened slurry to the product mixers in batches. These pumps also transfer the slurry through a recycle loop, where sampling occurs, and can transfer the slurry to other slurry feed tanks or back to the slurry receipt tanks, as necessary. The slurry feed pumps are located in a feed pump gallery adjacent to the feed tank vault, with limited personnel access for monitoring and maintenance.

2.1.3.4 Valves

Three-way diverter valves are used to direct the slurry flow during transfer and sampling operations. Each three-way valve has a carbon steel body and abrasion-resistant internals. Three-way diverter valves are electrically actuated to facilitate remote operations. Each valve has a "hand-off-auto" local switch to bypass the control room, if necessary.

Additionally, under manual operation, a manual position switch is installed for correct valve alignment. Under remote operations, the valve sends a position signal to the control room that confirms valve alignment in one of the three positions.

Pinch valves are used on primary slurry lines to minimize pluggage and flow restrictions. Pinch valves are constructed of a cast iron body surrounding a double-walled elastomer sleeve. Pinch valves are full-port design and are capable of bi-directional, bubble-tight shutoff. A combination of manual and electric actuators is specified for operation. Manually operated pinch valves are positioned in slurry lines for double isolation to facilitate maintenance on process equipment. Electrically actuated pinch valves are installed to facilitate line flushing from the control room.

4654

Ball valves are constructed of a carbon steel housing with a stainless steel ball and are used on process and flush water lines. The flush water ball valves are equipped with electric actuators to facilitate remote line flushing from the control room. Additionally, full-port ball valves are installed in a locked-open position on all lines entering the tanks. These valves are used to isolate the tanks during maintenance operations, if necessary.

2.1.3.5 Piping

Piping from the tanks exiting the vaults is flanged outside the shielded enclosure. Overflow lines between the three slurry feed tanks are located inside the shielded enclosure.

2.1.3.6 Sampling

The thickened slurry is sampled from a point in the slurry recycle loop using an isolock-type sampler. This sampler is pushed into the slurry stream and collects a small amount of material, which is withdrawn and placed in a sample container. Several pulls of material may be necessary, depending on sample volume requirements. The slurry sampling equipment (SSL-84-1004, -1005, and -1006) is contained within glove boxes to control radon emissions. The samples are analyzed to determine total percent solids and Ra-226 content. A loss-in-weight test will be performed to determine the percent solids content in order to determine the quantities of cement and fly ash to be added. A test to determine Ra-226 content using gamma spectroscopy will be performed so that the batch recipe can be adjusted to ensure that the final product meets both transport and disposal requirements.

2.1.3.7 Instrumentation

As the slurry is transferred, flow, density, and pressure of the slurry in the line are determined. Line pressure is determined using a diaphragm-type pressure sensor. The diaphragm is flush-mounted to the inner pipe surface.

Temperature is monitored using a thermocouple-type sensor.

As slurry is recycled within the slurry feed tanks, a radiation measurement is taken to measure the gamma dose in the slurry feed that might impact waste transport criteria.

The tanks are equipped with level indicators and controls. Each tank also has a separate pressure relief valve and vacuum relief valve to prevent pressurization or vacuums above the tank design levels.

The types of instruments to be used will be finalized based on results of the cold loop tests.

2.1.3.8 Flushing Lines

The system is designed to provide automated line flushing. Flush water is supplied by one of two flush water pumps connected to the sluice/flush water tank. A flush water line is

4654

routed to the slurry pump suction side to flush the tank discharge line and flush through the pump. A second flush water line is routed to the pump discharge side to flush slurry transfer and sampling lines. A third flush water line is routed to the top of each slurry feed tank to dilute slurry, if necessary.

2.1.4 Product Additive System (System 44)

(Refer to Drawings 94X-3900-F-01157 and 94X-3900-F-01160.)

Cement and fly ash are added to the thickened slurry in the product mixers to produce the final stabilized product. The Product Additive System includes equipment, piping, and controls to handle the cement and fly ash additives from delivery by truck until they are added to the product mixers.

2.1.4.1 Cement Additive Equipment

2.1.4.1.1 Cement Storage Bins

Cement is stored in one carbon steel ~4,600-ft^3 bin (BIN-44-1000), approximately 12 ft in diameter and 60-ft-high. Cement is delivered to the bin, located outdoors, by cement supply trucks through carbon steel piping. The cement storage bin has multiple level indicators. A bin vent filter (FLT-44-1000) is used to contain cement dust in the cement bin during the filling operations. A cement dust collector blower (BLR-44-1010) is connected to the bin vent filter, and its motor controls are interlocked with the cement truck filling connection and cement transfer operations. The bin vent filter has a differential pressure indicator and alarm to indicate plugging of the filter bags. Compressed air is blown back through the filter elements to unplug them. The cement bin bottom is equipped with a pneumatic activator to prevent bridging of cement within the storage bin and allow free flow of cement to the pneumatic conveying system.

2.1.4.1.2 Pneumatic Conveying System

A carbon steel cement feeder (FDR-44-1000) with approximately 10-ft^3 capacity is located directly beneath the cement bin. A pneumatic conveying system is used to transfer the cement from the cement feeder to the cement receiving bin located inside the Remediation Facility. The pneumatic conveying system is a high-pressure system, generally known as a dense phase system, and uses a full-line conveying concept. Compressed air (above 15 psig) and positive pressure are used to push the cement through the conveying line at a relatively low velocity. The transfer cycle begins with cement feeding by gravity from the cement bin into the cement feeder through an inflatable, seated butterfly valve. Displaced air is vented up through a vent valve to the cement bin to allow easier filling. The cement feeder is equipped with high-level and low-level indicators and alarms. Once the cement feeder is filled, as indicated by the high-level control, the inlet and vent valves close and seal. The outlet valve then opens and compressed air is introduced into the cement feeder to displace the cement to be conveyed. Booster fittings are spaced at 5- to 10-ft intervals along the conveying line to introduce additional compressed air for conveying. When the cement feeder is completely empty, as signaled by the low-level control, the compressed

000028

air is turned off and the cement stops in the conveying line. Since the line always remains full, no time is lost in emptying and filling the conveying line, and air consumption is significantly reduced. Before the cement feeder is refilled, the air pressure inside is vented through the vent valve that remains open during the next filling cycle.

2.1.4.1.3 Cement Receiving Bins and Hoppers

Three carbon steel cement receiving bins (HBN-44-1002A, B, and C) are filled from the cement feeder by the pneumatic conveying system. Each cement receiving bin has approximately 36-ft^3 capacity. The cement is discharged from the receiving bins to cement hoppers (HBN-44-1000A, B, and C) that have approximately 75-ft^3 capacity. The cement hoppers have weigh cells that accurately measure the amount of cement and have multiple level sensors. The cement hoppers are equipped with rotary valves and motor-driven screw feeders, which are used to discharge the cement to the product mixers and to provide barriers for radon from the product mixers. The discharge process occurs continuously during the product mixer feed cycle. Each cement receiving bin and each cement hopper are dedicated to one of three product mixers (MXB-17-1000A, B, and C).

2.1.4.2 Fly Ash Additive Equipment

2.1.4.2.1 Fly Ash Storage Bins

Fly ash is stored in one carbon steel ~6,400-ft^3 storage bin (BIN-44-1001), approximately 14 ft in diameter and 60-ft-high. Fly ash is delivered to the bin, located outdoors, by fly ash supply trucks through carbon steel piping. The fly ash storage bin has multiple level indicators. A bin vent filter (FLT-44-1001) is used to contain fly ash dust in the fly ash bin during the filling operations. A fly ash dust collector blower (BLR-44-1011) is connected to the bin vent filter, and its motor controls are interlocked with the fly ash truck filling connection and fly ash transfer operation. The bin vent filter has a differential pressure indicator and alarm to indicate plugging of the filter bags. Compressed air is blown back through the filter elements to unplug them. The fly ash bin bottom is equipped with a pneumatic activator to prevent bridging of fly ash within the storage bin and allow free flow of fly ash to the pneumatic conveying system.

2.1.4.2.2 Pneumatic Conveying System

A carbon steel fly ash feeder (FDR-44-1001) with approximately 20-ft^3 capacity is located directly beneath the fly ash bin. A pneumatic conveying system is used to transfer the fly ash from the fly ash feeder to the fly ash receiving bin located inside the Remediation Facility. The fly ash pneumatic conveying system is the same type of system as used for conveying the cement additive. Fly ash is fed by gravity from the fly ash bin into the fly ash feeder through an inflatable, seated butterfly valve. Displaced air is vented up through a vent valve to the fly ash bin to allow easier filling. The fly ash feeder is equipped with multiple level indicators. Compressed air is connected to the fly ash feeder to convey the fly ash. Booster fittings are spaced at 5- to 10-ft intervals along the conveying line to introduce additional compressed air for conveying.

4654

2.1.4.2.3 Fly Ash Receiving Bins and Hoppers

Three carbon steel fly ash receiving bins (HBN-44-1003A, B, and C) are filled from the fly ash feeder by the pneumatic conveying system. Each fly ash receiving bin has approximately 36-ft^3 capacity. The fly ash is discharged from the receiving bins to fly ash hoppers (HBN-44-1001A, B, and C) that have approximately 150-ft^3 capacity. The fly ash hoppers have weigh cells that accurately measure the amount of fly ash and have multiple level sensors. The fly ash hoppers are equipped with rotary valves and motor-driven screw feeders, which are used to discharge the fly ash to the product mixers and to provide barriers to radon from the product mixers. The discharge process occurs continuously during the product mixer feed cycle. Each fly ash receiving bin and each fly ash hopper are dedicated to one of three product mixers (MXB-17-1000A, B, and C).

2.1.5 Processor System (System 17)

(Refer to Drawing 94X-3900-F-01157.)

Three product mixers/blenders (MXB-17-1000A, B, and C) are used to mix the thickened slurry with cement and fly ash on a batch basis in the Processor System.

2.1.5.1 Product Mixers/Blenders

The mixers/blenders are carbon steel horizontal double ribbon mixers, each having approximately 16,000-lb working capacity of mixed product. Only one product mixer is filled at a time with the correct quantities of slurry feed, cement, and fly ash. Each product mixer is installed on four weigh cells to weigh the slurry feed. After mixing, the product from each mixer is emptied into a disposal container via a product fill chute. One batch of product from one product mixer fills one disposal container. Samples of the product, if needed, may be taken from the fill chute or from the container after filling.

2.1.5.2 Flushing Product Mixers

Water from the sluice/flush water tank is made available to flush the product mixers and to adjust the moisture content of the product mixture, as necessary. The flush water is transferred into a disposal container, and the wastewater is decanted and transferred to the supernatant tank using a double-diaphragm pump. Process water is made available to flush the vent lines that lead from the product mixers to the product mixer vent scrubber (Section 2.1.8).

2.1.6 Supernatant Water System (System 55)

(Refer to Drawing 94X-3900-F-01159.)

In the Supernatant Water System, a large supernatant tank is used to collect a variety of slurry spills and wastewater streams. The supernatant tank is primarily used to collect the clarifier supernatant, which overflows a perimeter weir in the clarifier and gravity drains to the supernatant tank. Other streams that are collected in the supernatant tank include

slurry spills and wash water from the product mixer room sumps and other treatment facility sumps (except for sumps within the shielded areas of the slurry receipt tanks and slurry feed tanks, which are transferred to the slurry receipt tanks) and wash water from mixer washouts. Settled solids from the bottom of the supernatant tank are pumped back to the reaction tank, and supernatant water from the bottom and vertical center of the supernatant tank is pumped to the sluice/flush water tank.

2.1.6.1 Supernatant Tank

The large carbon steel supernatant tank (TNK-55-1000) has ~100,000 gallon capacity and is approximately 24 ft in diameter and 30 ft high. A variable-speed supernatant tank mixer/agitator (MXA-55-1000) is used to keep solids in suspension. This tank is also used to settle and recycle solids back to the treatment process. Overflow from the supernatant tank flows to (and from) the sluice/flush water tank. Supernatant from the center of the supernatant tank is pumped to the sluice/flush water tank using a centrifugal supernatant pump (PMP-55-1000A). Supernatant water and settled solids from the bottom of the supernatant tank are pumped to the sluice/flush water tank and the reaction tank, respectively, using a second centrifugal pump (PMP-55-1000B). The supernatant pump seals are water-lubricated mechanical seals. Level indicators are positioned at intervals along the height of the supernatant tank. The supernatant tank is vented through an off-gas header and subsequently to the RCS to control radon emissions. A sampler (SSL-84-1007) in a glove box can take samples of the material pumped from the bottom of the supernatant tank.

2.1.6.2 Sumps

The slurry receipt tanks and slurry feed tanks each have two sumps (numbers 1, 2, 5, and 6) within their shielded containment areas. Slurry or wash water collected in these sumps is pumped to the slurry receipt tanks using double-diaphragm pumps (PMP-55-1001, PMP-55-1002, PMP-55-1005, and PMP-55-1006). In addition, the slurry receipt tanks and slurry feed tanks each have two pump galley sumps (numbers 3, 4, 7, and 8) located outside the concrete shields. Slurry or wash water collected in these sumps is pumped to the supernatant tank by double-diaphragm pumps (PMP-55-1003, PMP-55-1004, PMP-55-1007, and PMP-55-1008).

The clarifier area has a sump (number 9) in the reaction/polymer addition tank and clarifier enclosure. Materials collected in the clarifier sump are pumped to the supernatant tank by a double-diaphragm pump (PMP-55-1009). Two sumps (numbers 10 and 11) are located in the sluice/flush/supernatant tanks area, and materials collected in these sumps are pumped to the supernatant tank by double-diaphragm pumps (PMP-55-1010 and PMP-55-1011).

The chemical make-up area has a sump (number 12) to collect materials that leak or spill from the chemical additive system. Materials collected in this sump are pumped to a tote bin by a double-diaphragm pump (PMP-55-1012). The polymer make-up area has a quick connector for use with a portable pump to remove any leaks, spills, or wash water.

The product mixer/container fill areas have multiple sumps. The product mixer rooms have sumps (numbers 13, 14, and 15), and materials in these sumps are pumped to the supernatant tank by double-diaphragm pumps (PMP-55-1013, PMP-55-1014, and PMP-55-1015). The product fill rooms have sumps (numbers 16, 17, and 18), and materials in these sumps are pumped to the supernatant tank by double-diaphragm pumps (PMP-55-1016, PMP-55-1017, and PMP-55-1018). A product mixer wash water container serves as a sump (number 19), which uses a double-diaphragm pump (PMP-55-1019) to pump mixer wash water, after decanting, to the supernatant tank.

2.1.7 Sluice/Flush Water (System 62)

(Refer to Drawing 94X-3900-F-01158.)

In the Sluice/Flush Water System, a large sluice/flush water tank receives supernatant water from the supernatant tank or directly from the clarifier and provides it as sluice water to the TTA and as flush water throughout the Remediation Facility. Process water is also available (as makeup water) for addition to the sluice/flush water tank as needed.

Water from the ~100,000-gal, approximately 24-ft-diameter, 30-ft-high, carbon steel sluice/flush water tank (TNK-62-1000) is returned to the TTA for use as sluice water via redundant centrifugal pumps (PMP-62-1000A and -B). Flush water is also supplied from the sluice/flush water tank for line and equipment flushing throughout the treatment facility via redundant centrifugal pumps (PMP-62-1001A and -B). The centrifugal pumps have water-lubricated mechanical seals. Before sluice or flush water exits System 62 and is supplied to the TTA or the Advanced Wastewater Treatment (AWWT) facility, flow is measured and sampling equipment (SSL-84-1008) in a glove box is used for taking samples as needed to meet the AWWT facility waste acceptance criteria (WAC).

The sluice/flush water tank uses a variable-speed mixer/agitator (MXA-62-1000) to keep any solids in suspension. The agitator seal is conventional packing. Level indicators are positioned at intervals along the height of the supernatant tank. Overflow from the sluice/flush water tank flows to (and from) the supernatant tank. The sluice/flush water tank is vented to an off-gas header connected to the RCS.

2.1.8 Vessel Vent System (System 19)

(Refer to Drawing 94X-3900-F-01190.)

The Vessel Vent System contains three vent headers from process equipment that vent gases to the RCS for control of radon emissions. Total emissions from the remediation facility vessel vent system are anticipated to be 350 cfm. The slurry receipt tanks and sluice/flush water tank are connected to the sluice/flush water tank vent header. The slurry feed tanks, supernatant tank, reaction/polymer addition tank, and clarifier are connected to the supernatant tank vent header.

The product mixer vents are connected to a wet scrubber system for removal of particulates, which is then vented to the RCS for radon control. The product mixer vent

4654

scrubber (SCR-19-1000) uses process water as the scrubbing solution. The solution is recirculated in the scrubber using a centrifugal pump (PMP-19-1000). After the solids level in the aqueous scrubber solution builds up to approximately 5 to 10 percent, the scrubber solution is recycled back to the supernatant tank or the slurry feed tanks.

2.1.9 Sampling System (System 84)

Sampling plans and equipment will be further refined in the final design phases of the project based on treatability studies and lessons learned during the AWR start-up. Major equipment envisioned in the Sampling System, at this time, consists of:

Three slurry samplers (SSL-84-1000, -1001, and -1002) enclosed in glove boxes (GLB-84-1000, -1001, and -1002) for the three slurry receipt tanks; three slurry samplers (SSL-84-1004, -1005, and -1006) in glove boxes (GLB-84-1004, -1005, and -1006) for the three slurry feed tanks; a supernatant water sampler (SSL-84-1007) in a glove box (GLB-84-1007); and a sluice and flush water sampler (SSL-84-1008) in a glove box (GLB-84-1008). Isolock-type samplers are used to collect samples. One additional glove box is used for analytical equipment. Other details of the sampling system are discussed in the Sampling and Analysis Plan (40750-PL-0006), Appendix C.

2.2 CONTAINER HANDLING SYSTEMS

(Refer to Drawings 94X-3900-F-01101 through 94X-3900-F-01107.)

2.2.1 Container Receipt and Preparation System (System 23)

The Container Receipt and Preparation System includes the mechanical equipment and processes that are used to receive, move, stage, and prepare product containers for filling with stabilized Silos 1 and 2 material. Much of the equipment is designed to operate automatically and remotely. Processing steps located in radiation zones are designed to meet ALARA requirements. Equipment maintenance is performed "hands-on" as long as the area meets radiological standards for contact maintenance.

The movement of the product containers is automatically controlled by an integrated control system. Manual overrides are available for each step of the operation for operator control. In addition, programmed hold points are designed into the handling system for operator verification. Inputs to the control system are from devices such as limit switches, positional detectors, motor device feedback, bar code scanners, and weigh cells. The Container Receipt and Preparation System is divided into three distinct areas that include:

- Empty container receiving
- Empty container staging, and
- Empty container preparation.

4654

2.2.1.1 Empty Container Receiving

Empty product containers are delivered to the Remediation Facility by truck trailers, up to five containers per trailer. Monorail hoists, which are manually controlled by an operator pendant, are used to unload the containers from the truck and to place the containers on conveyors, which are used to transport the containers into the building. The empty container receiving equipment is located outside the Remediation Facility in a covered area.

Three 4-ton monorail hoists (CRH-23-1001A, B, and C) are equipped with 12-ton container grapples (RLD-23-1002A, B, and C) of the same design used for filled containers in other areas of the facility. During container unloading, the trailer is parked under one of the monorail hoists against a rear stop. Container shipping tie-downs and protective wraps are removed. The hoist is positioned over the rear-most empty container on the trailer. The grapple is lowered and engaged with the container; indicator lights are used to verify engagement of the grapple. The container is then lifted clear of the trailer. The monorail trolley is then advanced and positioned over one of three conveyors (LRC-23-1000A, B, or C), aligned with the monorail hoist. The container is lowered to the conveyor, the container grapple is disengaged, and the grapple is then raised to clear the container. After the container staging entrance door (ASD-23-1003A, B, or C) is opened, the conveyor is started manually so that the empty container is advanced into Room 114, the Empty Container Staging Room, in the Remediation Facility. The empty container is then transferred onto the first conveyor (LRC-23-1004A, B, or C) in one of three lines of accumulating conveyors running in an east-west direction. The unloading steps are then repeated for the remaining four containers on the trailer, and the empty trailer is then removed.

2.2.1.2 Empty Container Staging

Staging the product containers in Room 114, the Empty Container Staging Room, in the Remediation Facility allows the containers to approach ambient conditions to reduce sweating and to be visually inspected, manually cleaned if needed, and labeled before their use. The Empty Container Staging Room contains three accumulating conveyor lines, each containing multiple conveyors for product container staging. Each conveyor, positioned in an east-west direction, moves one or two product containers. When containers finish moving to the end of the two southern-most lines, they are transferred to a single line of conveyors positioned in a north-south direction by pneumatically-powered chain transfer devices (CCT-23-1008, -1010, and -1012).

Following container receipt, the empty containers will be transferred onto one of three conveyors (LRC-23-1004A, B, and C) located in the Empty Container Staging Room. The empty containers will be advanced when an empty space is detected. For example, in the "A" line of conveyors a container is moved from LRC-23-1004A to LRC-23-1005A to LRC-23-1006A until it reaches the last conveyor in the line (LRC-23-1007A). From LRC-23-1007A, a conveyor equipped with chain transfer equipment (CCT-23-1008) is used to move the container to a conveyor line positioned in a north-south direction. The container moves next from CCT-23-1008 to LRC-23-1009. From the last conveyor in the "B" line

4654

(LRC-23-1007B), a conveyor equipped with chain transfer equipment (CCT-23-1010) is used to move the product container to north-south conveyor line. The container moves next from CCT-23-1010 to LRC-23-1011. From the last conveyor in the "C" line (LRC-23-1007C), a conveyor equipped with chain transfer equipment (CCT-23-1012) is used for transfer and for empty container preparation.

The conveyors used in the Remediation Facility have several design features to improve their performance and safety. Each conveyor is independently powered and interlocked with the conveying control system. The interlocks control the conveyor operations based on information about physical location of the containers provided by photoelectric position sensors. Two photoelectric sensors are used per conveyor. Each conveyor has a 2.5-ton capacity and moves at approximately 30 fpm. The conveyors have step plates between the rollers to allow operators to walk on the conveyor surfaces to access the containers for operations such as cleaning. The conveyors have emergency stops, which can be tripped by pulling on ropes running along both sides of each conveyor. There is a pause before startup of a conveyor while an alarm is sounded and warning lights are activated.

2.2.1.3 Empty Container Preparation

Initial empty container preparation operations are performed manually while containers are located on the container preparation conveyor (CCT-23-1012). Temporary fasteners used to secure the lid to the container during transport are removed. A jib crane with a vacuum hoist (CRH-23-1021) is used to lift the lid for container inspection. At this point, a decision is made whether the product container is defective. Defective containers are removed for return to the vendor. Accepted containers' lids are lowered into place using alignment pins and the vacuum hoist is disengaged and raised. The container identification label is scanned and the container preparation conveyor advances the container to a conveyor (LRC-23-1013) to the north by the entrance door to the Product Container Vestibule.

A roll-up door (ASD-23-1014) is opened and the container is moved to a conveyor (LRC-23-1017) inside Room 141, the Product Container Vestibule. The first roll-up door is closed and a second door (ASD-23-1019) between Room 141 and Room 140, the Container Survey and Decontamination Room, is opened. The container is advanced to another conveyor (LRC-23-1018), and the door (ASD-23-1019) is then closed. A 16-ton monorail hoist (CRH-24-1001) equipped with a container grapple (RDL-24-1000) is positioned over the container. The monorail hoist is operated remotely from the control room. The grapple is lowered and engaged. The container is raised, weighed by a weigh cell on the hoist, moved to a position over a container transfer car (CRT-24-1002A, B, or C) and then lowered onto the transfer car. The weight is recorded in the container database before container filling operations. The grapple is then disengaged and raised.

Product containers that are defective are moved from conveyor LRC-23-1013 by a chain hoist equipped with a container grapple. The container is raised by the hoist, a pallet is inserted under the container with a forklift, and the container is lowered onto the pallet. The palletized container is then moved by the forklift to a holding/repair area.

4654

2.2.1.4 Container Identification Equipment

Container identification equipment is used to identify each product container at specific locations during the movement and operations associated with filling the container. The container identification equipment is bar code based for compatibility with both on- and off-site use. Each container is labeled with a bar code, and the container label is affixed before the container is filled with product. Once the container is filled, bar code scanners are used to scan bar codes within a prescribed viewing window. Process information collected during filling, sampling, surveying, weighing, and shipping is tagged and recorded in a database with the bar code to identify each container.

2.2.2 Container Filling System (System 24)

The Container Filling System is divided into five distinct areas:

- Container transfer,
- Container filling,
- Container inspection,
- Lid replacement/fastening, and
- Product sampling.

2.2.2.1 Container Transfer

Each container transfer car is driven by a servomotor connected to a gearbox, which rotates the rear wheels and provides movement along two parallel rails. The wheels of the container transfer cars are connected to the gearbox by axles with independent safety couplings. The container transfer cars are equipped with an electric brake for safety, front and rear lights, as well as an alarm for warning that a container transfer car is moving. A positioning frame is located in the center of each container transfer car so that the container is correctly aligned when the monorail hoist places it on the container transfer car. During container filling, the container transfer cars are positioned in the product fill station by redundant positioning controls. In addition to the servomotor feedback control, a wall-mounted laser reflects back from a reflector affixed to the container transfer car to ensure that the container transfer car is in the correct position for product filling.

2.2.2.2 Container Filling

Each container transfer car, which moves on rails, is moved into one of three Product Fill Rooms after a door (ASD-24-1008A, B, or C) is opened. Container transfer car CRT-24-1002A is filled in Room 134; container transfer car CRT-24-1002B is filled in Room 135; and container transfer car CRT-24-1002C is filled in Room 136. After the container transfer car is positioned within the Product Fill Room, the door is closed. The container transfer car is positioned under a gantry manipulator in front of an operator-viewing window. The gantry manipulator, equipped with a gripping tool, is used to raise and move the lid away from the container.

The container transfer car is then moved to the filling station. Each container fill station is located beneath a product fill chute (LSR-24-1007A, B, or C), which is attached to a discharge valve from one of the mixers located above each Product Fill Room. The fill chute has a bellows portion, which is extended so that the fill chute is coupled to the container opening. When a positive coupling is sensed, the mixer discharge valve is opened and product material is allowed to flow by gravity from the mixer into the container. A drip pan under the product fill chute is retracted during filling operations and repositioned afterwards to minimize the potential for product material to drip and contaminate container surfaces or the surrounding area.

2.2.2.3 Container Inspection

After the container is filled with product material, the container transfer car is moved to an inspection/lid fastening station under the gantry manipulator in front of the operator-viewing window. An operator inspects the container, using a remotely operated camera, to determine whether any product has dripped or splashed onto the container surface. If contamination is observed, decontamination activities are initiated to clean the container before the lid is fastened.

2.2.2.4 Lid Replacement/Fastening

After container inspection is complete, the gantry manipulator is engaged by the operator to replace the container lid using alignment pins and cameras, and fasten the lid with rivets. A vision system and programmable logic controller identify the locations of the rivet holes to allow the gantry manipulator to accurately insert the rivets automatically. After the container lid is fastened, the door (ASD-24-1008A, B, or C) is opened, and the container transfer car is moved out of the Product Fill Room. The container transfer car is then positioned at the filled container removal station, and the door is closed.

2.2.2.5 Product Sampling

Since performing the TCLP would be a "worst case" scenario for testing, it will be assumed that the TCLP will be required. Therefore, samples will be prepared by the guidelines set forth by the U.S. EPA in Method 1311: Toxicity Characteristic Leaching Procedure.

Every second container will be sampled. From each container sampled, enough Silos 1 and 2 material will be drawn for two TCLP samples. After the samples have cured, they will be examined for the presence of free liquids. One of the samples will then be sent to a laboratory for analysis, and the other sample will be stored in the container fill room. The stored samples will be maintained up to 10 days, at which point they will be disposed of in an appropriate manner.

The TCLP requires a minimum of 100 g for each sample tested. To build robustness into the sampling equipment design, each proposed sampler will be designed to take a 300 g (0.66 lb) sample. A 300 g sample will allow for one 100 g sample to be tested and one 100 g sample to be archived. The remaining 100 g is for a safety factor only and may be

discarded after the test sample and archive sample are prepared. This material must be treated as hazardous waste.

If it is found that the process operates without TCLP failures, the sampling frequency may be reduced at the discretion of the TSDF. The sampling frequency stated previously could also be reinstated if failures were detected at any time.

Samples will be drawn from the fill chute used to transfer product from the mixer to the container. As the mixing cycle is completed, a knife gate valve located immediately below the mixer opens, allowing the Silos 1 and 2 material to gravity feed from the mixer through the fill chute and into a waiting container. The sampling device would be inserted horizontally into the vertical fill chute and the sample drawn. Samples taken from the fill chute could either be deposited into an attached container for manual removal by personnel in PPE, or it could be transported mechanically (robotically or by pump) to a glove box located outside the container fill area.

2.2.3 Container Shipping System (System 25)

The Container Shipping System contains the processes and equipment to load and ship the filled product containers. Rail transportation using shielded gondola cars has been selected for transporting the filled product containers to an appropriately licensed off-site disposal facility. The Container Railcar Loading Area within the Remediation Facility accommodates up to nine gondola cars on three parallel tracks. The tracks will be installed flush with the floor level to facilitate the use of trucks in lieu of rail shipment if necessary.

Loading operations are performed remotely while cameras are used for viewing. First, a roll-up door (ASD-25-1000A, B, or C) is opened between the Container Survey and Decontamination Room and the Container Railcar Loading Area. The container transfer car is then moved into the Container Railcar Loading Area, and the door is closed. A 15-ton bridge and trolley (BRC-25-1002) equipped with a container grapple (RLD-25-1001) is moved over the container to be shipped. The container grapple is lowered and engaged, as verified by indicator lights. The container is then raised off of the container transfer car, moved by the bridge crane, weighed, and lowered into one of seven steel-lined transport cells with lids inside the gondola car. Customized top loading truckbeds could also be used for this service. A weigh cell that is integral to the bridge crane, located between the hook and the grapple, is used to weigh the containers. The weighing equipment is designed for calibration with known weights to ensure that measurements are accurate and repeatable. The grapple is then disengaged, raised, and moved by the bridge and trolley to pick up the next container. Each gondola car is loaded with up to seven filled product containers.

Surveys of the railcars are performed in the rail yard to ensure that the waste packages, when combined with the shielding of the railcar with transport cells, meet the DOT dose rate criteria. Containers with high radiation levels can be placed in railcars with containers having lower radiation levels in order to meet these requirements. An exemption from the DOT requirement for contamination surveys of individual packages is being pursued to

4654

minimize the collective radiation dose to personnel performing the surveys, since the contact dose rate at the surface of each package ranges from 70–100 mrem/hr.

2.3 HVAC SYSTEMS (SYSTEMS 70, 71, AND 77)

(Refer to Drawings 94X-3900-H-01140, 94X-3900-H-01141, 94X-3900-H-01142, 94X-3900-H-01632, 94X-3900-H-01633.)

2.3.1 Overview

The Remediation Building has a relatively high degree of HVAC complexity due to the contamination potential presented from processing the Silos 1 and 2 material. Areas within the building are normally occupied, normally non-occupied, and completely unoccupied or sealed from personnel entry, such as the tank shield enclosures. The building areas are maintained within a prescribed range of temperatures and pressures.

The Remediation Building contains a "once-through" ventilation system for areas with the potential to be contaminated by Silos 1 and 2 material and material migration. The HVAC system for this building has a degree of redundancy based on the postulated HVAC component failure modes, including loss of power. The HVAC system maintains all areas that have the potential for contamination under prescribed levels of negative pressure (approximately -0.25 to -1.50 in. water column (w.c.) with respect to the outside atmosphere. This ensures that any leakage through the building boundaries will be in-leakage, such that all radiological contamination is controlled and particulates are filtered before release to the atmosphere. The system is also designed to compensate for infiltration caused by open doors or door seals.

Off gases from specific vessels, such as the slurry tanks, are not processed by the HVAC system. Instead, they are piped to the separate Vessel Vent System (Section 2.1.8) and controlled by the AWR Project RCS.

In general, the HVAC system maintains temperatures within the recommended ranges for the operation and service life of plant equipment and for the comfort and well being of workers in normally occupied areas. The system operates on a "push-pull" arrangement. Outside air, filtered and conditioned, is supplied to clean areas (e.g., personnel access corridors, etc.) that are normally occupied and then pulled to, and through, areas that have the potential to be contaminated. The air is then drawn into, and exhausted through, the areas with progressively higher potential for contamination. The air sweep caused by this push-pull arrangement ensures contamination control for those areas where personnel may be present.

2.3.2 Remediation Building HVAC System

The Remediation Building HVAC System is designed to maintain temperatures, air flow patterns, and sufficient air change rates in the recommended ranges for the comfort and safety of workers in normally occupied areas, for contamination control, and for the operation and service life of plant equipment. The ventilation system considers air capture

4654

velocity, room differential pressure, and room air change rate as priorities in the order listed.

Normally occupied areas within the Remediation Building are maintained at a slightly negative pressure with respect to the outside ambient pressure. Areas with a potential for contamination are maintained at a slightly more negative pressure to ensure that all air exchange between a normally occupied area and a potentially contaminated area is always towards the latter, and that air exhausted from the potentially contaminated areas is filtered through high-efficiency particulate air (HEPA) filters before being released to the atmosphere. The HVAC System is designed so that 100 percent outside air is supplied to cleaner areas and exhausted through areas with progressively greater potential for contamination. Airflow is cascaded from outside air to increasingly dirtier ventilation zones. The ventilation zones are:
Zone 3 – Generally occupied clean areas. Normally free of radioactive contamination.
Zone 2 – Areas that could be contaminated due to unplanned low-level radioactive releases from operations or maintenance.
Zone 1 – Areas with the highest potential of radioactive contamination.

Ventilation air exchange rates are as follows:

- Normally non-occupied areas (Warehouse) – minimum of three air changes per hour (minimum of 55°F, maximum of 103°F);

- Normally non-occupied areas (Remediation Building) – minimum of five air changes per hour (minimum of 55°F, maximum of 103°F);

- Normally occupied areas – minimum of five air changes per hour (minimum of 68°F, maximum of 80°F);

- Potentially contaminated areas (such as process equipment areas with sealed equipment [pump galleries]) – minimum of 10 air changes per hour (minimum of 55°F, maximum of 103°F); and

- Areas with a higher potential for contamination (such as areas or rooms with exposed Silos 1 and 2 material [product fill rooms]) – minimum of 10 air changes per hour (minimum of 55°F, maximum of 103°F).

2.3.2.1 Air Supply System (System 70)

The air supply system has three 50 percent capacity air conditioning units (ACUs). Only two ACUs are required for normal operation, and the third is on stand-by. ACUs are rooftop packaged units, containing supply fans, pre-filters, high-efficiency filters, compressors, condensers, condenser fans, evaporator coils, and electric heating coils. In addition, electric space heaters are installed in rooms and areas where supplementary heat may be required to provide personnel comfort.

4654

2.3.2.2 Air Exhaust System (System 71)

The air exhaust system has three parallel filter trains, each with 50 percent capacity (two of which are required for normal operation, with the third as stand-by). Each filter train has one ~35 percent efficiency filter, one ~90 percent efficiency filter, and two stages of HEPA filtration (99.97 percent combined efficiency), in series. Each filter train contains pressure differential monitors and alarms across the overall filter train, as well as pressure differential indicators across each individual filter bank. Filter trains are placed in the Exhaust Ventilation Equipment Room, as near as practical to the source of contamination, to minimize the spread of contamination. The exhaust air from the building passes through the filter trains before being discharged to the stack by the exhaust fans. Exhaust fans are designed for 100 percent redundancy with backup power from a diesel generator.

2.3.2.3 HVAC Cascade Ventilation System Control

Manual volume dampers are provided in all supply, transfer, and exhaust ducts to balance the HVAC cascade ventilation system and obtain design airflow rates and room pressure differentials. The positions of these dampers will be set during initial facility testing and balancing, and they will be locked in their set positions.

Motorized dampers are provided in the supply ducts to rooms that receive conditioned air directly from the ACUs. These dampers provide the ability to isolate the supply air and maintain each room's differential pressure when a door is opened that breaches the cascade ventilation system boundary.

A bypass loop comprised of motorized isolation dampers, controlled by door interlocks, isolates the Product Fill Rooms and the Container Survey and Decontamination Room whenever one of the three doors between the Container Railcar Loading Area and the Container Survey and Decontamination Room is open. This bypass loop allows the remainder of the cascade ventilation system to operate as designed when the door is open. It maintains an acceptable air capture velocity across the open door and a slightly negative pressure in the Product Fill Rooms and the Container Survey and Decontamination Room.

A modulating vacuum relief damper, attached to the main exhaust header leading to the filter trains, operates together with the modulating supply dampers to maintain the Remediation Building within the design differential pressures under varying operational conditions. The vacuum relief damper is controlled by a pressure differential controller with a sensor located in the exhaust header.

Motorized isolation dampers are installed in the transfer ducts between Zone 3 and Zone 2 rooms so that the Zone 3 rooms can be isolated from the rest of the HVAC cascade ventilation system if a radiological release is detected by the HVAC stack continuous emissions monitor. All motorized isolation dampers are connected to the uninterruptible power supply.

4654

2.3.2.4 Ductwork

Supply ductwork is galvanized steel with flanged connections. Exhaust ductwork is round, galvanized steel of welded construction with welded joints. Ductwork that penetrates a firewall has a fire damper installed that is of equal value to the wall that is penetrated.

2.3.2.5 Vessel Vent System (System 19)

(Refer to Drawing 94X-3900-F-01190.)

A separate Vessel Vent System for process off gases (not associated with the HVAC system) is provided for vessel vents and other localized areas where the Silos 1 and 2 material is present. The Vessel Vent System is connected to the RCS and is exhausted through the RCS stack (Section 2.1.8).

2.3.2.6 Exhaust Stack and Monitoring

The Remediation Building HVAC System has its own exhaust stack. Isokinetic sampling, monitoring, and recording of stack exhaust data are performed in compliance with 40 Code of Federal Regulations (CFR) Part 61, Subpart H and Department of Energy (DOE) Order 5400.5, Section IV.6.B.

Two HEPA filters in series are designed to remove up to 99.97 percent of particles with an aerodynamic mean diameter of 0.3 microns or greater, and are considered to be best available technology (BAT). A stack monitor is provided in the stack after the HEPA filters. The sample air stream is passed through a filter paper, where a beta-sensitive radiation detector continuously measures the beta radiation emitted by the collected particulates. The air stream then enters a continuous radon monitor that measures the concentration of radon in the stack effluent. Monitoring data are collected and analyzed by a local computer and then transferred to the Remediation Building control room for display and record keeping. Alarm signals for particulates alert the control room operator if an out-of-specification condition exists in the stack. The radon monitor has an alarm set point established to maintain radon releases ALARA. Operating controls for the entire system are included in the Remediation Building control room.

2.3.2.7 Control Room HVAC System (System 77)

(Refer to Drawings 94X-3900-H-01140, 94X-3900-H-01141, and 94X-3900-H-01142.)

The control room HVAC system is designed to provide the occupants with comfortable conditions and safe (filtered) breathing air. This is an independent system, which primarily uses recirculation and some outside air for makeup with positive pressurization. The control room HVAC system has one packaged ACU with one 35 percent efficiency filter, one 90 percent efficiency filter, and two HEPA filters (99.97 percent combined efficiency), in series. The ACU is connected to the backup diesel generator. System temperature is controlled from the control room.

4654

2.4 INFRASTRUCTURE

2.4.1 Logistical Support

Logistical support will be a significant component of the Remediation Facility. The following list provides an overview of the daily transportation and material support needs of the facility.

- 30 empty product containers (cylindrical, painted, carbon steel cylinders, approximately 6 ft in diameter by 6 ft high) delivered to the site on 6 trucks/day;

- 55,000 lb of cement – about 1.1 truck loads of cement/day;

- 220,500 lb of fly ash - about 4.4 truck loads of fly ash/day; and

- 4 gondola railcars loaded for shipment to the off-site disposal facility per day (assembled into unit trains of about 60 to 65 railcars).

In addition to the major material deliveries listed above, the Remediation Facility will receive small quantities of chemicals, including:

- 100 lb of neat polymer/day – delivered as 29 percent solution in totes or drums, about 1 tote/month; and

- chemical additives (to be determined) – delivered as solutions in totes or drums.

There is limited space around the Remediation Facility for truck parking, truck unloading, or trailer storage. A truck trailer staging area will be located in the existing FEMP southwestern parking lot.

2.4.1.1 Truck Transport

Transfer trucks that provide logistical support are divided by function into the following two categories:

- Trucks delivering empty product containers and bulk materials to the site, and

- Trucks delivering small quantities of chemicals to the site.

Trucks bringing empty product containers and bulk materials (cement and fly ash) to the site are day shift deliveries. The trucks will travel to the FEMP southwestern parking area and wait for clearance to proceed to the Remediation Facility for unloading. Cement and fly ash are then unloaded pneumatically into the dry additives silos. Empty product containers are unloaded by monorail hoists into the Empty Container Staging Room of the Remediation Facility.

Trucks delivering small quantities of chemical additives to the site make deliveries on an infrequent basis, approximately once a week. The trucks first check in at the access control station in the southwestern parking lot and are then sent directly to the Cold Chemical Make-up Room on the southwestern corner of the Remediation Building. The chemical deliveries are off-loaded from the trucks in front of the Cold Chemical Make-up Room (Room 124). Forklifts are used to off-load and move the chemicals into the building.

2.4.1.2 Rail Transport

Gondola railcars are used to transport filled product containers to the off-site disposal facility. Each gondola railcar has the capacity to carry seven product containers. Containers are loaded into steel liner transport cells with lids in the railcars by a bridge crane in the container railcar loading area of the Remediation Facility. This area can accommodate nine gondola cars on three parallel rail lines.

Three new rail spurs will be constructed on Track No. 12 and will serve to connect the Silos 1 and 2 Remediation Facility to the existing FEMP railroad infrastructure. The existing railroad infrastructure will be used to manage, maintain, and assemble the gondola cars into unit train shipments of about 60-65 cars. As a contingency, a railcar staging area will be constructed with the capacity to store up to 120 gondola cars at any time in the unlikely event that the existing railroad infrastructure is not available for use by the Silos 1 and 2 Project. The railcar staging area would be located along the existing Haul Road and would consist of two parallel rail lines. One rail line is used to assemble unit trains, and one rail line is used for staging and inspecting empty gondola cars. The railcar staging area has perimeter lighting and an office trailer to house gondola car inspection and waste shipping personnel.

2.4.1.3 Road and Rail Improvements

Road improvements are to be determined. Additional rail lines and spurs will be constructed from the existing rail lines to the Remediation Facility and to the railcar staging area.

2.4.2 Site Facilities and Functions

A total of four sites are included in the design or are discussed as potential sites.

2.4.2.1 Remediation Building Site

The site is a 2.8-acre area located between the Haul Road and the AWR Facility. Currently, several contractor trailers are located on the eastern end of the site, but these trailers are to be removed before beginning construction on this site. The site will be developed for the following facilities and functions:

Facilities
- Chemical stabilization area,
- Empty container staging room,
- Cold chemical makeup room,
- Dry additives silos (fly ash and cement silos),
- Mixers and product fill rooms,
- Container railcar loading area,
- Control room, and
- Electrical room.

Functions
- Slurry treatment and preparation for mixing,
- Empty containers receiving and staging,
- Additives receiving and storage,
- Slurry/dry additives mixing,
- Filling containers with product,
- Loading gondola railcars for shipping, and
- Operations and maintenance.

2.4.2.2 Warehouse Site

The site for the proposed warehouse is located east of the Haul Road, immediately north of the High Nitrate Storage Tank. The available area is approximately 1 acre.

Facilities
- Warehouse, and
- Truck loading/unloading areas.

Functions
- Receiving and storage of materials and parts.

2.5 SUPPORT SYSTEMS

2.5.1 Electrical Systems

2.5.1.1 Electrical Power

Normal electrical power is supplied by the local utility company, and power at 13.2 kV is supplied by the FEMP site distribution system. The 13.2 kV power is available from a double circuit (i.e., circuits 2C and 3C) line adjacent to the Remediation Facility. One or both of these circuits are available for feeding the facility, based on the load requirements for the project. All necessary switchgear will be included in the final design. The electrical room in the Remediation Facility will house the major electrical equipment such as switchgear, motor control centers, transformers, uninterruptible power supply equipment, and electrical panel boards.

4654

2.5.1.2 Standby Electrical System (System 32)

A diesel generator is provided for backup power to facilitate safe shutdown of the facility during a power outage. Critical items are connected to backup power in order to prevent a release of contamination or equipment failure. Backup power is provided to critical systems such as additional RCS needs, instrumentation and controls (including stack monitoring), slurry tank agitators, equipment and pipe flushing pumps, product mixing and pouring operations, and facility HVAC. There will be a 1 to 2 minute power outage (unless connected to the UPS) until backup power is available. The diesel generator and an integral sub-base fuel tank are located on a concrete pad outside of the Remediation Building.

2.5.1.3 Uninterruptible Power System (System 33)

An uninterruptible power system (UPS) provides continuous power to mission or operations critical instrumentation and control equipment that cannot tolerate a temporary interruption of power. The UPS provides critical power needs and is also connected to the backup power diesel generator.

2.5.2 Air Utilities

2.5.2.1 Plant And Instrument Air System (System 40)

An oil-less reciprocating compressor is used to supply compressed air. All plant air will be instrument air quality. The system capacity is primarily based on the major process and mechanical end use devices such as pneumatic conveyance systems for additives (cement and fly ash) and air-operated diaphragm pumps.

2.5.2.2 Breathing Air System (System 41)

The breathing air system is sized to provide 10 cfm per person with 9 people connected at one time. The connections for the breathing air system are provided in vestibule areas prior to entry into areas where radon exposure or radioactive contamination is a potential. A compressor package is used that contains a receiver tank sized to provide an efficient compressor cycle time. The air intake is on the roof of the Remediation Facility above the compressor room, and provides a clean air supply. The receiving tanks, coupled with a 6-pack bottle backup system, provide sufficient capacity during the onset of a power outage.

2.5.3 Water Systems

2.5.3.1 Process Water System (System 50)

Process water is supplied from 3 tanks, with a total capacity of 25,000 gal, connected to the FEMP site utility water supply services. Process water is supplied to the feed preparation system for mixing with polymer in the cold chemical make-up room. Process water is supplied to the sluice/flush water tank for process make-up water needs. Process

water is also used to flush and clean any buildup of cement and fly ash in the product mixer vent lines. Process water is used as the scrubbing solution in the product mixer vent scrubber. To facilitate clean-up and decontamination activities, hose bibs are strategically located throughout the treatment process, container filling, and container loading portions of the Remediation Facility. The hose bibs are placed so that hose lays are reasonable in length.

2.5.3.2 Potable Water System (System 51)

Two emergency showers and eyewashes are provided in the Remediation Building. These are connected to domestic water. One shower and eyewash station is located in the cold chemical make-up room. Another is located on the second floor in the tank access to the feed tanks area.

There are no drinking fountains or restrooms in the Remediation Building or its control room.

2.5.3.3 Fire Protection Systems

2.5.3.3.1 Fire Detection and Alarm System (System 92)

A fire detection and alarm system is provided. The system is compatible with the existing FEMP site Honeywell Delta 1000 system and provides remote notification of alarms, via phone modem, to the Savannah River Site Communications Center. Manual fire alarm pull stations, area smoke detectors, audible and visual fire alarm notification devices, and supervision of automatic sprinkler flow and tamper switches are provided throughout the Remediation Facility. The fire detection and alarm panel is located in the Remediation Building control room.

Duct smoke detectors are provided in HVAC ducts for shut down of the affected unit(s). Automatic or manual activation of the fire detection and alarm system automatically activates local audible and visual fire alarm notification devices and provides remote notification to the Savannah River Site Communications Center.

An emergency voice and evacuation system is provided for the Remediation Facility to notify personnel and to facilitate a quick response by safety units. The system is compatible with the FEMP site Honeywell emergency voice and evacuation system. The master control for the system is located at the FEMP Emergency Operations Center.

2.5.3.3.2 Fire Suppression

The Remediation Building is supplied with an automatic sprinkler system, with the exception of Zone 1 and 2 contamination areas (due to the potential for firewater contamination). With the code officials' approval, an automatic sprinkler system will not be installed in these areas, with the exception of two Zone 2 areas described below. An early warning fire detection system will be installed to detect a fire in the incipient stage and allow time to control the spread of the fire. Two Zone 2 areas are supplied with an

4654.

automatic sprinkler system. These are the exhaust ventilation equipment room and the vestibules on the second floor. The vestibules on the second floor have an automatic sprinkler system to provide personnel access to escape routes in case of fire. Both of these Zone 2 areas provide adequate containment for the potential firewater. Contaminated firewater is routed to the supernatant water tank.

An automatic sprinkler system is not required and is not provided for the trailer facilities. Fire extinguishers are provided in the trailer facilities to extinguish incipient fires. The automatic sprinkler system for the Remediation Building is comprised of a wet pipe system with a sprinkler density of 0.2 gpm over 3,000 ft^2 and a dry pipe system (for areas that are not heated, such as the truck canopy area) with a sprinkler density of 0.2 gpm over 3,900 ft^2. The Remediation Facility firewater line ties into an existing 8-in. site firewater line. Fire extinguishers are provided throughout the facility, located external to fire hazard areas and near access ways so that incipient fires can be extinguished. Hose stations are provided in the facility for use by the FEMP emergency response team.

2.5.3.4 Process Chilled Water System (System 56)

In this system, process chilled water is used to provide cooling to the slurry receipt tanks and slurry feed tanks. The tanks are wrapped with cooling coils and chilled water is circulated through the coils to remove heat resulting from agitation of the tank contents.

2.5.3.5 Seal Water System (System 54)

Seal water is supplied to pumps with water-lubricated seals throughout the facility. A vendor-supplied seal water skid (SKD-54-1000) contains a seal water tank (TNK-54-1000) approximately 6 ft in diameter and 6 ft high with an approximate capacity of 1000 gallons. Process water is used to supply the seal water system, and the tank is equipped with a low-level indicator. The skid also contains two centrifugal seal water pumps (PMP-54-1000A and B) and flow is measured as seal water is supplied to the four seal water headers.

2.5.4 Health Protection System (System 93)

To keep radiation exposures ALARA, radiation shielding is incorporated into the design to shield workers from process tanks and equipment containing significant amounts of Silos 1 and 2 material. Radiological or potentially contaminated areas are controlled and segregated from uncontrolled "clean" areas by airlocks or vestibules. Personnel have access to equipment within the facility's radiological working areas. Areas to don and doff protective clothing are provided to protect personnel from becoming contaminated when entering potentially contaminated areas and to provide safe disposal of contaminated protective clothing upon exit. Airlocks and vestibules are equipped with radiological survey equipment so that contamination can be found before it is tracked out of one area and into another by personnel or on equipment.

Approximately 14 area radiation monitors (ARMs), sensitive to gamma radiation, are placed throughout the Remediation Building, based on engineering judgment, in frequently

occupied areas. The ARMs are set up so that both a local alarm and a control room alarm sound if permissible radiation limits are exceeded.

Four to six portable continuous air monitors (CAMs) are provided for use throughout the Remediation Building. The CAMs, sensitive to alpha radiation, are set up on carts that can be moved around the Remediation Building to provide continuous air monitoring where it is needed during maintenance or other activities. The CAMs sound a local alarm if permissible radiation concentration limits are exceeded.

4654

3.0 PROCESS CONTROL PLAN (40750-PL-0003)

The Process Control Plan provides a narrative description of the Silos 1 and 2 material settling, stabilization, and packaging process giving process objectives, process methods, and process controls, including both administrative and hardware/software process control systems used to accomplish the process objectives.

The overall purpose of the Remediation Facility is to receive the Silos 1 and 2 material from the TTA tanks and process the material for shipment to an off-site disposal facility. The material is received as a slurry (~15 wt % solids), treated with a settling additive, concentrated in a clarifier (~30 wt % solids), and mixed with stabilization additives to produce a product suitable for shipment and final disposal. Figure 1-1 provides an overall process block flow diagram that shows the basic flow of materials through the facility. The final design of the stabilization process has incorporated the results of treatability studies.

3.1 PROCESS OBJECTIVE

The process objective is to treat material removed from Silos 1 and 2 so that it meets an appropriately licensed off-site disposal facility's WAC for disposal, and to package it so that it meets the applicable U.S. Department of Transportation (DOT) regulations concerning the transportation of such material. Some additional process objectives are included in case the product is disposed at the NTS. The primary process objectives are as follows, as given in the Design Basis and Requirements Document for the Silos 1 and 2 Project:

The final packaged material shall not have any free liquids in the waste form or disposal container.

The concentration of Ra-226 shall not exceed 100,000 pico Curies per gram (pCi/g). Disposal at a permitted commercial disposal facility is contingent on the facility having a valid license for this concentration level.

The treated material shall not exhibit a characteristic of a hazardous waste (defined by 40 CFR 261 Subpart C) and shall not contain any listed hazardous wastes.

The treated material must pass the U.S. EPA Toxicity Characteristic Leaching Procedure (TCLP) test, with leachability for lead (primary heavy metal of concern) at less than 5 parts per million (ppm).

The waste shall meet Low Specific Activity (LSA) II criteria per 49 CFR 173.403.

The waste packages, when combined with the shielding of the railcar, shall meet the dose rate criteria per 49 CFR 173.441(b). An exemption from the DOT requirement for contamination surveys of individual packages is being pursued to minimize the collective

4654

radiation dose to personnel performing the surveys, since the contact dose rate at the surface of each package is about 100 mrem/hour.

The waste container shall be an Industrial Packaging Type-2 (IP-2) container as presented in 49 CFR 173.411 (b)(2).

3.2 PROCESS METHOD

To meet the process objectives stated in Section 3.1, the Silos 1 and 2 material must be chemically and physically stabilized prior to packaging for shipment to the disposal site. A recipe, developed in treatability testing, is the starting point for treatment of each batch of material. Depending upon the composition of the material being treated, the recipe is adjusted to accomplish the process objectives. The current proposed recipe is based on a 15 wt% Silos 1 and 2 material solids content in the final product. This recipe has also been demonstrated for waste loadings up to 30 wt % of K-65 solids. The recipe is also formulated to produce a grout that has flowable and self-leveling physical properties to enable effective packaging.

Chemical stabilization and solidification are accomplished by mixing together the Silos 1 and 2 material, Portland cement, fly ash, and possibly other chemical additives. The proportions (by weight) of each component are determined according to a recipe, developed as part of a treatability study and tested for waste variability. Portland cement and fly ash are added to physically bind the material, increase the material's flow properties, and produce a solid with no free liquid present after curing. The cement and fly ash content will be varied depending on the percent solids content of the Silos 1 and 2 material feed. A relationship will be developed between the feed material percent solids, the flow and self-leveling properties of the freshly mixed batch, and the properties of the final product in the no-free-liquid state. In summary, the stabilization recipe will contain amounts of additives that will be valid for a range of lead concentrations, with the amounts of cement and fly ash also dependent on the solids content of the feed material.

To control the radioactivity levels and thus meet the process objectives, the solids content of the feed material is controlled. The slurry is thickened in a clarifier after the addition of a polymer settling agent. By controlling the clarifier feed rate and discharge rate of settled solids, the percent solids can be adjusted. The percent solids sent to the slurry feed tanks and then fed to the product mixers are controlled to meet the Ra-226 and specific activity limits of the final product.

3.3 PROCESS CONTROLS

Process controls for the Silos 1 and 2 remediation system consist of two types of controls: administrative controls and hardware/software controls. Administrative controls are those actions that are planned and performed so that the process objectives are met. Hardware/software controls consist of measurement equipment and action initiated based on the measurements taken, which result in the stable operation of the process system so that the process objectives are met.

4654

3.3.1 Administrative Controls

Administrative controls for processing the Silos 1 and 2 material consist of procedures, metrics, and quality control (QC) testing. Through the use of these controls, there is a conscious, prescribed method of handling the Silos 1 and 2 material, methods to measure the initial and intermediate conditions of the feed material to adjust the recipe, and methods for QC testing of the product (or process knowledge) to assure regulators that the final product meets the process objectives.

3.3.1.1 Operational Procedures

Operational procedures will be prepared that guide system operators through the step-by-step processing of the Silos 1 and 2 material. These procedures provide instructions on how to operate the various pieces of process equipment and the automated control system. The procedures also delineate QC hold points where samples of the material are taken and analyzed. Based on the analytical results and analytical instrument readings and with direction from their supervisor and/or lead process engineer, operators are able to select settings from prescribed recipes, which have been previously validated for treating the range of material constituents present. They can then set up the automated control system so that it operates the process equipment in a manner that will result in a product that meets the process objectives.

3.3.1.2 Metrics

Slurry percent solids, pH, Ra-226 content (or a correlated indicator), and additive quantities are the metrical data measured at various points in the process for use in recipe adjustments.

At the slurry receipt tanks, samples are taken and measurements are made to determine the slurry percent solids and pH. The percent solids and pH measurements determine the clarifier feed rate and polymer addition rate in order to ensure settling to the target percent solids in the clarifier output.

At the slurry feed tanks, samples are taken and measurements are made to determine the slurry percent solids and Ra-226 content. This is the final sampling point in the process for any recipe adjustments to be made for additive additions to the product mixers.

The quantities of stabilization additives are measured to ensure that the prescribed amounts of additives are actually added. The chemical additives, which may be added, are measured during addition into the slurry receipt tanks, reaction tank, slurry feed tanks, or product mixers. The weights of cement and fly ash additives are measured as they are added to the product mixers by loss-in-weight feeders. The weight of the slurry feed added to the product mixers is measured by weigh cells on the product mixers.

4654

3.3.1.3 Quality Control Testing

QC testing is required throughout the process to ensure that the final product meets the process objectives. Sampling and analysis are conducted in accordance with the Sampling and Analysis Plan (40750-PL-0006), Appendix C.

Sampling and analysis will be performed using a graded approach because of the radiological hazards associated with the Silos 1 and 2 material. During initial process operations, samples will be taken on a relatively frequent basis, and once stable process control is achieved, sampling frequency is decreased. During initial startup and following upset conditions, all slurry batches are sampled and analyzed. Once stable process conditions are achieved for at least three days of operation (approximately 90 batches), the sampling frequency will be reduced. Screening-level and definitive data are used to verify process instrument readings. When it is demonstrated that process instruments provide accurate and reliable measurements of process conditions (after approximately 2 weeks), sample frequencies are further reduced to minimize radiological exposure to personnel performing sampling and analysis. If it is determined that an instrument is no longer providing accurate measurements, this is considered an upset condition, followed by increased sampling. This graded approach is presented in Table 3-1, Sampling and Analysis.

Table 3-1, Sampling and Analysis

Sample Location	Analyses Performed	Graded Approach	Sample Frequency	QC Verification
Slurry Receipt Tank Sampling Loop	% solids pH	Startup/Upset	1 sample/tank	FE-PMP-13-1000A/B/C (flow) DE-TNK-13-1000A/B/C (density)
		Initial Control	1 sample/day	
		Verified Control	1 sample/week	
Slurry Feed Tank Sampling Loop	% solids Radium-226	Startup/Upset	1 sample/tank	AE-PMP-16-1001A/B/C (flow/density) AE-TNK-16-1000A/B/C (radiation)
		Initial Control	1 sample/day	
		Verified Control	1 sample/week	
Product Mixer Fill Chute	% solids Radium-226 TCLP Lead	Startup/Upset	1 sample/batch	Treatability Test Results Waste Acceptance Criteria
		Initial Control	1 sample/15 batches	
		Verified Control	1 sample/30 batches	

Initial slurry percent solids and pH are determined to set the process to a prescribed recipe. While not a typical QC hold point, a sample is drawn and analyzed to provide data on the initial conditions.

Likewise, the composition of the intermediate slurry feed is needed so that the recipe can be adjusted to ensure that the final product will meet all of the process objectives. Slurry feed material is tested to verify the percent solids content and Ra-226 content.

Testing and calibration of the additive measurement equipment is also necessary to ensure that the amount of material added to the process as prescribed by the recipe is accurate. Provisions have been made to randomly sample the final product during container filling operations.

After loading the product packages onto railcars, survey measurements of each gondola car are made to ensure that DOT requirements are satisfied. An exemption from the DOT requirement to perform a contamination survey of each product container is being requested. The exemption should be granted because the individual containers are shipped in a closed, shielded configuration directly to the disposal site.

3.3.2 Hardware/Software Controls

Hardware/software controls for processing the Silos 1 and 2 material consist of the hardware and software used to measure system parameters, solve operating logic, and control the process systems and subsystems, either automatically or by operator intervention.

3.3.2.1 Control Philosophy

The remediation process for the Silos 1 and 2 material is both a batch and a continuous process. The process consists of various pieces of equipment used to treat the material and convert it into a form that meets the process objectives. The process system can be broken down into three basic material flows: Silos 1 and 2 material, additives, and wastewater for recycling. For this discussion, the Silos 1 and 2 material flow path is considered the main process system. The additives, wastewater, and any other support system flow paths are considered subsystems.

Both batch and continuous flow processes lend themselves well to automatic control by programmable logic-solving devices. This being the case, a programmable logic controller (PLC) is selected as the means to control the process.

Based on the procedural steps outlined in the section on administrative controls above, the PLC is programmed to execute the functions required to process the material. Since QC hold points are required to assess the properties of the feed material and adjust the recipe on a batch-by-batch basis, the process cannot be totally automated to the point that the operator can start the system and then just monitor its operation. The control philosophy is based on automatic control with manual operator action required to move beyond QC hold points.

Human Machine Interface (HMI) software is used to build operator-friendly graphical display screens on video display terminals that represent the status of the process system. The HMI also allows operator input to and control of the system by providing areas on the

4654

screen where operational parameters can be adjusted through a pointing device (mouse) or keyboard input into the system. The amount of input or control that an operator can exert on the system is governed by a software security system that allows certain levels of control based on "rights" granted to operators according to their level of authority in making process decisions.

3.3.2.2 Process Measurement

The process control system uses various sensors to measure vital process parameters. Input from these sensors is used by programmed automatic control functions as well as to provide alarms and system conditions to the operator.

Sensors applied in process measurement use technologies that allow the most direct measurement of the process parameter of interest. Where process measurements are critical, sensors are installed that are both redundant and diverse in their technology to ensure that the process conditions are correctly and reliably detected and input into the control system.

3.3.2.3 Process Control Elements

Various process control elements are used to perform the controls required by the system. Pumps and agitators driven by variable speed controllers and control valves represent the most common control elements used in the process system.

Where it is desirable to regulate the flow of material using the pump speed (as opposed to running the pump full speed and throttling the flow with a valve), a variable speed drive is used in association with the pump as a final control element. This control method has several advantages over pump and valve throttling including elimination of flow valves that can wear rapidly in slurry service, resulting in improved control and reduced maintenance.

Several types of valve technologies are used in the process system depending on what type of material is being transported through the valve.

Table 3-2, Valve Types and Service

Valve Type	Service
Ball	Non-Slurry Liquids (e.g., Water, Liquid Additives) and Air; for Tank Isolation
Butterfly	Dry Materials (e.g., Fly Ash, Cement)
Knife	Dry Materials and Grout
Rotary	Dry Materials (Where Air Lock Function is Required)
Diverter	Slurry with Solids
Pinch	Slurry with Solids
Plug	Slurry with Solids
Disc	Slurry with Solids

Since the process involves handling solid materials mixed with water to form a slurry, it is important that a uniform suspension of the solids be maintained throughout the process, and this is accomplished with agitators in tanks and appropriate slurry velocities in pipelines.

3.3.2.4 Operator Intervention (Additive Adjustments)

The operator (with direction from their supervisor and/or lead process engineer) intervenes in the process after receiving the analytical results for a batch of material in a slurry receipt tank. The operator determines the correct target solids content to be obtained from the clarifier and makes set point adjustments in the logic controller, which in turn controls the clarifier feed rate and discharge rate to obtain the desired solids content. The operator also determines the amount of chemical additive(s), which may be added to the slurry receipt tanks, reaction tank, slurry feed tanks, or product mixers, based on treatability study results. After testing the slurry in the feed tanks to verify the percent solids and Ra-226 content, the operator makes set point adjustments in the logic controller, which controls the cement and fly ash additive systems so that the proper amounts and proportions of additives are mixed with the slurry feed.

3.3.3 Automatic Data Collection

To maintain a permanent record of the process parameters during operation, the logic controller system collects and stores all analog signals at a periodic poling rate. System alarms that occur because of abnormal conditions are also stored. Changes in operating parameters such as set points and controller rates are logged, as well as the person that initiated those changes through system log-in and security access levels. Data are permanently archived by writing the data logging files to Compact Disk Read Only Memory every 30 days at a minimum. All HMI consoles use password security to prevent unauthorized use. There are also security levels of passwords to allow changes to set point parameters and recipe adjustments.

3.4 SYSTEM AND CONTROL DESCRIPTIONS

Detailed system design descriptions are provided in the System Design Description Document for the Silos 1 and 2 Project (40750-RP-0001) (Section 2.0).

Silos 1 and 2 material and Bentogrout™ are removed from the silos under the AWR Project. Upon removal, the material is temporarily stored in the TTA until processing in the Remediation Facility. The material is sluiced from the TTA and transported to the Remediation Facility as a slurry with nominally 15 wt % solids. The treatment process for Silos 1 and 2 material continuously produces stabilized product using several systems, some that operate in a batch-wise fashion and others that operate continuously. Redundant lines of equipment are used to ensure that batch operations performed sequentially result in a continuous overall operation.

The flow of Silos 1 and 2 material from the TTA to the three slurry receipt tanks is a batch transfer operation through one of two parallel piping systems. Flow of material from the

4654

slurry receipt tanks to the reaction/polymer addition tank is a continuous transfer operation through one of three parallel pump and piping systems. Flow of material from the reaction/polymer addition tank to the clarifier for thickening (to nominally 30 wt% solids) is a continuous overflow process. Material is transferred continuously from the clarifier underflow to the three slurry feed tanks through one of three parallel pump and piping systems. Overflow from the clarifier, supernatant consisting primarily of recycle water, is continuously transferred to the supernatant tank and/or the sluice/flush water tank and then back to the TTA. Flow of material from the slurry feed tanks to the product mixers is conducted in batches using one of three parallel pump and piping systems. The final product is produced in mixers by batches, each sized to fill one disposal container, using one of three parallel mixer lines. The disposal containers are filled with stabilized product, sealed, and loaded onto gondola railcars for shipment to an appropriately licensed off-site disposal facility.

Throughout the treatment process, pressure indicators are used to determine pump performance, whether slurry is flowing through lines or whether plugging has occurred, and whether the pumps must be shut down.

3.4.1 TTA Waste Retrieval System

The Silos 1 and 2 material for treatment is received at the Remediation Facility in one of three 83,800-gallon slurry receipt tanks. During normal operations, one of the slurry receipt tanks is filling from the TTA, one tank is undergoing analysis and continuous mixing, and one tank is feeding the reaction/polymer addition tank. The slurry receipt tank system is designed to provide sufficient slurry for a 24-hour shift using the volume contained in two of the three tanks. The design includes the capability of filling two of the three tanks in approximately 5 hours and pumping slurry from any of the tanks to another tank when required. Tank filling and emptying processes are monitored and controlled by tank level sensors interlocked with pumping operations.

3.4.2 Feed Preparation System

In the Feed Preparation System, slurry from the receipt tanks and chemical additives are mixed together in a reaction/polymer addition tank. One additive is a polymer to aid flocculation and settling. The polymer additive is premixed with water in the cold chemical make-up room. The polymer is then added to the polymer addition tank. Other additives, chemical solutions to be determined, may be added to the slurry receipt tanks, reaction tank, slurry feed tanks, or product mixers to provide process flexibility.

All tanks, including the polymer premixing tank and the reaction/polymer addition tank, are monitored and controlled by tank level sensors. Weigh cells, metering pumps, and/or flow meters are used to ensure that the additives are added in the correct amounts and concentrations. The contents of the reaction/polymer addition tank overflow to a clarifier, which is designed to thicken the slurry in preparation for product mixing.

The clarifier is a gravity thickener, which facilitates solids settling and separation to nominally 30 wt% solids. The clarifier is equipped with multiple density/level

measurement devices for monitoring and controlling the slurry thickening process. Thickened slurry is removed from the clarifier sump by one of three clarifier underflow pumps and transferred to the appropriate slurry feed tank. As thickened slurry is removed from the clarifier sump, it is monitored for density and radiation level to ensure that the percent solids and Ra-226 content are satisfactory for final product mixing. The supernatant liquid, which overflows the clarifier, is transferred to the supernatant tank system or the sluice/flush water system, depending on its density (i.e., solids content) and the water needs of the overall system.

3.4.3 Processor Feed System

The Processor Feed System is comprised of three 24,100-gal slurry feed tanks. The clarifier continuously feeds thickened slurry to one of the three slurry feed tanks at any given time. The thickened slurry is then transferred by batches to the product mixers.

During normal operations, one of the slurry feed tanks is being filled from the clarifier, and the other two slurry feed tanks are available for feeding the product mixers (except when one of the tanks is undergoing analysis). Each tank is sized to provide at least 10 product batches of slurry with 30 wt % solids to the product mixers (minimum of an 8-hour supply at the minimum percent solids envisioned from the clarifier underflow). The slurry feed tanks are equipped with level sensors to monitor and control tank filling and slurry transfer operations.

3.4.4 Product Additive System

The Product Additive System consists of equipment and controls for handling cement and fly ash additives. Both cement and fly ash are stored in bins until they are needed for mixing with the thickened slurry feed in the product mixers. As required, the two additives are transferred by pneumatic conveying systems to receiving bins and weigh hoppers, which in turn, provide measured quantities of the additives to the mixers.

The storage bins have multiple level sensors to control bin filling and emptying operations. Vent filters on the bins for dust emission control have differential pressure indicators to indicate plugging. The pneumatic conveying systems have feeder vessels, located under the storage bins, with level sensors to control filling and transfer of the additives by using compressed air. The additive hoppers have weigh cells and multiple level sensors to accurately control the amount of additives delivered to the product mixers.

3.4.5 Processor System

Three product mixers on weigh cells are used to weigh and mix the thickened slurry feed with cement and fly ash on a batch basis. After mixing is completed, the product is discharged into the disposal containers. Water used to flush and clean the mixers is collected in a rinse container, and liquids are decanted to the supernatant tank.

Each mixer is a high shear type, which thoroughly blends the ingredients and provides a homogenized product that, once placed in the container, will meet the disposal facility license and WAC and the transportation requirements.

The valves for discharge of product from the mixers to the containers are interlocked with correct positioning of the containers and the fill chutes. The flow of water is controlled to flush and clean the mixers as needed.

3.4.6 Supernatant and Flush/Sluice Water Systems

The Supernatant Water System and the Sluice/Flush Water System each contain a 100,000-gal tank to collect and recycle wastewater streams. The supernatant tank may contain some Silos 1 and 2 material. The flush/sluice water tank primarily contains water decanted from the supernatant tank and contains lower levels of radioactivity. The supernatant tank collects the overflow supernatant liquid from the clarifier as well as wash water and spills from sumps throughout the treatment facility, including wash water from product mixer cleaning. Material that settles to the bottom of the supernatant tank is returned to the reaction tank to be reintroduced to the treatment process after it is sampled as needed to determine its parameters for appropriate treatment. Liquid from the center of the supernatant tank is transferred to the sluice/flush water tank. Liquid in the sluice/flush water tank is recycled to the TTA to be used as sluice water and is used throughout the treatment facility to flush equipment and piping as necessary. Before water is transferred to the TTA or possibly to the AWWT Facility, it is sampled to determine contaminants as needed, and during transfer, flow is measured. Both the supernatant and flush/sluice water tanks are equipped with level sensors to control filling and emptying of the tanks. All sumps throughout the treatment facility are equipped with level sensors for activation of pumps for transfer of sump contents when necessary.

3.4.7 Container Receipt and Preparation System

The Container Receipt and Preparation System includes the mechanical equipment and processes that are used to receive, move, stage, and prepare product containers for filling with stabilized Silos 1 and 2 material. This system is divided into three distinct areas that include: (1) empty container receiving, (2) empty container staging, and (3) empty container preparation.

Empty product containers are transported to the Remediation Facility by truck trailers, five containers per trailer. Monorail hoists are used to unload the containers and place them on indexing conveyors, which are used to transport the containers inside the Remediation Facility. Containers are staged on multiple conveyors in the empty container staging room within the Remediation Facility. During empty container preparation, a container is lifted off of the last conveyor by a monorail hoist, weighed, and placed onto a container transfer car. The transfer cars are motorized and move on rails.

The movement of the product containers is automatically controlled by an integrated control system. Manual overrides are available for each step of the operation for operator control. In addition, programmed hold points are designed into the handling system for

operator verification. Inputs to the control system are from devices such as limit switches, positional detectors, motor device feedback, bar code scanners, and weigh cells. Each container is labeled with a bar code, and process information is recorded in a database with the bar code to identify and track each container throughout the process.

3.4.8 Container Filling System

The Container Filling System is divided into three distinct areas that include: (1) container filling, (2) container inspection, and (3) lid replacement/fastening. During container filling, the container transfer car is moved into a product fill room equipped with a viewing window for operator control. The container is positioned under a gantry manipulator, which removes the container lid. The container is then moved underneath the product mixer, and a product fill chute is extended to mate with the container opening. The mixed product is discharged through the fill chute into the container, and the fill chute is then retracted. A drip pan is positioned under the retracted product fill chute. An operator visually inspects the containers for external contamination through the product fill room window. The capability exists to take a sample of the final product if needed to meet the disposal facility WAC. The container is again moved beneath the gantry manipulator, the lid is positioned onto the container and the container lid is fastened with multiple blind bolts (rivets).

3.4.9 Container Shipping System

Container transfer cars move the containers out of the product fill rooms, where a bridge crane then lifts, weighs, and places the containers into steel liner transport cells with lids in gondola rail cars. The crane is remotely operated and uses a grapple hook system to pick up the containers and place them in the gondola cars. Up to seven product containers are carried by each shielded gondola car. Containers with high radiation levels are placed in railcars with containers having lower radiation levels in order to meet DOT requirements. Rail transport has been selected as the transportation method for the Silos 1 and 2 product to an appropriately licensed off-site disposal facility.

4654

4.0 TECHNOLOGY OVERVIEW

4.1 SITE BACKGROUND

The original ROD for OU4, approved in December 1994, identified removal, on-site vitrification, and off- site disposal at the NTS as the remedy for the uranium residues (K-65 material) contained in Silos 1 and 2. Difficulties encountered during the pilot studies of this technology resulted in a revised Feasibility Study/Proposed Plan (FS/PP) being prepared and submitted to the U.S. EPA and the OEPA in December 1999.

The Revised FS Report for Silos 1 and 2 (40730-RP-0001) considered the following technological alternatives for the treatment and disposal of Silos 1 and 2 wastes.

- Vitrification - Joule-heated
- Vitrification - Other
- Chemical Stabilization - Cement-based
- Chemical Stabilization - Other

The Department of Energy (DOE) recommended in the Revised Proposed Plan for Remedial Actions at Silos 1 and 2 (40700-PL-0001, dated March 2000) that the remedy for Silos 1 and be changed to retrieval, treatment by chemical stabilization, and off-site disposal at the NTS. This recommendation was made after review of the results of the Revised FS Study with U.S. EPA, OEPA, and key stakeholders on the conclusions to be drawn from that evaluation.

DOE's remedy proposal is based upon its determination that the remedy:

- Satisfies the statutory requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

- Chemical stabilization has an overall advantage over vitrification when evaluated against the five primary balancing criteria prescribed by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

- Specifically, the advantages of chemical stabilization in ease of implementation and short-term effectiveness are judged to outweigh the advantages of vitrification due to its lower treated waste volume.

Further Treatability Studies were conducted at the University of Cincinnati (UC) to define the flocculation and stabilization technologies to be utilized in this remedy. The results of these studies are reported in Silos 1 and 2 Flocculation Studies Final Report 40700-RP-0011, September 2002, and Silos 1 and 2 Stabilization Treatability Study at the University of Cincinnati Final Report, 40700-RP-0010, September 2002.

000061

4654

4.2 FLOCCULATION STUDIES

In the Silos 1 and 2 treatment process, a clarifier will be used to partially dewater the feed slurry. The solids in the clarifier feed slurry will consist of Silos 1 and 2 material, a radioactive inorganic residue from a uranium ore extraction process, and Bentogrout™, a non-radioactive bentonite added to the silos to attenuate radon emissions. The dewatered slurry, when mixed with stabilization additives, will produce a treated waste product exhibiting the desirable chemical, physical, and radiological characteristics required for disposal at a permitted disposal facility.

The composition of the clarifier feed slurry, including total solids and Bentogrout™ content, is expected to vary. As it presently exists in the silos, the Silos 1 and 2 material contains, on average, an estimated 2.21 percent by weight (wt) of Bentogrout™ on a dry basis. As a baseline, it is assumed that this clarifier will receive slurry at a 15 percent total solids level and will produce underflow slurry at a 30 percent solids level.

The primary goal of the flocculation study was to develop the data required to optimize the design of the clarifier used in the treatment process for Silos 1 and 2 material. This was to be accomplished by the specific objectives listed below:

- Identify additives that will effectively settle the Silos 1 and 2 material at a reasonable cost. This was to be accomplished by testing the effectiveness of various coagulants, polymeric flocculating aids, and pH modifiers to settle mixtures of Bentogrout™ and K-65 material.
- Produce a high solids content (30 wt percent or more) in the clarifier underflow. It is desired that the settling be reasonably rapid.
- Produce a low solids supernatant (less than 2 wt percent). The supernatant will be recycled to retrieve material from the TTA in a thin slurry form.

For the most part, these additives as used in the initial tests did not produce settled solids heights of less than, or equal to, 50 percent of the initial slurry heights. Notable results were obtained when 4.0 percent Bentogrout™ slurry was treated with Nalco 7768 polymer at a dose of 0.133 ml of as-received polymer per liter of suspension. At the natural pH of the system (7.6), the final settled height was 17 percent of the initial height. The settling was also rapid. After one minute, the settled height was 21 percent of the initial height. Thus, the use of Nalco 7768 polymer, with no coagulant and with no pH adjustment, emerged during the initial series of tests as a preferred settling treatment.

The final phase of testing was performed with actual Silos 1 and 2 material and varying ratios of Bentogrout™ to the material. The overall solids content of all the slurries was maintained at 15 percent by weight. The Silos 1 and 2 material used in these tests was a homogenized blend of approximately 56 percent Silo 1 material and 44 percent Silo 2 material. Only Nalco 7768 and CETCOFLOC 64102 polymers were added to the slurries and settling characteristics were observed over a two-hour period after the polymer was added.

4654

From these tests, it was observed that Nalco 7768 polymer is a more effective flocculating aid. No pH adjustment is required or desired. The key results from the tests with Nalco 7768 polymer are shown in Table 4-1.

TABLE 4-1 – CHARACTERISTICS OF SETTLED AND SUPERNATANT LAYERS

Polymer Name	Bento-grout™-to-K-65 Dry Weight Ratio	ml (mg) As-Received Polymer/ kg Waste Solids*	Final pH	Settling Time (Minutes)			Supernatant Layer			
				0	60	120	TSS, mg/l	Pb, mg/l	Ba, mg/l	Se, mg/l
				% Solids in Settled Layer						
Nalco 7768	0	0.00	7.52	15	36	43	130	0.23	0.04	0.71
	0.03	0.00	7.71	15	31	36	100	1.51	0.99	1.06
		0.97	7.78	15	38	45	0	0.38	0.11	0.69
		2.01	7.83	15	46	46	20	-	-	-
	0.05	1.04	7.74	15	45	45	30	-	-	-
		2.19	7.72	15	46	46	30	-	-	-
	0.1	0.00	7.61	15	22	25	140	12.10	7.74	0.75
		1.19	7.65	15	35	35	10	0.53	0.20	0.69
	0.15	0.00	7.65	15	18	19	6530	38.80	23.80	0.93
		1.16	7.46	15	33	33	0	0.19	0.18	0.83
			8.62	15	29	29	0	-	-	-
			9.41	15	31	31	250	-	-	-
		1.26	7.63	15	33	33	20	-	-	-
	0.3	1.27	8.3	15	20	21	120	9.44	5.06	0.89

Nalco 7768 is an effective settling agent at the natural pH conditions of K-65 and Bentogrout™ slurry. For each 100 g (dry basis) of K-65, about 0.1 to 0.15 ml of as-received Nalco 7768 appears to be an effective addition level, promoting rapid settling and leaving a clear supernatant. The Nalco 7768 was diluted to 0.67 wt percent of as-received polymer before use in the tests.

The addition of lime to adjust pH offers no benefit and may, in fact, have a small deleterious effect on the Nalco 7768 system. In other words, the system is effective over a wide pH range.

4654

When Nalco 7768 is employed at the "average" operating condition, with a ratio of 0.03 g Bentogrout™/g K-65 (dry basis), the supernatant was of good quality, with no measurable suspended solids and having a lead concentration of 0.38 ppm, which is below the RCRA TCLP limit.

At the expected or "average" operating conditions, slurry concentrations of 35 wt percent to about 45 wt percent were obtained using Nalco 7768. Thus, higher percent solids of K-65 slurry than used in the baseline design are possible in the clarifier underflow under normal operating conditions.

4.3 STABILIZATION TREATABILITY STUDY

Conceptual design of a treatment process was initiated and was based on prior experience and existing data for the Silos 1 and 2 materials. Present concepts consist of retrieving the material as thin slurry, thickening the slurry, and treating the thickened slurry using chemical stabilization.

The stabilization treatability study was carried out at the Accelerated Life Testing and Environmental Research (ALTER) facility at UC. The overall objective of this treatability study was to develop a stabilization/solidification formulation, or a number of formulations, that could be used to treat the Silos 1 and 2 materials. The treated waste must meet the requirements for transportation and disposal at the NTS or another approved commercial disposal facility. Specific requirements for the stabilization formulations to be developed were:

- RCRA heavy metals would not leach above their TCLP limits. Based on historical information, lead was expected to be the only metal of concern.
- The formulation(s) would produce a grout that would be self-leveling when filling large shipping containers.
- The grout mix would solidify within two days so that temporary staging facilities for containers of treated waste could be minimized.
- The formulation(s) would produce a grout that does not require environmentally controlled facilities to solidify. For example, the grout produces enough heat in the large containers that the grout cannot freeze before it cures (sets), or, if little or no heat is produced, freezing of the treated material does not affect the grout's desired qualities.
- The formulation(s) would provide adequate treatment throughout the range of expected variations in the feed.
- Control parameters for the treatment process would be identified and measured so that the required adjustments in the process could be readily made to meet treatment goals.

- No free liquids would be present after solidification.

- The treated waste would meet all requirements for transportation to and disposal at the NTS or a commercial waste disposal facility once solidified.

The formulation development program was to initially focus on the use of phosphate (as sodium phosphate or phosphoric acid), Portland cement, fly ash, and bentonite as the preferred reagents. This initial plan was based on the results of treatability studies done with surrogate material as part of an effort to support the revised FS for Silos 1 and 2.

Past studies found that lead was the only RCRA heavy metal of concern and this was confirmed in this study. Initial stabilization testing was focused on determining whether or not phosphate treatment was effective in reducing the solubility of lead and if pretreatment with phosphate prior to binder addition to the mix was necessary or desirable. The sources of phosphate were phosphoric acid (H3PO4) and trisodium phosphate (Na3PO4 · 12H2O). During this study it was noted that the TCLP requirement for lead was met for most runs in which Portland cement was added. It was subsequently determined that the pH of the TCLP filtrate was far more important than whether or not phosphate had been added in influencing the concentration of lead in the TCLP filtrate. The pH could be controlled by adjusting the amount of Portland cement in the formulation. For a certain pH range, TCLP lead concentrations were below 1.0 mg/L, corresponding to very effective chemical stabilization of lead. It was ultimately shown that this pH range extended from about 8.0 to about 11.7.

This was a major finding of this study. It provided a means of establishing a treatment basis for lead stabilization. At this point in the study, it became clear that Portland cement and fly ash would be the only reagents needed as stabilization reagents; a source of phosphate was not required. It was also determined that if phosphoric acid were to be used, its use would result in the evolution of carbon dioxide, which could cause overloading of the radon control system.

The base case design for the full-scale operation assumed that the thickened slurry fed to the stabilization process would have a solids content of 30%, of which 97.8% would be K-65 material and 2.2% would be Bentogrout™. To treat 100 parts by weight of this slurry, a preferred formulation of 20 parts by weight of Portland cement and 95 parts of fly ash was identified. The grout resulting from this formulation had a solids content of 67.5%. This formulation, or minor variations, stabilized lead effectively and was not sensitive to variations in the percent solids in the starting waste slurry, the amount of added Bentogrout™, the amount of Portland cement added, the amount of fly ash added, or the lead content of the waste. To test for effectiveness on wastes with varying lead concentrations, the formulation was employed on blended Silos 1 and 2 material, Silo 1 material alone, and Silo 2 material alone. Of special significance is the fact that the TCLP lead concentration was below the detection level in the treated Silo 1 sample since the untreated Silo 1 sample leached lead at 1190 mg/L, as compared with 34.2 mg/L for the untreated Silos 1 and 2 blend.

4654

The waste loading corresponding to the preferred formulation is 13.95%. This was lower than desired. Starting with a solids content in the thickened slurry of greater than 30% would be of benefit, and it is very possible that this can be done. For dry Bentogrout™/K-65 ratios of 0.05 and less, thickened slurry solids concentrations of greater than 40% (up to 46%) were obtained in the recently completed flocculation study when using Nalco 7768 polymer as a settling aid. The study included tests that started with waste slurry solids contents of 33% and 37% solids. For the 33% solids waste slurry, a 19.8% waste loading was achieved using 19 parts Portland cement and 47 parts fly ash per 100 parts waste slurry. For the 37% solids slurry, a 23.9% waste loading was achieved using 18.5 parts Portland cement and 37 parts fly ash per 100 parts waste slurry. Free water was not present in the cured product from either test.

Since thickened slurries with solids contents of greater than 30% are desirable and may occur, formulations that could accommodate any given solids content were of interest. Considering the results of all parts of this treatability study, a total solids content of between 65% and 70%, and preferably 67.5%, in the grout appeared to be an operating requirement. If the total solids were less than 65%, free water was at times present on the surface of the cured product. If the total solids was greater than about 70%, the grout was considered to be too stiff to be self-leveling in the product container. Adjusting the amount of fly ash in the formulation best controlled the total solids content.

As indicated above, the other major formulation requirement is that the pH of the TCLP filtrate must be between about 8.0 and about 11.7, and this can be achieved by varying the amount of Portland cement. The desired range for percent Portland cement in the grout was 8 to 12, with 10 being a good target value for control purposes.

These concepts were combined to prepare a generalized formulation in which the amount of Portland cement and fly ash added are functions of the percent solids in the thickened slurry. The total solids content of the grout is fixed at 67.5 percent, and the Portland cement content of the grout is fixed at 10%. This generalized formulation is:

Thickened slurry containing S percent solids, parts by weight	100
Portland cement, parts by weight	$C = (10 - 0.1S) / 0.325$
Fly ash, parts by weight	$F = 207.7 - C - (S / 0.325)$
The corresponding waste loading, weight percent, can be calculated from	$W = S / (100 + F + C)$

If Envirocare of Utah is used, they may impose a limit of 100,000 pCi/g of Ra-226 on products shipped to them. At the inception of this study, it was thought that this limit might be reached for some of the formulations tested. However, this would be unlikely for the low (30%) solids slurry used as the base case feedstock in this study and lower-than-expected Ra-226 concentrations in the samples used. This situation might change if the

4654

full-scale plant operates at a higher thickened slurry solids content and/or an area of high Ra-226 concentration is encountered in a silo.

Densities of freshly prepared grouts were in the range of 1.5 to 1.6 grams per cubic centimeter (g/cm^3) (94 to 100 pounds per cubic foot (lb/ft^3)). This was the expected range and compared favorably with the assumed base case design density of 95 lb/ft^3. The addition of antifoam, which was thought to possibly increase grout density by facilitating the release of air bubbles from the fresh grout, did not have an appreciable effect.

Several studies were carried out to test the impact of storing and transporting the full scale shipping containers. Temperature cycling tests showed that the amount of condensate that formed and clung to the top of the container cover during extreme diurnal temperature cycling was trivial. Migration of water due to diurnal temperature cycling during storage and shipping did not appear to be a problem. A shaker study test showed that vibration of the shipping containers during transportation would be unlikely to result in any significant release of water from the cured product. Freezing and thawing did not interfere with the curing process, did not reduce the integrity of the cured product, and did not cause any significant release of water from the cured product. The grout curing process did not result in significant pressure and temperature excursions in a sealed container during a six-day period after preparation. The maximum pressure increase was 7.9 inches of water, and temperature excursions were no more than 2.5°F during the mixing and curing steps. Radon generation in the sealed container over the six-day period did not cause a pressure increase.

000067

4654

5.0 INTERFACES WITH AWR

5.1 AWR PROJECT DESIGN CHANGES IMPACTING SILOS 1 AND 2

The current Fernald baseline schedule calls for the Silos 1 and 2 Remediation Facility to be constructed concurrently with the AWR Project. The current schedule also reflects some degree of operational overlap between the AWR process and the Remediation Facility process.

The AWR technical objectives and criteria are defined in the Silos 1 and 2 AWR Project Technical Requirements Document (TRD) (40710-RP-0001). In December 2000, Foster Wheeler Environmental Corporation (FWENC) prepared a final design report supporting the AWR TRD. Based on this design, a RD Package was submitted to, and subsequently approved by, the U.S. EPA and OEPA.

Subsequent to the December 2000 AWR final design submittal, the FWENC contract was terminated, and Fluor Fernald acquired the services of Jacobs to review, modify, and optimize the existing FWENC design in an effort to reduce project risk and enhance the probability of success for the AWR Project.

Based on the Jacobs AWR design optimization efforts, a modified AWR system design description document, System Design Description Document for the AWR Project (40710-RP-0021) was prepared. A number of design changes were made to the AWR project based on the design optimization efforts. Only those changes that are relevant to the Silos 1 and 2 Remediation Facility are reviewed below.

5.2 BASELINE SCHEDULE MODIFICATIONS

The Fernald baseline schedule was modified to reflect concurrent construction of the AWR facilities and the Silos 1 and 2 Remediation Facility. The baseline schedule also reflects concurrent operation of both facilities during the later phases of the AWR Project.

5.2.1 Design Basis Changes

The AWR design was modified to include the capability for transfer of material from either Silo 1 or Silo 2 to any one of the four TTA tanks, and at the same time, transferring material from any TTA tank (not receiving material from the silos or supplying sluice water to the silos) to the remediation facility.

5.2.2 Physical Design Changes

- A fixed bridge will be constructed over each silo to support waste retrieval operations.
- Each bridge will support two sluicer modules and a slurry pump module.
- Two sluicer modules and a slurry/decant pump module will be installed on each TTA tank.

4654

5.3 AWR WASTEWATER MANAGEMENT STRATEGY

The previous design basis specified treating AWR wastewater by one of the following three methods, followed by its discharge to the AWWT Facility:

- ultra-filtration
- hold-up of wastewater for radon decay, or
- ion exchange and filtration using skid-mounted equipment.

5.3.1 Design Basis Changes

The modified wastewater management plan specifies the following methods of wastewater disposition:

During RCS Phase I, prior to the availability of the TTA tanks, condensate from the dehumidification system will be stored (~20 days) in the condensate holdup tanks for radon decay. Following radon decay, the condensate will be transferred to a tanker truck (until RCS Phase 2 when it will be pumped to the TTA tanks).

When the TTA tanks become available for use (during RCS Phase 2), condensate is pumped to the TTA tanks for use during sluicing operations.

The water component of the slurry transferred to the Silos 1 and 2 Remediation Facility will be recycled to the TTA as sluice water or will be consumed in the treatment process.

5.4 RCS DESIGN CAPACITY

5.4.1 Design Basis Changes

The radon treatment capacity was expanded to support concurrent operation of the AWR Project and the Silos 1 and 2 Remediation Facility. The RCS components will be sized to adequately treat 2,000 scfm at the design conditions of 100 percent relative humidity and 95°F. A design flow rate of 350 cfm will be collected from the Remediation Facility vessel vent system and treated in the RCS System. The Phase III operations do place a larger radiological load on the RCS system, but the system, as installed, is capable of meeting all limits for on-site and off-site exposures. RCS operations will be monitored during Phases I and II to determine whether additional carbon beds would be required.

5.4.2 Physical Design Changes

The ducting and fans were increased in size to accommodate a process flow rate of 2,000 standard cubic feet per minute (scfm). The drying system and the discharge HEPA filters were reconfigured to allow parallel operation at 2,000 scfm. The RCS line from the Remediation Facility will tie into the AWR RCS line in the TTA building. This will eliminate running a separate Remediation Facility line to the RCS building from the TTA building.

4654

5.5 AWR SYSTEMS INTERFACE WITH SILOS 1 AND 2

TTA Waste Retrieval System (TWRS) (System 13)

The TTA TWRS is designed to access, mobilize, and transfer Silos 1 and 2 materials stored in the transfer tank system. The TWRS can retrieve and transfer the entire inventory of waste from the transfer storage tanks to the Silos 1 and 2 Remediation Facility for treatment. Each TTA tank is provided with two sluicer modules and one slurry/decant pump module. The equipment for each TTA tank and on each of the silo bridges is the same design and is fully interchangeable.

During TWRS activities, the slurry/decant pumps are operated as a slurry transfer system rather than as a sluice water supply system. To accomplish slurry transfer, the variable speed pump controls are used to adjust the discharge parameters of the pump.

Equipment is provided for the transfer of stored material from any one of the four TTA tanks to any other TTA tank. Motor-operated, multi-way diverter valves with flanged connections are provided for connecting slurry and sluice water piping. Sluice water for TWRS operations is supplied from the Silos 1 and 2 Remediation Facility. The transfer tank system provides piping and valves between the Remediation Facility interface point and each of the four TTA tanks. The transfer operations are continued until the four TTA tanks are emptied.

5.5.1 Waste Retrieval Operating Modes

The AWR Project encompasses multiple modes of operation as the Silos 1 and 2 material (with bentonite) is transferred from the silos to the TTA and ultimately to the Silos 1 and 2 Remediation Facility. The AWR Project systems are designed to operate in two general configurations: (1) SWRS and (2) TWRS. The equipment and valve configuration design creates this operating flexibility. Based on the possible tank and valve configurations, three operating scenarios are considered likely to occur. One scenario occurs when slurry is retrieved from one of the silos. Another scenario is when slurry is retrieved from one of the transfer storage tanks. A third scenario is operation of the SWRS and TWRS concurrently.

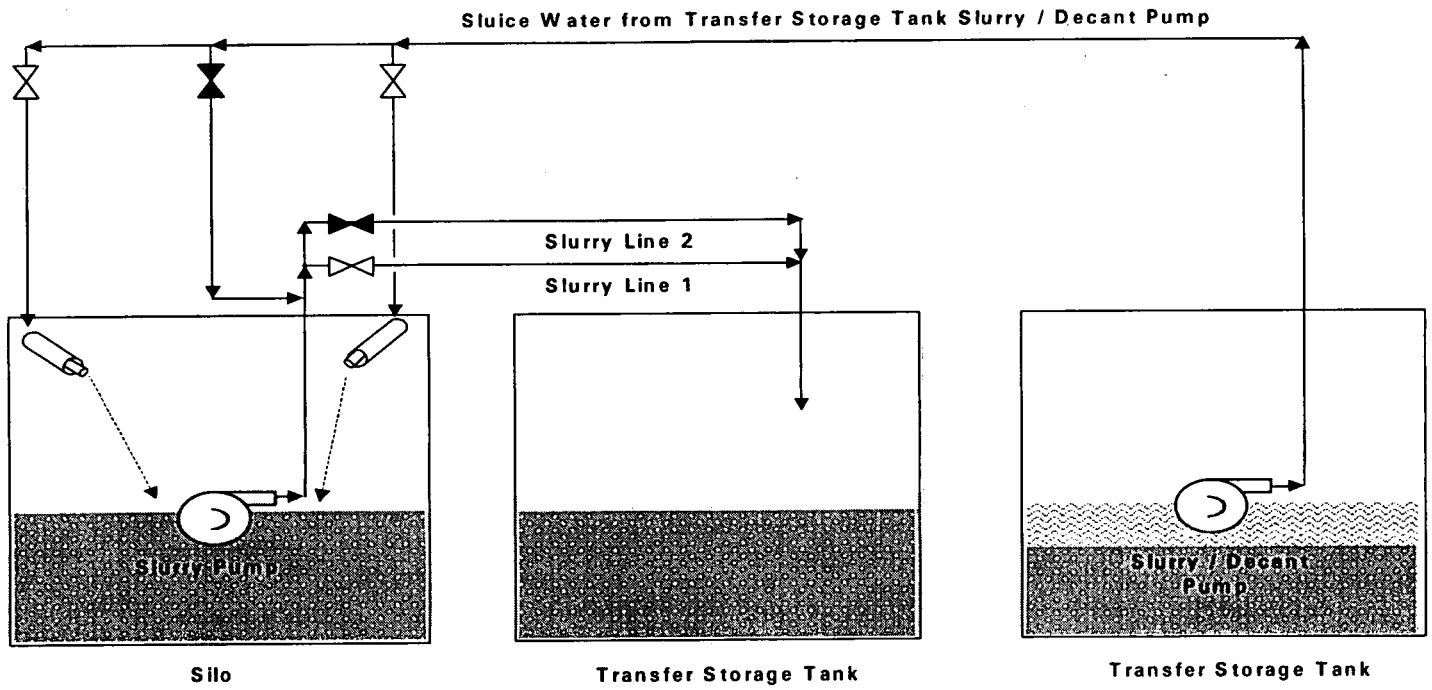
5.5.2 SWRS Operating Mode

In the SWRS operating mode, supernatant (sluice water) is pumped from one transfer storage tank to the sluice nozzle(s) in one silo, while slurry retrieved from that silo is pumped to a different transfer storage tank (Figure 5.1). In the SWRS mode, supernatant may be pumped from any of three transfer storage tanks and supplied to either Silo 1 or 2. Depending on the level of material in a particular transfer storage tank, retrieved slurry can be pumped to any transfer storage tank except the tank from which supernatant is being pumped.

1

Figure 5-1

Silo Waste Retrieval System (SWRS) Operating Mode



2 = Valve closed. ▷◁ = Valve open.

000071

F-4654

4654

In this operating configuration, one silo and two transfer storage tanks are involved in the operations and the other silo and two transfer storage tanks are idle. When slurry transfer is complete, sluice water or process water is used to flush the slurry lines between the silo and transfer storage tank.

5.5.3 TWRS Operating Mode

In the TWRS operating mode, supernatant (sluice water) is pumped from the Silos 1 and 2 Remediation Facility to the sluice nozzle(s) in one transfer storage tank, and slurry retrieved from that tank is pumped to the Remediation Facility (slurry receipt tanks). This operating concept is shown in Figure 5-2. In this operating configuration, one transfer storage tank is involved in operations and both silos and three transfer storage tanks are idle. When slurry transfer is complete, sluice water or process water is used to flush the slurry lines between the transfer storage tank and the Remediation Facility.

5.5.4 Concurrent SWRS and TWRS Operating Modes

An operating mode with concurrent SWRS and TWRS operations is shown in Figure 5-3. Supernatant (sluice water) is pumped from one transfer storage tank to the sluice nozzle(s) in one silo, while slurry retrieved from that silo is pumped to a different transfer storage tank. Simultaneously, supernatant (sluice water) is pumped from the Silos 1 and 2 Remediation Facility to the sluice nozzle(s) in a third transfer storage tank, and slurry retrieved from that tank is pumped to the Remediation Facility. The remaining transfer storage tank is allowed to settle, and slurry solids and water separate to generate supernatant on top of the slurry material.

When slurry transfer is complete, sluice water or process water is used to flush the slurry lines between the silo and transfer storage tank and between the transfer storage tank and the Remediation Facility.

5.6 PROCESS WATER SYSTEM (SYSTEM 50)

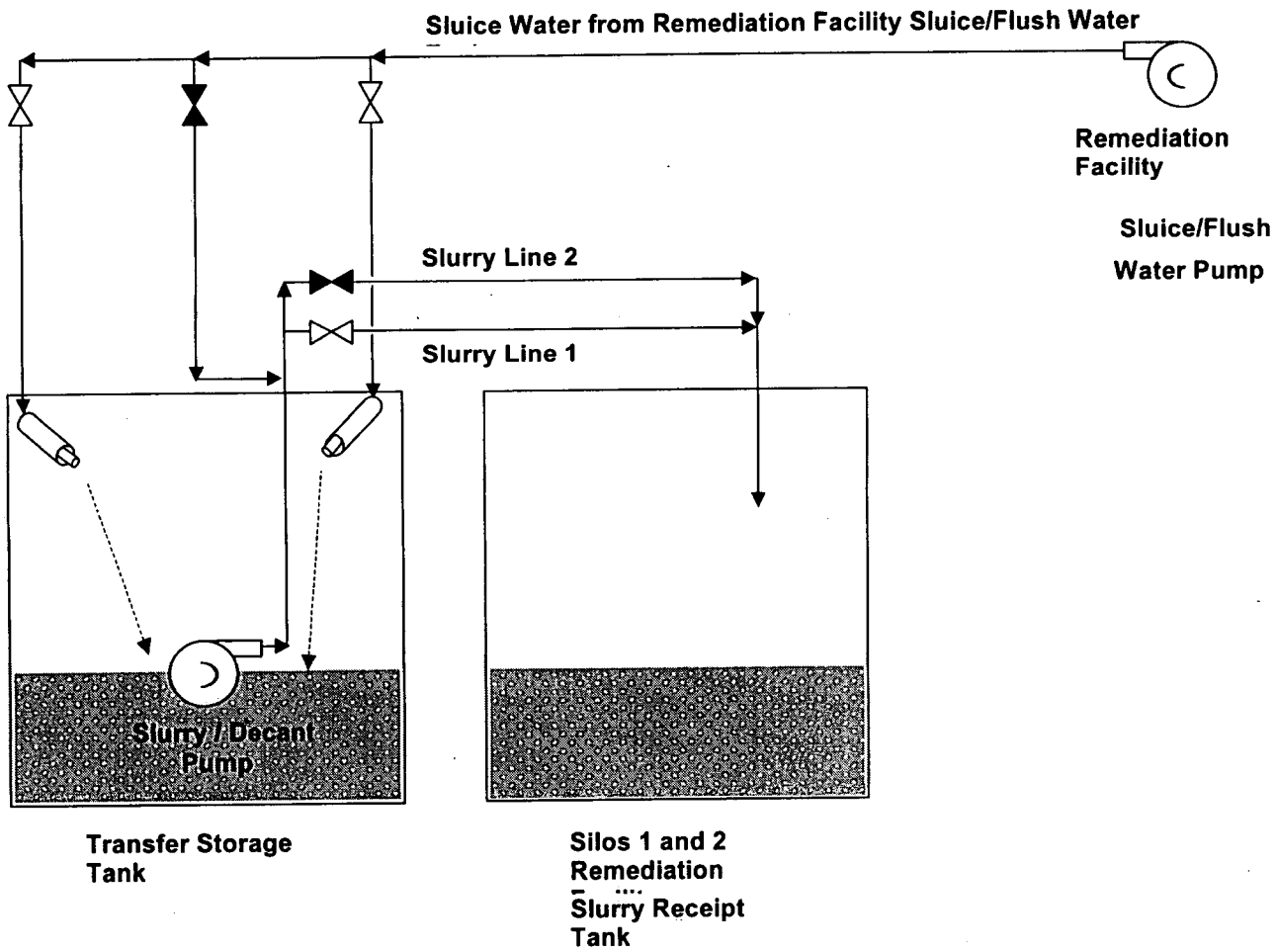
One 10,000-gallon and two 7,500-gallon storage tanks (TNK-50-001, TNK-50-002, and TNK-50-003, respectively) provide process water storage. The tanks are normally used together, acting as a single water source, but may be isolated in the event one tank needs to be removed from service for maintenance or other reasons. The three tanks are installed so that the tops of the tanks are at the same elevation. This allows the common discharge header to equalize the tank levels. Combined, these three tanks have sufficient capacity to supply the silo sluicers with backup water at full flow for approximately 1 hour. The tanks are equipped with level instruments to control the domestic fill water valve, based on tank level, so that the tanks maintain adequate levels of stored water.

Makeup water is transferred from the makeup water tanks by one of three centrifugal pumps located adjacent to the makeup water tanks. The makeup water pumps transfer process water to Silos 1 and 2 (for SWRS), transfer storage tanks (for TWRS), RCS, or Silos 1 and 2 Remediation Facility. The PLC automatically stops the pumps if a low tank level is detected.

000072

Figure 5-2

Transfer Storage Tank Waste Retrieval System (TWRS) Operating Mode



1 = Valve closed. ▷◁ = Valve open.

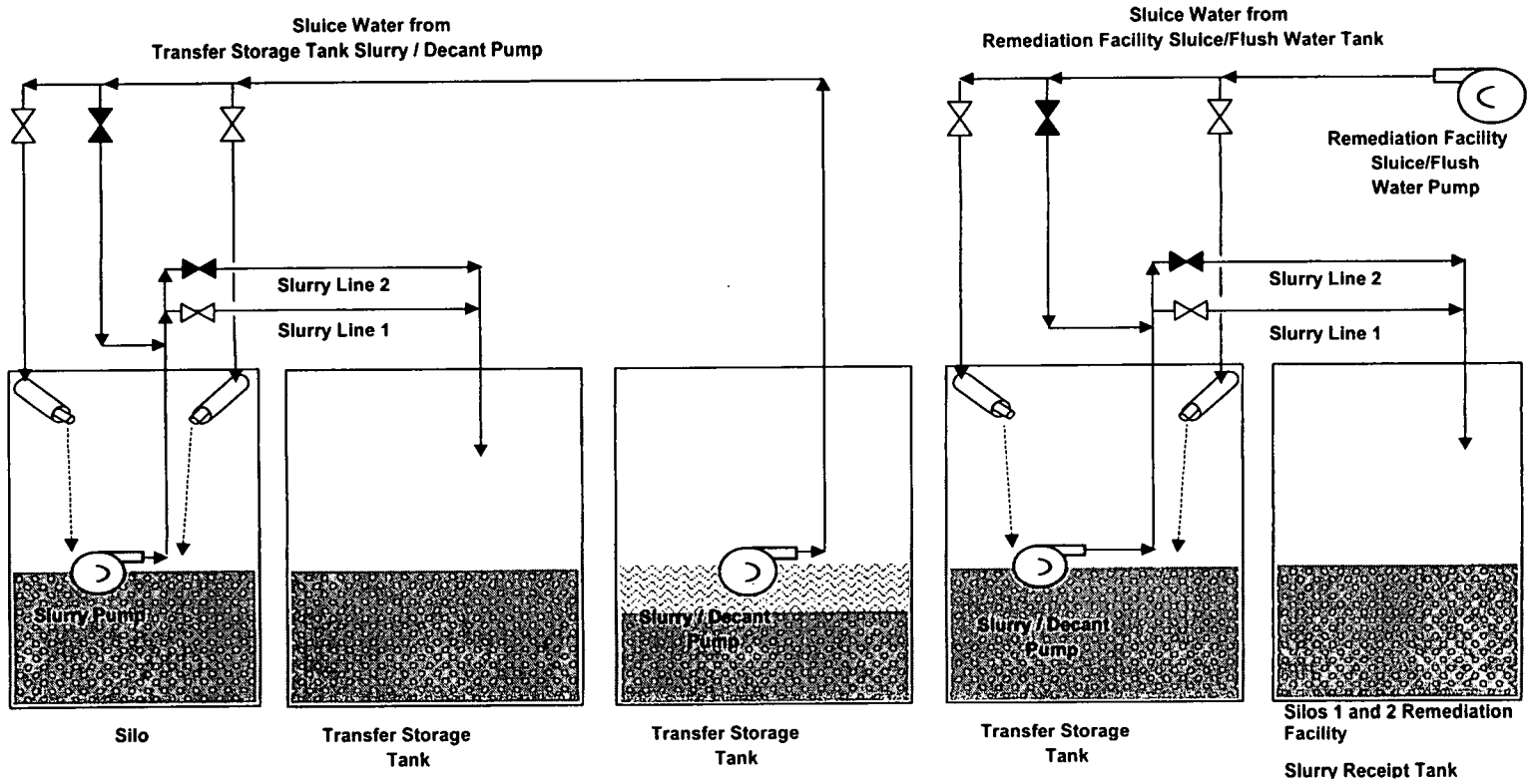
000073

4654

1

Figure 5-3
Concurrent Silo Waste Retrieval System (SWRS)

Transfer Storage Tank Waste Retrieval System (TWRS) Modes



2

3 = Valve closed. ▷◁ = Valve open.

000074

4654

5.7 RADON CONTROL SYSTEM (SYSTEM 20)

The RCS receives gas vent streams from the following sources: Silos 1 and 2, the TTA tanks, and the Silos 1 and 2 Remediation Facility (when it becomes operational). The RCS removes radon from gas streams, reduces radon releases to the atmosphere, monitors all releases to the atmosphere for radon and other radionuclides, and mitigates system upsets. The RCS is operated in three phases:

Phase 1 reduces and controls radon concentrations in the silo headspaces before construction in the silo area and before the initiation of waste retrieval.

Phase 2 reduces and controls radon concentrations in the silos and TTA during silo retrieval operations (SWRS operations).

Phase 3 reduces and controls radon concentrations in the added vessel vent system from the Silos 1 and 2 Remediation Facility (TWRS operations).

5.7.1 RCS Requirements

The RCS is designed to achieve the following requirements and criteria:

- Prevent over/under pressurization of the silos and transfer storage tanks by +0.5 in. W.C. and −2.0 in. w.c. beyond their design.
- Maintain radiation fields on the surface of the silo domes below 50 mrem per hour during non-construction periods of Phase 1.
- Maintain radiation fields on the surface of the silo domes below 10 mrem per hour during construction periods of Phase 1 and during all of Phase 2 (assumed to be a radon concentration of $< 1 \times 10^6$ pCi/L in each silo headspace).
- Provide sufficient shielding and exclusion area fencing to maintain the area outside the RCS facility as a Radiation Access Zone (RAZ) 1 (less than 0.4 mrem per hour) during all phases.
- Ensure there are no uncontrolled releases of radon to the atmosphere.
- Provide local evacuation alarms.
- Provide both local and remote monitoring to verify RCS process control.
- Provide a design life of 20 years.
- Provide isokinetic sampling, monitoring, and recording of all stack exhaust streams to the atmosphere in accordance with 40 CFR Part 61, Subpart H. Provide remote alarm

4654

capability to indicate buildup of radioactive particulate. Provide continuous monitoring of the stack exhaust radon concentration.

- Maintain radon emissions from the exhaust stack below the level resulting in an annual average concentration of 0.5pCi/L above background at the FEMP fence line.

- Provide safe shutdown, secure standby, and restart capability.

5.7.2 Radon Control System Description

The RCS includes three separate treatment equipment configurations or phases. Phase 1 continuously reduces and controls the concentration of radon in the Silos 1 and 2 headspaces until the SWRS is operational. Phase 1 recycles air from the silo headspaces through a radon treatment system to lower headspace radon concentration. After the radon concentration is reduced in the headspace and waste retrieval is ready to begin, additional equipment will be added to the Phase 1 equipment for conversion to the Phase 2 system.

Phase 2 provides control of radon during SWRS, transfer, and staging in the TTA tanks. Phase 3 operation provides radon control during transfer of wastes from the TWRS and operation of the Silos 1 and 2 Remediation Facility. The fans and other equipment are designed to support concurrent operation of bulk waste retrieval and Remediation Facility waste treatment with a total flow of 2,000 scfm. Additional carbon beds may be added, if identified as necessary based on data collected during Phase 1 operations. The Phase 2 and 3 RCS systems are designed to provide a minimum of 25 ft/min capture velocity.

Phase 1 is a recirculating system with four carbon beds operating in a parallel configuration. Each carbon bed contains 40,000 lbs of carbon. Headspace air is pulled from the silos at 500 scfm per silo and combined into one air stream. The 1,000 scfm combined air stream passes first through a dehumidification and chilling system to remove excess moisture and chill the air to approximately 45°F. The chilled air passes through a desiccant drying system, which removes the remaining moisture and heats the air up to approximately 80°F. The air stream then passes through another cooler to cool it back down to 40°F before entering the carbon beds. The air stream (conditioned to 40°F and 15 percent relative humidity) then passes through the carbon beds for radon removal. The four carbon beds are connected in parallel, each receiving a generated flow of 250 scfm. The air stream is monitored for radon, both upstream and downstream of the carbon beds, to determine the removal efficiency. Upon exiting the carbon beds, the air stream passes through the recirculation fan before being returned to the silo headspaces.

The 500-scfm vent rate from each silo should maintain the radon concentration in the silo headspaces at less than 0.5×10^6 pCi/L based on pre-bentonite rates of radon emanation into the silo headspaces. The 160,000 lbs of carbon provided in the RCS is designed to keep radon emissions to the atmosphere to less than 0.2 Ci/day per silo.

4654

Phase 2 is designed as a once-through treatment system using the same process equipment as that described for Phase 1. During Phase 2, the recirculation fans are used to produce an induced draft ventilation stream through the silos, TTA tanks, condensate tanks, and the various equipment modules. During normal Phase 2 operations, the treated air stream will pass through the carbon beds and a HEPA filter train; it will then exhaust through a monitored stack to the atmosphere. If abnormal radiological conditions are detected at the stack, the RCS control system automatically alarms and switches from the once through mode of operation to the recycle mode of operation.

During Phase 3, the RCS operates in the same manner as during Phase 2 except that the Silos 1 and 2 Remediation Facility vessel vent system is added to the RCS treatment streams. The addition of the Silos 1 and 2 Remediation Facility off-gas stream increases the flow; therefore, the RCS was designed for 2,000 scfm to handle this increased capacity. The RCS line from the Remediation Facility will tie into the AWR RCS line in the TTA building. This will eliminate running a separate Remediation Facility line to the RCS building from the TTA building.

Additional carbon beds may be added during Phase 2 and/or Phase 3 to enhance the system's radon removal capabilities. The need for additional carbon beds will be evaluated during Phase 1 operation. The following sections describe RCS equipment that is the same for all Phases of operation.

Previous radon control studies indicated that the efficiency of radon adsorption onto carbon is enhanced when moisture and temperature are reduced. Therefore, an air-conditioning system is incorporated into the design for all phases of the RCS operation. The air-drying and air-cooling system has three components: condenser, dryer, and cooler. The air pulled from the silos is first passed through a water-cooled condenser. The air temperature is reduced to 40°F saturated air based on inlet conditions of 95°F air at 100 percent relative humidity. This step removes the readily condensable moisture and helps to minimize the required capacity of the air dryers. The air dryers use desiccant to remove the remaining moisture from the air stream. Using desiccant to dry the air raises the air stream temperature above the optimum temperature for removing radon with carbon beds. Therefore, before entering the carbon beds, the air stream is passed through a cooler. The conditioned air then enters the carbon beds at 40°F and 15 percent relative humidity.

Radon is a radioactive gas with a short half-life (3.82 days). Because radon is an inert gas, it does not react with other chemicals. Radon has an affinity for activated carbon, which can be used to trap radon and allow it to decay to its daughter products. For the carbon beds to be effective, the air must be cool and dry as it enters. RCS Phases 1 and 2 use four carbon beds operated in parallel. If required, additional beds may be added to the system during Phase 3. Each carbon bed consists of a 15-ft long by 10-ft wide by 10 ft-high steel shell containing 40,000 lb. of activated carbon.

All gases discharged from the RCS pass through a HEPA filter train downstream from the carbon units before exhausting through the stack. There are two parallel HEPA filter

trains; each sized for 1,000 scfm flow. The HEPA filters are used to trap fine particulate and typically have an efficiency rating of 99.97 percent for 0.3-micron particles.

4654

4654

6.0 ENVIRONMENTAL CONTROL PLAN (40750-PL-0005)

This Environmental Control Plan (ECP) provides details of the methods and materials to be employed during implementation of the Silos 1 and 2 Project to control erosion, air emissions, stormwater, fugitive dust, contaminated soil, and construction and operations waste and minimize the impact of these activities on the environment. This plan covers the construction of the Silos 1 and 2 Remediation Facility, and related ancillary facilities. These areas are shown on drawing 94X-3900-G-01368, Civil Remediation Facility Overall Site/Future Railroad Plan. The Silos 1 and 2 ECP contains the following plans:

- Air Emission Control: Assessment of Potential Doses from the Release of Exhaust Air from the Silos 1 and 2 Chemical Treatment Facility (40750-RP-0027) calculates the potential emissions of air contaminants during the operation of the Remediation Facility.

- Erosion and Stormwater Control: Descriptions of the methods and materials that will be used to prevent erosion of soil either by wind or surface water in the process or project work area and to reduce sediment loading in the stormwater. Descriptions of the methods, materials and existing site features that will be used to capture and control stormwater.

- Fugitive Dust Control: Descriptions of the methods and materials that will be used to suppress and minimize the creation and dispersion of dust.

- Waste Management: Description of the methods that will be used to manage waste and debris generated during site preparation and construction.

6.1 AIR EMISSIONS CONTROL PLAN

The Assessment of Potential Doses from the Release of Exhaust Air from the Silos 1 and 2 Chemical Treatment Facility (40750-RP-0027) calculates doses to nearby receptors from the potential emissions of contaminants in exhaust air during the operation of the Silos 1 and 2 Remediation Facility. The primary source of air contaminants during Remediation Facility operations is expected to be the Remediation Building HVAC System exhaust stack and the RCS stack. The location of the stack is shown on drawing 94X-3900-G-1368. The building HVAC Process Flow Diagram (PFD) is provided on drawings, 94X-3900-H-01141 and 94X-3900-H-01142. The RCS system installation was addressed in the AWR Remedial Design Package. The interface with the RCS is discussed in Section 5.4.1 of this RD Package.

Due to the physical nature of the Silos 1 and 2 materials and their high Ra-226 and radium daughter product content, control of airborne particulate emissions and radon are key considerations in designing the process systems and the emission control and monitoring systems. The air emission control systems for the Silos 1 and 2 Remediation Facility have been designed to BAT in accordance with Ohio Administrative Code (OAC), Section 3745-31-05(a)(3), and to meet the requirements of applicable or relevant and appropriate requirements (ARARs), ALARA, and other applicable requirements.

4654

For radionuclide particulate emission sources at the FEMP, the OEPA has specified that the Best Available Technology (BAT) is the use of HEPA filters. The use of HEPA filters is also required for compliance with 40 CFR 61, Subpart H. HEPA filters, pre-filters, and housing assemblies will be obtained in accordance with Silos 1 and 2 Project Technical Specifications and Project Quality Procedure (PQP) 7.1, Control of Purchased Items and Services.

Emission of radionuclide particulate materials, excluding radon, will meet the requirements of 40 CFR Part 61, Subpart H, National Emission Standards for Hazardous Air Pollutants (NESHAP). 40 CFR Part 61.92, states that emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent (EDE) of 10 millirem (mrem)/year or greater. NESHAP Subpart H also specifies continuous monitoring for certain point sources (stacks or vents).

Provisions will be provided to monitor radon emissions during the Silos 1 and 2 Project, to verify that the site fence line radon concentration will not exceed the annual average background concentration by more than 0.5 pCi/L.

The Silos 1 and 2 Remediation Facility air emission control system is depicted by drawing 94X-3900-H-01142. The major components of the emission control systems are detailed below.

6.1.1 Air Emissions Controls

The primary components of the air emission control strategy for the Silos 1 and 2 Project are as follows:

- Process systems containing Silos 1 and 2 materials are located in areas within the Remediation Building serviced by the Remediation Building HVAC system. Areas within the building are normally occupied, normally not occupied, and completely unoccupied or sealed from personnel entry, such as the process tank shield enclosures. The building areas are maintained within a prescribed range of temperatures and pressures.
- There are no open tanks or equipment. Vent gases from process tanks are collected by a vessel vent system and routed to the AWR RCS for treatment. Emission from the RCS stack under Phase III operation is documented in Table 6-3.
- The Remediation Building HVAC System is designed such that 100 percent outside air is supplied to cleaner areas and exhausted through areas with progressively greater potential for contamination. The HVAC System maintains normally occupied areas at a slightly negative pressure with respect to outside ambient air. Areas with a potential for contamination are maintained at a slightly more negative pressure to ensure all air exhausted from the potentially contaminated areas is filtered through HEPA filters before being released to the atmosphere through the air exhaust stack.

- The Remediation Building HVAC System has a degree of redundancy based on postulated HVAC component failure modes, including loss of power. The system is also designed to compensate for infiltration caused by open doors or door seals.

4654

6.1.1.1 HVAC Air Supply System

The air supply system has three ACUs, each 50 percent capacity. Only two ACUs are required for normal operation, and the third ACU is on standby. ACUs are roof top packaged units containing supply fans, pre-filters, primary filters, compressors, condensers, condenser fans, evaporator coils and electric heating coils. In addition, electric space heaters are installed where supplementary heat may be required to provide personnel comfort.

6.1.1.2 Air Exhaust System

The air exhaust system has three parallel filter trains, each with 50 percent capacity (two of which are required for normal operation, with the third as standby). Each filter train has a pre-filter, a primary filter, and two stages of HEPA filtration in series, which are designed to remove up to 99.97 percent of particles with an aerodynamic diameter of 0.3 microns or greater. Each stage of HEPA filtration can be tested. Each filter train contains pressure differential monitors and alarms across the overall filter train as well as pressure differential indicators across each filter bank. Filters are placed in an equipment room, as near as practical to the source of contamination, to minimize the spread of contamination. The exhaust air from the Remediation Building passes through the filter trains before being discharged to the stack by the exhaust fans. Exhaust fans are designed for 100 percent redundancy with backup power from diesel generators.

6.1.1.3 Ductwork

Supply ductwork is made of galvanized steel with flanged connections. Exhaust ductwork is round galvanized steel of welded construction with welded joints.

6.1.1.4 Vessel Vent System

A separate process off-gas system (not associated with the Remediation Building HVAC System) is provided for vessel vents and other localized areas where the Silos 1 and 2 material is present. The Vessel Vent System is connected to the AWR RCS.

6.1.1.5 Exhaust Stack and Monitoring

Isokinetic sampling, monitoring, and recording of stack exhaust data are performed in compliance with 40 CFR Part 61, Subpart H, and DOE Order 5400.5, Section IV.6.B. A stack monitor is provided in the stack after the HEPA filters. The sample air stream is passed through a filter paper, where a beta-sensitive radiation detector continuously measures the beta radiation emitted by the collected particulates. This measurement is used for real-time assessment of effectiveness of the filtration system. Laboratory

4654

analysis of the filters provides for a quantitative evaluation of the particulates released. The air stream then enters a continuous radon monitor that measures the concentration of radon in the stack effluent. Monitoring data are collected and analyzed by a local computer, then transferred to the Remediation Building control room for display and record keeping. Alarm signals for particulates are available to alert the operator if an out-of-specification condition exists in the stack. The radon monitor has an alarm set-point established to maintain radon releases ALARA. Operating controls for the entire system are included in the Remediation Building Control Room.

6.1.1.6 Ambient Monitoring

As detailed in Section 3.1 of the Fluor Fernald Silos Project Environmental Monitoring Plan, monitoring and reporting of emissions from the Silos 1 and 2 Project will be accomplished through a combination of enhancements to the current site-wide Integrated Environmental Monitoring Plan (IEMP) monitoring network and project-specific stack monitoring.

6.1.2 Estimated Point Source Air Emission Data

The Assessment of Potential Doses from the Release of Exhaust Air from the Silos 1 and 2 Chemical Treatment Facility (40750-RP-0027) provides estimates of the anticipated doses to nearby receptors from emissions of contaminants in exhaust air during operation of the Silos 1 and 2 Project. As described in the preceding sections, the emissions from various sources within the Remediation Building are collected, and discharged through the monitored air exhaust stack after HEPA filtration. Table 6-1 summarizes expected emissions from the Silos 1 and 2 exhaust stack. The Remediation Building Air Exhaust Stack is equipped with an isokinetic air sampler and a continuous radon monitor.

Table 6-1: Estimate of Release from the Silos 1 and 2 Remediation Building Air

Exhaust stack flow, cfm	46590
Offgas temperature, F	90 - 103
Stack exit velocity, fpm	3708
Stack diameter (ft.)	4' (outlet)
Stack height (ft.)	125'
Max. Particulate emission uncontrolled, lb/hr	$5.6X10^{-2}$
Max. Particulate emission controlled, lb/hr	$5.6X10^{-4}$
Radionuclide emission, pCi/L (Rn not included)	$2.6 X10^{-3}$
Radon (Rn) emission, pCi/L	0.54

Dispersion modeling (Assessment of Potential Doses From the Release of Exhaust Air from the Silos 1 and 2 Chemical Treatment Facility, 40750-RP-0027) was performed to quantify the impact of estimated emissions from the Silos 1 and 2 Air Exhaust Stack. The

4654

dispersion modeling for the Silos 1 and 2 Air Exhaust Stack emissions, used the FEMP site-specific meteorology data and the CAP88-PC modeling package, to be consistent with the requirements of 40 CFR 61, Subpart H. The results of the dispersion modeling for the Silos 1 and 2 Air Exhaust Stack emissions are summarized in Table 6-2.

Table 6-2
Results of Dispersion Modeling for Releases from Silos 1 and 2 Remediation Facility Air

Maximum effective dose equivalent (EDE) to off-site receptor (excluding Rn) uncontrolled	430 mrem/year
Maximum EDE to off-site receptor (excluding Rn) controlled	4.3×10^{-2} mrem/year
Maximum annual average FEMP fence line Rn concentration	3.6×10^{-4} pCi/L
Maximum hourly average FEMP fence line Rn concentration	1.1pCi/L

The RCS Phase III Material Balance (Calculation No.: 35H19606-00-PR-003) provides calculated carbon loads and RCS stack emissions during Phase III operations. The loadings and stack emission rates for all phases of RCS operations are shown in Table 6-3 below.

Table 6-3, Silos 1 and 2 AWR Design Basis Exposure, ^{222}Rn

Worker and Public Exposure Basis					On Site (instant.)	On Site (weekly avg.)	Off Site
Limit (pCi^{222}Rn/L)					295.5	29.55	0.5
X/Q – Atmospheric Dispersion Coefficient s/m^3					4.91E-03	1.68E-06	5.02E-07
RCS Phase	C_{RCS} pCi/L	Q_{RCS} ft^3/min	Q_{STACK} ft^3/min	C_{STACK} pCi/L	C_{ATM} (pCi/L)		
1	159	50	9360	0.85	0.018	6.32E-06	1.89E-06
2	10076	1000	10310	977	23.33	7.99E-03	2.39E-03
3	52349	2000	11310	9257	242.5	8.31E-02	2.4E-02

C = Concentration in pCi/L.
Q = Flowrate in cubic feet/min.

6.2 EROSION AND STORMWATER CONTROL PLAN

This section describes the Erosion and Stormwater Control Plan that will be used during the construction phase of the Silos 1 and 2 Project, including erosion control practices and surface water management. This Plan addresses surface water management and erosion control practices throughout the construction of the Silos 1 and 2 Remediation Facility, the ancillary warehouse and office trailer relocation, consistent the Construction Drawings and Silos 1 and 2 specifications.

4654

6.2.1 Functional Requirements

The functional requirements of this Erosion and Stormwater Control Plan will satisfy the criteria outlined below:

Route surface water to designated locations where it can be appropriately managed; Protect the construction areas from damage caused by precipitation and storm water run-on and run-off;

- Discharge surface water into existing watercourses will be in accordance with applicable Ohio Department of Natural Resources (ODNR), OEPA and DOE directives and requirements; and

Segregate clean area run-off from potentially contaminated area run-off. Contaminated stormwater will not be discharged with "clean" stormwater.

Functional requirements will be met by constructing the run-on/run-off control features outlined below. Erosion control features will be installed prior to any disturbance of soil in work areas. The Civil Grading, Drainage and Erosion Control Plans listed below illustrate the location and limits of the control features.

Civil Grading, Drainage and Erosion Control Plans for the Silos 1 and 2 Project	
Remediation Facility	Drawing 94X-3900-G-01370
Warehouse	Drawing 94X-3900-G-01291
Office Trailer Relocation	Drawing 94X-3900-G-01354 Drawing 94X-3900-G-01355 Drawing 94X-3900-G-01356

Features include, but are not limited to, the following six control features:

- Installation of silt fences on the down slope sides of the construction areas;
- Installation of silt fences below sump discharges where applicable;
- Installation of check dams in drainage channels and swales as required;
- Maintenance, repair or replacement of existing surface water and erosion control features as required;
- Excavations which are expected to be inactive for 45 days or more will be stabilized within 7 days of their final use; and
- Dewatering.

The type and location of erosion control features will be subject to adjustment depending on field conditions. The Contractor will routinely inspect and evaluate (in accordance with Section 6.2.2) the effectiveness of, and need for maintenance of, the control measures that are in place.

000084

4654

6.2.2 Run-On/Run-Off Control Structural Practices

Process design and operation will minimize the potential for generation of contaminated stormwater, including any run-on and run-off. A description of the construction, inspection and maintenance of the run-on/run-off control feature is presented in this section. These features may include, but will not be limited to:

- Drainage channels and swales;
- Rip rap check dams;
- Culverts;
- Silt fences; and
- Diversions.

Details of silt fences, check dams and diversions can be seen in Appendix B-1. Any repairs to the erosion and stormwater control measures will be corrected within 24 hours of the problem being discovered. Areas of excavation, and all erosion control measures will be inspected to verify that they are installed in accordance with the Silos 1 and 2 specifications and are still functioning properly. An inspection checklist will be developed in support of the inspection schedule. Disturbed areas will also be inspected for evidence of excessive erosion or siltation. These inspections will occur, at a minimum, at the following frequency:

- Weekly for general inspections;
- Daily after each rain event exceeding 0.5 inches at the site; and
- At least once per day during prolonged rainfall events.

Inspections will be documented in the daily reports at the Silos 1 and 2 Project site. These records will be made available for review upon request. This inspection frequency is in addition to any specific requirements identified in the Inspection and Maintenance requirements for each control measure as described below.

6.2.2.1 Temporary Drainage Channels and Swales

If necessary, temporary drainage channel and swales will be constructed between control points on predefined lines and grades. Temporary drainage channels and swales will be stabilized in accordance with the Silos 1 and 2 specifications.

Inspection and Maintenance

Drainage channels and swales will be inspected in accordance with the following, as a minimum:

- The criteria stipulated in Section 6.2.2. Any necessary repairs to the drainage channels will begin within 24 hours of the discovery of a problem.

000085

4654

- Drainage channels and swales shall be kept clear of debris at all times. The protective lining vegetation or erosion-resistant materials will be maintained as built to prevent undermining, scour, or deterioration.
- Silt fence placement requirements as stated in the Silos 1 and 2 specifications.

Inspection and repair activities will be documented in the daily reports and available for review upon request.

6.2.2.2 Check Dams

Check dams will be used in channels that have a design flow equal to or greater than 3-feet per second or as needed. Check dams will be incorporated to enhance water quality benefits by maximizing the detention time within the swale and to increase channel stability by decreasing flow velocities.

Check dams will be installed in accordance with the requirements of ODNR, "Rainwater and Land Development" manual, at the necessary spacing.

Check dams will be constructed of 4-inch to 8-inch diameter stone to a height of 2-feet over the entire channel width. The top of the check dam will be constructed so that the center is approximately 6 inches lower than the outer edges, so that water will flow across the center and not around the ends. The maximum height of the check dam at the center of the weir will not exceed 3 feet. A detail of the check dam is provided in Appendix B-1.

Inspection and Maintenance

Check Dams will be inspected in accordance with the following, as a minimum:

- The criteria stipulated in Section 6.2.2;
- Maintained as constructed; and
- Frequently inspected to ensure that the structures have not been damaged by high-energy flows.

Inspection and repair activities will be documented in the daily reports and available for review upon request.

6.2.2.3 Riprap

Where required, properly sized riprap will be placed in the designated work area. Ohio Department of Transportation Type "D" riprap will be installed in the temporary drainage channel as check dams at appropriate locations.

Inspection and Maintenance

Riprap will be inspected according to the following, as a minimum:

000086

4654

- The criteria stipulated in Section 6.2.2.

- To determine if high flows have caused scour beneath the riprap or dislodged any of the stone. If repairs are needed, ensure that those repairs are accomplished within the same workday of their discovery.

Inspection and repair activities will be documented in the daily reports and available for review upon request.

6.2.2.4 Silt Fences

Silt fences will be installed in accordance with ODNR requirements, the construction drawings and the Silos 1 and 2 specifications. Silt fences will be constructed before up slope land disturbance begins. Silt fences will be installed as close to the contours as possible so that water will not concentrate at low points in the fence. Silt fences will be installed on the down slope side of disturbed areas, perpendicular to where run-off occurs as sheet flow or where flow through small rill can be converted to sheet flow. Appropriate equipment and personnel will be used to install the silt fence at locations shown on the construction drawings. The silt fence will be placed in a trench cut to a minimum of 9 inches deep, staked and back filled accordingly. The height of the silt fence will be a minimum of 16 inches above the original ground surface. To prevent water from flowing around the ends of the silt fence, each end will be constructed up slope so that the ends are at a higher elevation. Seams between sections of silt fencing will be overlapped with the end stakes of each section wrapped together before driving into the ground. Breaks and overlaps will be installed as necessary to allow equipment access to the construction area. Silt fences will remain in place until the disturbed area has been stabilized. Appropriate equipment will be available to maintain silt fencing.

Inspection and Maintenance

Proper applications of silt fencing will allow the intercepted run-off to pass as diffused flow through the geotextile. If diffused flow does not occur, the layout of the silt fence will be changed, accumulated sediment will be removed and other practices will be implemented.

Silt fences will be inspected and maintained according to the following, as a minimum:

- The criteria stipulated in Section 6.2.2.
- Any sediment and debris that have been deposited and trapped will be removed from the silt fence and relocated and stockpiled as directed by the Construction Manager.

Inspection and repair activities will be documented in the daily reports and available for review upon request.

4654

6.2.2.5 Temporary Diversions

If required by changing site conditions, the Contractor will construct temporary diversions. Earthen material cut out for the channel will be used to build the berm on the opposite side. The temporary diversion will be similar to the one shown in Appendix B-1. Check dams will be installed to slow the flow velocity.

Inspection and Maintenance

Temporary diversions will be regularly inspected and maintained as follows, as a minimum:

- The criteria stipulated in Section 6.2.2.
- Repair damage and removed deposits or sediment from the diversion.
- Re-stabilize as needed.
- Check for points of scour or bank failure, rubbish or channel construction, rodent holes, breaching or settling of the berm, excessive wear for pedestrian traffic and construction traffic on a regular schedule.

Inspection and repair activities will be documented in the daily reports and be available for review upon request.

6.3 FUGITIVE DUST CONTROL PLAN

The section describes the methodology that will be used for controlling fugitive dust emissions and ensuring compliance with the required standards and site specific limits for the Silos 1 and 2 Project. Dust releases from field activities will be proactively suppressed by applying BAT dust control materials and/or implementing CFR work practices at the beginning and during field activities. RM-0047, *Fugitive Dust Control Requirements,* will be used as the appropriate site-specific definition of BAT for fugitive dust control together with OAC 3745-17-07 and OAC 3745-17-08, to minimize the creation and dispersion of fugitive dust.

6.3.1 Site-Specific Limits

The following site-specific limits will be applied:

- Visible particulate emission from any paved roadway or paved parking area should not exceed one minute during any sixty-minute observation period.

- Visible particulate emissions from any unpaved roadway, unpaved parking area, project field activities, or wind erosion from storage piles should not exceed three minutes during any sixty-minute observation period.

Personnel using 40 CFR Part 60, Appendix A, Method 22 "Visual Determination of Fugitive Emission from Material Sources and Smoke Emissions for Flares", will verify compliance

with these limits. Fluor Fernald will provide "Method 22" training to qualify Contractor personnel.

6.3.2 Suppression Equipment

Due to the radiological issues associated with working on the Silos 1 and 2 Project, dedicated equipment will be used for radiological work zones to avoid potential decontamination requirements. If required by site conditions, the Contractor may switch equipment and systems between areas, after decontamination and radiological scanning verifies no contamination. The proposed equipment list to suppress dust releases includes, but is not limited to, the following:

- Motor grader,
- Backhoe,
- Miscellaneous hand tools (shovels, brooms),
- Miscellaneous pumps and hoses,
- Skid steer loader with broom attachment (for road crossing only if water flushing and hand wet brooming is ineffective),
- Water wagon, and
- Smooth drum roller.

6.3.3 Methods and Materials

At the beginning of each day and periodically throughout that day, project personnel will tour the Silos 1 and 2 Project site, applying BAT Fugitive Dust Controls and/or other work practices to identify and thereby minimize dust generation. If the visible limit is exceeded, (i.e., visible particulate missions from any paved roadway or paved parking area exceeding one minute during any sixty-minute observation period or visible particulate emissions from any unpaved roadway, unpaved parking area, project field activities, or wind erosion from storage piles exceeding three minutes duration during any sixty-minute period), then mechanical dust generating activities must cease immediately. BAT dust controls and/or work practices will be instigated or increased to bring the fugitive emission, as a minimum, below the visible limit during the dust generating activities. Additionally, BAT dust controls and/or work practices will be implemented at the end of each day to minimize the alerts during off-hours. Specific materials and methods may include the following:

- Water,
- Crusting agents such as Pine Sap Emulsion® or equivalent (as approved by Fluor Fernald),
- Plastic sheeting or tarps, and/or
- Revegetation materials.

4654

6.3.4 Work Practices

Project field activities will be monitored for visible emissions. The contractor will implement, direct and coordinate BAT work practices to monitor project field activities for visible emissions. Specific work practices may include the following:

- Effective "wheel washing" prior to entering the paved area and/or as required by contamination control.
- Applying dust suppression materials (mainly water) to active work areas or other areas where dust is likely to be generated.
- Before the end of shift, sealing off (by rolling, grading or compacting) work areas stockpiles, working piles, etc. where fugitive emissions are likely to occur if not sealed
- During dry conditions or as needed, initiating dust control prior to start of shift and continuing throughout the day, as needed to minimize fugitive dust emission.
- Wet sweep, blade or otherwise remove any clods, clumps, tracks, or other deposits of soil or mud from paved roadways and parking area; applying appropriate dust control measures to suppress the generation of visible dust that may result from the removal process.
- Using alternative routing for hauling of materials.
- Changing method of excavation when feasible, including reducing the rate of excavation.
- Maintaining roadway shoulders.
- Minimizing unnecessary traffic.
- Adhering to site specific speed limits of 15 mph on paved surfaces and 10 mph on unpaved surfaces, and if necessary, further reduce the speed of equipment and haul/other site vehicles.
- Applying water or other appropriate dust suppression agents to material being transported and covering truck beds when material is still likely to become airborne.
- Utilizing load covers during periods of equipment movement, regardless of truck being empty or full.
- Minimizing configuration of material being hauled (i.e., place less material in haul vehicle).
- Minimizing drop height during loading and unloading.

88B

4654

- If practical, cover small storage piles with tarps or plastic sheeting.

- For extended periods of planned inactivity, vegetate as a last resort, if protective cover or periodic application of surfactants or crusting agents prove ineffective.

- Repair or resurface roadways/parking areas as needed or use an alternative road surface as a last resort.

6.3.5 Monitoring

All personnel who have been briefed on this plan will report suspected fugitive dust emissions to the appropriate personnel who will then direct the implementation of BAT work practices and fugitive dust control. As outlined in Section 6.3.3, field conditions will be monitored for visible dust emission. When required, BAT material will be applied and BAT work practices will be implemented to limit fugitive dust emissions.

6.3.6 Recordkeeping

The record keeping process will begin with field supervisors and managers, who will brief those workers applying BAT materials pursuant to the required record keeping. The form to be filled out can be found in Appendix B-2. Appropriate personnel will complete these forms. Completed forms will be part of the Silos 1 and 2 Project daily reports and will be filed in the permanent project files and transmitted to Fluor Fernald when requested. Additional blank copies of the forms will be kept in the field trailer. Completed forms will be turned over to the Silos 1 and 2 Project Field Supervisors on a daily basis. Forms will be reviewed for completeness, and incomplete forms will be returned to the appropriate individual for corrections. Failure of an individual to consistently produce complete and accurate records may result in disciplinary action.

6.3.7 Off-Hours Fugitive Dust Alert Notification

A "Dust Alert" is defined as excessive or visible dust emanates from anywhere within the Work Area during non-working periods. "Non-Work" periods are defined as hours when neither the Contractor nor any subcontractor is performing Silos 1 and 2 construction activities on site. However, the FEMP remains staffed by Fluor Fernald Security personnel 24 hours per day. Silos 1 and 2 Project trained personnel will be on-call during non-work periods, seven (7) days per week (including holidays) to respond to any off-hours fugitive dust alert. Therefore, if visible dust is observed within the Work Area during project non-work periods, Fluor Fernald will notify the Contractor. Dust suppression will begin within two (2) hours of notification by Fluor Fernald.

6.3.7.1 Notification Procedure

During a Dust Alert, Fluor Fernald will refer to the "Off-Hours Dust Alert Schedule" that will be provided by the Contractor prior to initiation of construction activities. If Fluor

4654

Fernald cannot contact the Designated Primary Contact (DPC) within a reasonable time frame, an attempt to reach the designated alternative contact will be made. Similarly, if the alternative cannot be expeditiously contacted, the second alternative will be contacted. In the unlikely event that all three of these individuals cannot be reached, Fluor Fernald will attempt to contact any other person identified on the contractor-approved contact list.

Upon receiving notification from Fluor Fernald, the Contractor DPC will then contact qualified personnel, as appropriate, to respond to the Dust Alert. The Contractor DPC must verify that those responding to the "Off-Hours Dust Alert" are able to gain access to a controlled area if required. Only those personnel who meet the appropriate training and medical requirements for this work should be contacted. The Contractor DPC, as well as those personnel contacted, will go to the site to direct the work and implement the necessary corrective actions. Because dust suppression is defined as a Limited Scope Work, the Contractor is not required to have the Site Health and Safety Officer respond to these Dust Alerts. Fluor Fernald will provide any necessary safety coverage.

6.3.7.2 The Contractor Site Response

The Contractor personnel will utilize adequate BAT dust control methods to bring any fugitive dust emissions to below the site-specific limit during dust generating activities. Designated Contractor personnel will not leave the Silos 1 and 2 Project site without concurrence from Fluor Fernald that sufficient controls are in place or until Fluor Fernald has signed the Dust Alert Work Order included in Appendix B-3.

6.3.7.3 Schedule and Contacts

The Off-Hours Dust Alert Schedule and Contact List will be provided to Fluor Fernald prior to the start of the Contractor's Silos 1 and 2 Project construction activities.

6.4 WASTE MANAGEMENT PLAN

The purpose of this section is to describe the materials and methodology for removal and disposition of relevant waste materials. Management of secondary wastes generated as a result of the Silos 1 and 2 Project construction and operational activities will be consistent with site procedures and applicable regulatory drivers.

6.4.1 Waste Types

It is expected that construction activities will generate three main groups of secondary waste materials, i.e., clean construction debris, radiologically-contaminated construction debris, including soil and clean excavated soil. Smaller quantities of additional solid waste, [e.g., PPE, wood, and potentially some drums] are anticipated. Clean construction debris is material that as a result of construction has been brought onto the Silos 1 and 2 Project site or is created by construction activities, and has been surveyed or characterized and released as non-radioactive and non-hazardous waste. Radiologically-contaminated

000090

4654

construction debris is material that has been contaminated during construction inside the Controlled Area. Excess excavated soil will be generated as a consequence of earthwork.

The following waste types are estimated to be generated during Remediation Facility Operations:

- Spent pre-filters, primary filters, and HEPA filters;
- Sampling containers, stack sampling filter papers, and radiological survey smears/wipes;
- Used PPE;
- Empty chemical additive containers;
- Containerizing wastes (e.g. sealant drums, rivet pintails, temporary lids);
- Failed equipment/replaced tools (i.e. valves, pumps, etc.); and
- Miscellaneous and maintenance wastes.

A more detailed description with estimated quantities is included in the document Timed Estimate of Secondary Waste (40750-RP-013), Appendix B-5.

There is also the potential that some unknown debris will be encountered during soil excavation. This material may be manufactured objects or natural solid waste. These items will be dealt with on an item by item basis at the time of discovery. Fluor Fernald will be responsible for characterizing and approving the ultimate disposition of this material.

Waste oils, engine coolants, hydraulic fluids and other lubricants from the servicing of equipment have not been identified as a "waste stream" as these items will not be stored on the site. Vehicle and construction equipment maintenance will be done off-site. On-site failure of equipment or vehicles will be managed on an item by item basis following approval by Fluor Fernald and in accordance with Fluor Fernald ACR-007, Waste Material Handling Criteria for Construction Projects. Any accidental spill of these materials will be subject to Fluor Fernald spill notification requirements. The Contractor will conduct weekly inspections of fuel storage tanks and equipment. The estimated amount of each type of operational waste type is given in Appendix B-5.

6.4.2 Waste Minimization

Every effort will be made to minimize waste generation by limiting the amount of material that enters the Controlled Area. Material wrapping and packaging will be minimized on-site by requesting that suppliers provide material with as little packaging as possible. Where feasible assembly of equipment modules will be done off-site. Pre-job planning will be used to ensure that the number of tools identified and the equipment needed to complete the job are minimized. No hazardous materials will be brought into the Controlled Area unless absolutely necessary and only with the prior approval of Fluor Fernald.

000091

4654

It is expected that only small quantities of "hazardous" materials (e.g., pipe sealants, concrete sealants, marking paints, caulking materials) will be required for the Silos 1 and 2 Project construction activities. To minimize the amount of this type of waste, only that quantity which is required to complete the job will be brought on-site.

6.4.3 Construction Debris Management

Construction debris will be staged at predetermined locations that include controlled boundaries to define each area as well as limit access to them. The debris will be surveyed to verify that it meets the free-release criteria specified by Fluor Fernald Site Procedure RP-0009, Radiological Requirements for the Release of Materials at the FEMP. The waste will be segregated as either radiological contaminated, hazardous or clean construction waste.

Construction wastes such as fencing will be cleaned of soils awaiting radiological survey to ensure that it meets the free-release criteria.

Construction debris that does not meet the free-release criteria for the site will be segregated and containerized into waste streams. Project personnel will be briefed on the waste segregation and size-reduction criteria for the Silos 1 and 2 Project prior to mobilization. The estimated volume of secondary waste from construction activities, underground material, soft waste and caulking/sealants is estimated to be no greater than 155 yd^3. The estimated amount of each waste type is given in the table in Appendix B-5.

6.4.4 Soil Management

During site preparation it is estimated that the Contractor will generate approximately 25,000 yd^3 of excavated soil, 'cut' soil and 'raw fill' soil. The excavated soil and 'cut' volume will be monitored and dispositioned as excess waste according to Fluor Fernald requirements. Earthwork and related activities will not be performed during unfavorable weather conditions, e.g., rain, snow or high winds. Soil management will comply with the Silos 1 and 2 Project Health and Safety Plan, the Erosion and Stormwater Control Plan and the Fugitive Dust Control Plan. Excess soil will be dispositioned as soon as practical post excavation. Transportation of the soil to the OSDF will be the responsibility of Fluor Fernald. The schedule for transportation of the soil will be dependent upon the OSDF availability and the OSDF subcontractor's transportation schedules.

Excavations will be monitored by a Waste Acceptance Organization (WAO) representative to ensure that OSDF WAC is met as described in DOE's WAC Attainment Plan for the OSDF. Excess excavated and 'cut' soils will be characterized as either Category 1 (soil and soil-like material), Category 2 (debris), or Category 4 (organic or highly compressible). Materials will be segregated by OSDF category within the work area before being transported. Separate stockpiles of each category will be maintained as directed by the Construction Manager. The final volume of excess material generated will be reported to Fluor Fernald at the end of each normal working day. These excess materials will be tracked by WAO through the use of the Field Tracking Log (FTL).

4654

Additionally, the WAO will track with the FTL any interim material movements (whether soil or debris) between Material Tracking Locations (MTLs) established by WAO. The schedule for transportation will be dependent upon the OSDF availability and OSDF subcontractor's transportation schedules. It is expected that the transportation of the excess soil to the OSDF will be completed within 45 days of completing excavation. During construction and excavation, materials may be encountered which may not meet the OSDF WAC. Upon discovery of these materials, the Fluor Fernald Construction Manager shall be notified and will require further evaluation through the use of the Fluor Fernald's real-time monitoring and OSDF WAC Attainment Plan.

6.4.5 Unknown Debris Management

During excavation, the Contractor may encounter debris previously buried underground such as (e.g., conduit, piping, concrete). Before beginning earthwork, the contractor will determine the location of all existing underground utilities in the work areas. In the event that unknown debris is unearthed, the contractor will stop work and notify Fluor Fernald immediately of any non-soil debris requiring special handling or disposition. Unexpected debris will be managed in accordance with Fluor Fernald Safe Work Plan requirements (ACR-002). Fluor Fernald will arrange for container delivery, debris characterization, any sampling tasks that may be required, and ultimate transportation of the container to the appropriate facility. Fluor Fernald will track the volume of such debris.

6.4.6 Waste Container Management

Fluor Fernald will provide the appropriate waste containers for the various waste categories identified in the Waste Management Plan. The Contractor will use the Material Segregation and Containerization (MSCC) form, Appendix B-4, to identify categories of waste as their basis for containerization activities. These containers may include, but are not limited to, the following:

- Large metal boxes
- International Standards Organization (ISO) containers
- Small metal boxes
- 55-gallon drums with lids
- Roll-off boxes
- Dumpsters

Waste containers staged inside the Controlled Area will be lockable and will be kept locked unless authorized loading is taking place. Fluor Fernald Radiological Control personnel will be present to survey waste prior to authorized loading operations. Unfilled waste containers will be secured when no loading is in progress to prevent the addition of unknown materials. Fluor Fernald will provide and maintain the lock and key to clean waste containers.

4654

Designated personnel will be responsible for supervising container operations, including inspection of empty containers on receipt and waste loading activities. They will have the responsibility to ensure that containers, boxes and drums are filled such that the interior volume is as efficiently and compactly loaded as practical, either up to the maximum gross weight limit of that container or until full by volume.

Containers will be checked for free liquid prior to loading. Containers containing free liquids will not be transported until it is proven that the container no longer contains free liquid. Ice is considered a free liquid. Containers will be weather protected, particularly when the lid is not secured, to prevent entry of snow and rain.

6.4.7 Wastewater Control

Clean construction waste will be surveyed and loaded into dumpsters provided by the contractor or its subcontractors on a daily basis to prevent an excessive amount of material from piling up near the container staging area. These dumpsters will remain locked when no loading is taking place.

Fluor Fernald will visibly inspect full containers prior to final securing of their lids and container disposition.

The Contractor will follow the requirements of Fluor Fernald ACR-007, *Waste Material* Wastewater generated during construction will be collected in sumps or by other means and pumped through silt fence or check dams prior to discharge to the existing drainage features near the site. Any contaminated wastewater encountered will be collected and disposed of at the direction of the Construction Manager and this plan. Wastewater generated during operation will be handled according to the System Design Description Document for the Silos 1 and 2 Project (40750-RP-0001) (Section 2.0).

6.5 REFERENCES

OEPA, Chapter 3745-17-08 of the OAC, Restriction of Emission of Fugitive Dust, July 1997.

Fluor Fernald, ACR-007, Waste Material Handling Criteria for Construction Projects, June 1998. Fluor Fernald, PL-3088, Stormwater Pollution Prevention Plan, October 1999.

Fluor Fernald, RM-0047, Fugitive Dust Control Requirements, August 1997.

40 CFR Part 60, Appendix A, Method 22, Visual Determination of Fugitive Emission for Material Sources and Smoke Emissions for Flares.

Fluor Fernald Administrative Contractor Requirements, ACR-002, Contract Safe Work Plan Format Requirements, November 1994.

4654

Fluor Fernald, RP-0009, Radiological Requirements for the Release of Materials at the FEMP.

Assessment of Potential Doses from the Release of Exhaust Air from the Silos 1 and 2 Chemical Treatment Facility (40750-RP-0027).

System Design Description Document for the Silos 1 and 2 Project (40750-RP-0001).

Silos 1 and 2 Project Technical specifications and Project Quality Procedure 7.1, Control of Purchased Items and Services.

DOE Remedial Investigation Report for Operable Unit 4, Final, Volume 1 of 3, Fernald Environmental Management Project, Fernald, Ohio, 1993.

Fluor Fernald's Silos Project Environmental Monitoring Plan.

ODNR, Rainwater and Land Development Manual, Second Edition, 1996.

Timed Estimate of Secondary Waste, 40750-RP-0013, April 12, 2002.

Silos 1 and 2 Chemical Stabilization Project-Specific Health and Safety Plan, Preliminary Documented Safety Analysis, FEMP, April 29, 2002.

Fluor Fernald's OSDF WAC Attainment Plan.

Stormwater Drainage Plan Accelerated Waste Retrieval Project, 40710-PL-0008, May 29, 2002.

7.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS MATRIX 4654

Appendix A contains compliance matrices for the ARARs or To Be Considered (TBC) requirements associated with the Silos 1 and 2 Remediation Facility Project. These matrices provide an assessment and general description of the compliance strategy for each ARAR or TBC requirement, along with references to specific Silos 1 and 2 Remediation Facility Project documents that more fully describe the related compliance strategy and methods.

Appendix A-1 contains ARARs and TBC requirements that are defined as being chemical-specific to the Silos 1 and 2 Remediation Facility Project. Appendix A-2 contains ARARs and TBC requirements that are defined as being location-specific to the Silos 1 and 2 Remediation Facility Project. And finally, Appendix A-3 contains ARARs and TBC requirements that are defined as being action-specific to the Silos 1 and 2 Remediation Facility Project.

4654

8.0 HEALTH AND SAFETY PLAN (40000-PL-0014)

The Health and Safety Controls portion of the RD Package is designed to illustrate the planned preventative or mitigative measures to address the occupational hazards identified for the Silos Project. The Health and Safety Controls are presented consistent with the Silos Health and Safety Plan. The Silos Health and Safety Plan takes into account the specific hazards inherent to the Silos Project site and presents procedures to be followed by Fluor Fernald, its subcontractors, and all other on-site personnel to avoid and, if necessary, protect against health and/or safety hazards. Table 8-1, an excerpt from the Silos Health and Safety Plan, illustrates the activities associated with the Silos Project and the hazards associated with the activities.

The Health and Safety Matrix (Table 8-1) lists the occupational hazards as identified in the Silos Project Health and Safety Plan. The hazards identified in the Health and Safety Matrix are limited to those considered to be common construction and/or occupational safety hazards. These hazards are addressed by the safety programs, policies and procedures used to ensure that work is performed safely. Some of the health and safety controls used to mitigate the occupational hazards identified are listed in terms of:

Frequency and type of monitoring required
Personnel Protective Equipment Training Requirements
Medical Monitoring Requirements
Administrative and Engineering Control Measures
Permit(s)
Decontamination and Disposal Procedures

The FEMP Emergency Plan, PL-3020 describes the emergency management program that responds to potential hazards at the site. Potential hazards identified at FEMP include severe weather, hazardous and radiological material releases, bomb threats, vehicle/transportation accidents, earthquakes and other events. The Emergency Plan identifies the responsible parties to contact in the event of an emergency and details which personnel would respond to the event. Specific elements of emergency support procedures are addressed in the Silos Project Health and Safety Plan. These elements include communications, local emergency support units, preparation for medical emergencies, first aid for injuries incurred on site, record keeping, and emergency site evacuation procedures.

The health and safety controls will be developed further as the Operations Phase of the Silos Project is further delineated and with the development of activity specific Work Plans. Additional occupational hazards and associated mitigative measures may be identified as the project progresses.

Figure 8-1, Occupational Hazards Identified in the Silos Project Health and Safety Plan 4654

Motor vehicles, heavy equipment and crane operations (cranes, back hoes)

Cutting and welding

Overhead hazards

Material handling (rigging, forklifts)

Chemical and Radiological hazards

Energy control (lockout/tagout)

Silo integrity

Falling hazards

Slips and trips

Heat and cold stress

Electrical shock

Lifting and straining

Excavation and trenching

Confined space entry

1
2

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Work in Silos area Work in a construction area	Thermoluminescent Dosimeter (TLD) *Fluor Fernald* Radiological Control Technician (RCT) Periodic Monitoring as required	Steel toed, leather safety boots (ANSI Z41) Hard hat (ANSI Z89.1) Safety glasses w/ rigid side shields (ANSI Z87.1) Leather palm work gloves for sharps, abrasives, hot surfaces or pinch points during use of power hand tools/equipment (The above listed PPE is to protect from dropped objects, overhead hazards, eye injury, and punctures) PPE appropriate to the specific task beyond the standard required PPE will be identified in the Work Plans	General Site Worker • Site GET Training • Site Worker Training • Rad Worker I or II • 8 hr. Supervised field experience • Construction Rules and Regulations • Orientation on the HASP including matrix, and • Orientation on Project Specific MSDSs	Medical surveillance exam: baseline, annual, and termination Report all injuries to Fluor Fernald Medical Department Baseline, annual, and termination urine sample	Attend a pre-work kickoff/safety meeting Daily job briefing at start of shift, after lunch, and when beginning new tasks Fluor Fernald to inspect all equipment prior to entering site Weekly safety meeting held on the first working day of the week Fluor Fernald approved Work Plans	Work Permit Radiological Work Permit (RWP) Site Dome Access Permit if working inside Silos 1 and 2 boundary fence	Personnel and material radiological contamination monitoring as required by Radiological Work Permit

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Work in Contamination Areas (Uranium)	General Area (GA) air sampling by Fluor Fernald (Uranium) Breathing Zone air sampling for at least 25% of the workers by *Fluor Fernald*	A minimum of full cloth anti-Cs for hands-on work Full-face respirator with magenta (HEPA cartridges as required by RWP) PAPR as required by RWP	Respirator training and fit-test PAPR Training if PAPRs are worn Rad Worker II 24 hr Supervised field experience	Medical approval for respirator use Initial, every 60 days, and termination urine sample Initial, annual and termination in-vivo exam	Dust suppression technologies (including use of a surfactant) as required by the Radiological Work Permit Visitors who are not Rad Worker II trained are to obtain authorization from the Radiological Control Program Team Coach Fluor Fernald	RWP	Disposal of contaminated material (anti-C, waste, etc) in supplied bags or containers Personnel and material radiological contamination *monitoring required to* exit Contamination Area
Work in Contamination Areas (Radium)	(Radium) Breathing Zone air sampling for 100% of the workers by Fluor Fernald	Cloth anti-Cs with disposable outer anti-Cs for Radium Contamination Areas Air-supplied hood as required by RWP	Same as Uranium Contamination Area plus Air-supplied hood training, if air-supplied hood is worn	Same as Uranium Contamination Area plus Baseline and incident fecal sampling as required for *radium/thorium* contamination areas.	Same as Uranium Contamination Area	RWP	Same as Uranium Contamination Area
Heat Stress	Physiological monitoring Ambient temperature monitoring	Cool vests or cool suits (optional)	Safety meetings concerning signs and symptoms of heat stress	Fluor Fernald Medical approval for working in hot environments	Fluor Fernald-approved heat stress program Work/rest regimen based on physiological monitoring shall be used Cool room, including water		
Cold Stress	Ambient temperature monitoring	Clothing suitable for cold weather	Safety briefing on cold stress If temperature ≤32°F, special briefing on use of PAPRs in cold weather (if PAPRs are worn)	Fluor Fernald Medical approval for working in cold environments	Fluor Fernald-approved Cold Stress Program *Identify a warm-up area(s) to be used* Work/rest regimen may be used Use of PAPRs in cold weather is restricted as follows: • 0 to 15°F, Time is limited to 15 min. continuous use; and • <0°F, Use of PAPRs is prohibited except for emergency use.		

000100

4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Eye injury		Safety glasses with rigid side shields (ANSI 287.1)	Worker Awareness Training	Report all injuries to Fluor Fernald Medical Department	Attend a pre-work kickoff/safety meeting. Fluor Fernald Work Plans		
Overhead hazards		Hardhat (ANSI 298.1)	Worker Awareness Training				
Dropped Objects		Steel-toed, leather safety boots (ANSI 241)	Worker Awareness Training				
Elevated work (falls from elevations)		Body harness and lanyard	Training in proper use of fall protection equipment		100% fall protection required for unguarded work locations $\geq$ 6 feet, including work assembling and disassembling scaffold and working from ladders Barricades and post signs in the area(s) below the elevated work Secure lanyard to structure capable of holding 5000 lbs. Quarterly inspection of equipment by the competent person Inspect equipment before use		
Ladders and scaffolding		See "Elevated Work" above	Competent person for inspection of ladders and scaffolding Scaffold training for users and erectors		Ladders to be secured in place at the top when set up for use Ladders to have current inspection sticker Scaffolding to have current inspection tag		

000101

4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Use of a man lift (e.g., JLG, Grove, Scissors)		Safety harness and lanyard (except on scissors-type lifts with top rail, mid rail and toe boards)	Trained operator		All lift units are to be inspected and operated as defined within the manufacture's operation/safety manual Competent person to perform monthly inspections Operators to inspect daily or at the beginning of each shift 100% tie off when in equipment except for Scissors lifts that have top rail, mid rail, and toe boards Barricade around areas of operation Maintain $\geq$ 10 feet from power lines		
Silo dome collapse		Safety harness and lanyard			Fluor Fernald approved Work Plans Comply with Technical Safety Requirements for Silo domes of the Preliminary Hazard Analysis Report, Chapter 5, to include: Restrict placement on loads on domes of Silos 1, 2, or 4 so no live load greater than 700 lbs. (including up to three persons). Evaluate modifications in dead loads applied to silos. Equipment loads shall be distributed over the largest area practical. No equipment loads distributed over an area smaller than 3-foot-diameter circle	Dome Access Permit	

000102

4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Hoisting/Rigging			Competent person for Hoisting and Rigging Inspection Pre-Work Rigging Orientation Briefing on lifting plan prior to the lift		Comply with DOE Hoisting and Rigging Manual requirements, Chapter 15 Lifting Plan Qualified Rigger verification form for workers Avoid load swing paths over Silos1, 2, and 3. A Critical Lift Plan shall be required for all lifting of loads over Silos 1, 2 and 3.		
Hand and power tools		As recommended by the manufacturer	Worker Awareness Training. Review of manufacturer's instructions for use.		Daily inspection of tools prior to use. Remove damaged tools from use and tag as "Do Not Use."		
Weather limitations for outdoor activities					Outdoor activities will be suspended if the following condition(s) occurs(s): Lightning; Heavy persistent rain; Any wind velocity of 25 mph or greater will stop elevated work and crane work; and Any weather condition whose impact is judged to be detrimental by the Fluor Fernald Health and Safety Officer		

000103

4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Handling sharp objects/ Punctures/ Pinch Points.		Leather palm gloves		Report all injuries to supervisor and Medical.	Sharp edges will be identified, eliminated, or protected. All hand and power tools will be maintained in safe condition. Guards will be kept in place on all hand/power tools. Alert workers of possible pinch points.		
Impalement					Protective caps will be placed on the protruding ends of rebar. Sharp edges will be identified, eliminated, or protected		
Noise	Noise monitoring and/or dosimetry may be conducted to verify compliance with regulations (as required)	Hearing protection required if noise levels $\geq$ 85 dBA (i.e., when using power tools or heavy equipment) Hearing protection will provide a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs will be worn as required).	Personnel exposed to an 8-hr TWA of 85 dBA or greater shall be in a Hearing Conservation Program (HCP)	Audiometric evaluation required for employees in Hearing Conservation Program.	Areas and equipment where noise $\geq$ 85 dBA are to be posted "Hearing Protection Required" Engineer or design out noise whenever possible Time limits or job rotation may be used in conjunction with engineering controls		Store reusable hearing protection in a sanitary manner

000104

4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Fire (open flame during welding or cutting) See also specific activities for additional requirements when cutting lead painted or contaminated materials		Flame retardant clothing or outer anti-Cs Welder's leathers (when debris contacts clothing) UV eye protection when welding	Fire watch training		Fire extinguisher available near work site Remove combustibles and cover area with fire resistant welding blankets or wet down work area as necessary Maintain a fire watch at least 30 minutes after work is completed Welding screens as needed Ventilation as needed	Open Flame/ Welding Permit Confined Space Evaluation/ Permit if cutting or welding in confined space	
Vibration from powered hand tools.		Anti-vibration gloves shall be used during extended use of vibrating hand tools more than 2 hours on 1 day or more than 1 hour on consecutive days	Briefing for involved workers on vibration hazards		Personnel shall dress warmly when using power hand tools in cold weather Personnel shall take 10-minute breaks from vibration for each hour a vibrating hand tool is operated		
Confined Space.	Fluor Fernald performs initial monitoring Fluor Fernald performs continuous monitoring when required	PPE required for entry into permit required, confined spaces	Confined Spaces Training required for entry into permit required confined spaces	Fluor Fernald medical approval for permit required, confined space entry	Work from outside confined space when possible Controls required for entry into permit required confined spaces	Confined Space Evaluation/ Permit	

000105

4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Back Injury (Lifting Sprain and Strains)			Must evaluate personnel if required to lift 35-50 lbs. Cannot exceed 50 lbs. without assistance Site personnel will be instructed on proper lifting techniques		Mechanical devices will be utilized to reduce manual handling of materials. Team lifting will be used in lieu of mechanical devices.		

000106

7-4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Operation of mobile equipment (e.g., bulldozer, bobcat, forktruck, backhoe) (Property Damage)		Hearing protection required if noise levels ≥ 85 dBA. Orange Vest for nearby employees	Qualified equipment operator		Competent person to inspect equipment before use at FEMP and quarterly Evaluation prior to operation of any mobile equipment of the berms or within 10 feet of the silos. Rollover protection structures Overhead protection Daily inspection of equipment by the operator prior to use. Audible backup alarm and horn No obstructed rear views Barricade the swing radius of equipment Fire extinguisher Seat belts to be worn		

000107

4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Penetration of ground or wall penetrations - Contact with/ Hitting existing buried utilities.			Site Energy Control Training (OP-0004) for involved workers and supervisors if location of utilities cannot be determined Qualified equipment operator		Review as built drawings Daily Penetration Permit Briefing Barricade and protect as needed Flag utilities within 10 feet of penetration Lockout and tagout utilities if location of utilities cannot be determined Hand dig within 3 feet of underground utilities	Penetration Lockout/ Tagout	
Connection to site utilities and systems			Site Energy Control Training (OP-0004) for involved workers and supervisors		Verify isolation of utilities and systems Energy isolation plan Lockout/Tagout Specific Equipment Plans	Service Interruption Permit if utilities are disrupted Also see "Ground Penetration/ Excavation/ Radiological Contamination " below	

000108

7-4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Electrical Shock/ Electrocution (Hazardous energy)			Site Energy Control Training (OP-0004) for involved workers and supervisors		All electrical work will be performed by trained/ qualified electricians. All lockout/tagout procedures will be followed as outlined in the HASP and OP-0004. All electrical installation shall comply with National Electrical Safety Codes (NESE), and National Electric Code (NEC). Live parts of wiring or equipment shall be guarded to protect all persons from contact. No energized work will be permitted on live lines/equipment. Electrical tie-ins to existing overhead lines on existing equipment shall require and Energy Isolation Plan and a Service Interruption Permit. Shall maintain a minimum ten (10) feet clearance from overhead lines. Approach distance for qualified employees shall be followed as listed in 10 CFR 1926.416.	Outage Permit if utilities are disrupted	

000109

4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Electrical Shock/ Electrocution (Hazardous energy) (continued)					Flexible cords shall be elevated GFCI's required Flexible cords shall be UL-listed and rated for hard usage and damp locations Flexible cords shall be protected from vehicle traffic All electric tools shall be inspected for damage prior to use and used in accordance with the manufacturer's guidelines		
Slip/Trip/Falls		Elevated work will require fall protection (full body harness/lanyard) Steel-toed boots with substantial soles			Daily Inspections for Housekeeping. Work areas and means of access shall be maintained safely and orderly. Maintain clear travel paths. Barricade work areas. Level terrain will be utilized as unloading areas. Elevate electrical cords/welding leads when possible Tripping and poor footing hazards will be repaired as they are discovered or clearly identified. All extension cords, cables and hoses will be run overhead when possible.		

000110

4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Vehicular Traffic		Orange traffic vests will be worn when working near roadways and equipment.	Qualified equipment operator Worker awareness training		Spotters will be used when backing up trucks and moving equipment in congested areas. Equipment will be equipped with backup alarms Daily vehicle inspections Equipment equipped with horns Flaggers used as needed		

000111

4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Excavations (Cave in)	Any excavation four feet and deeper will be monitored for oxygen, combustible gases, and toxic atmospheres prior to entry by personnel.		The Excavation Competent Person shall have appropriate training		Daily inspections conducted by the Excavation Competent Person. Stockpiles shall be placed 3 feet or greater from the excavation Any excavation four feet and deeper will be provided with ladders to allow for means of egress in such a way as to require no more than 25 feet lateral travel. The excavated area will be barricaded to prevent field personnel from falling into the trench (when unattended). Protective systems to prevent excavation cave-in will be affected in excavations greater than five feet in depth, or if deemed necessary by a competent person. All trenching shall be in accordance with the provisions of 29 CFR 1926 Subpart P. Smoking or open flames will not be allowed near work areas, if open flames must be used, procedures outlined in the HASP for hot work will be followed. During backfilling operations, warning tape will be laid down to mark buried utilities. HASP and Work Plans	Penetration	

000112

4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Worker Struck By/ Against/ Between Equipment		Orange traffic vests will be worn when working near roadways and equipment.	Qualified equipment operator. Worker awareness training		Eye contact with operators will be made before approaching equipment. Barricade work areas Use of protective shields or guards on rotating equipment. Equipment will not be approached on blind sides. The lift and swing path will be maintained clear of obstructions. Personnel will maintain a safe distance from the swing radius of the suspended loads. Personnel will understand and review hand signals. All machines will be equipped with backup alarms. Spotters will be used when backing up trucks and moving equipment in confined areas.		
Spills					Spill and absorbent materials will be readily available. Employees will be instructed as to proper fueling techniques. Fuel nozzle and hose will be secured in holder after use. Fuel caps will be secured after fueling operations.		

000113

7-4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Fire/Explosion					All fuel tank/trucks shall be grounded and bonded during fueling operations. Smoking and open flames are not permitted within 50 feet of fueling/greasing areas. Safety Cans (Type II, UL approved) will be used All equipment shall be equipped with 10-lb. ABC type fire extinguishers. 10-lb. ABC type fire extinguishers shall be readily available during fuel/greasing operations.		
Chemical Exposure	Air monitoring may be conducted to document worker exposure.	Personal Protective Equipment required by Material Safety Data Sheets (MSDSs), Work Plan, and/or FEMP Work Permit	Material Safety Data Sheets shall be reviewed with all workers prior to their starting work. Hazard Communication Training	Inclusion in the appropriate medical surveillance program if required based on exposures.	Chemical overexposures shall be reported to the supervisor and Medical (as necessary). Follow requirements on MSDS Chemical Inventory Hazard Communication	Chemical/ Hazardous Material Work Permit (as required).	Skin will be rinsed with water if contact with chemicals occurs. Portable eyewash and/or safety shower (as required).
Overhead Utilities					Flag person as appropriate. Walk down of location to familiarize workers. All equipment will stay a minimum of ten feet from power lines of 50 kv or less. This minimum distance will be increased as the voltage of the power lines increase Insulate or de-energize lines as needed.		

000114

4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Dust Exposure	Fugitive dust monitoring as applicable.				Water truck or other wetting device.		
Compressed Air			Only workers trained in the proper use, storage, and movement of compressed air cylinders shall be allowed to handle them.		Compressed air cylinders shall be appropriately secured, stored and labeled. Compressed air cylinders shall be stored with the protective caps on. Compressed air hose connections shall be secured with wire or chain to prevent whipping if they become separated.		

000115

F-4654

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Crane use			Qualified equipment operator		Mobile cranes and boom trucks shall be inspected by Fluor Fernald's crane inspector prior to entry onto and use at the site. Avoid load swing paths over Silos 1, 2, and 3 A Critical Lift Plan shall be required for all lifting of loads over Silos 1, 2, and 3 Copies of the annual inspection documentation shall be presented to Fluor Fernald 24 hours before delivery of any mobile cranes or boom trucks. Maintenance records shall be presented to Fluor Fernald prior to use of equipment. Daily and monthly inspections of cranes and hoists will be recorded on Fluor Fernald Forms: FS-F-2965, Fluor Fernald Mobile Crane Operator Checklist, FS-F-2423, Fluor Fernald Record of Daily Hoist Check, and FS-F-3948, Fluor Fernald Wire Rope and Hook Condition. Only hooks with latches to bridge the throat opening shall be used. All slings shall have a certificate of proof test to 200% of vertical working load and a manufacturers tag indicating the manufacturers name, wire rope construction and the vertical work load limit. Periodic inspections of structural and mechanical below-the-hook lifting devices shall be conducted referencing Fluor Fernald Form FS-F-2478, Fluor Fernald Lifting Devices, Grabs, & Tongs Checklist	Lift and Critical Lift as applicable	

F-4654
000116

Table 8-1, Health and Safety Controls Based on the Silos Project Health and Safety Plan
General Project Minimum Requirements

HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION AND DISPOSAL PROCEDURES
Biological Hazards (insect stings, plants and snake bites)		Use insect repellent as needed. Gather pants legs and tape closed as needed. Wear a long sleeve shirt as appropriate.	Brief workers on insect, snake and plant hazards		Inspect work areas for potential biological hazards prior to start of activities.		Wash any areas of skin exposed to poisonous plants.
Concrete Splash		Neoprene or Nitrate gloves for hand protection Rubber pullover boots Long sleeve shirts Splash goggles or face shield and safety glasses	Worker awareness training with review of MSDSs.				Wash any area of body that comes in contact with the wet concrete Follow recommendations of Manufactures MSDS for eye contact. Eyewash stations.
Metal Fumes (Welding/Torch Work)	Personal Exposure Monitoring based on type of metal being welded, welding rods used, and duration of task.	Respiratory Protection may be required in enclosed or confined spaces.	Worker awareness training with review of MSDSs.	Medical approval for respirators if one is used. Fit Test for respirator	Welding and torch work to be performed in open, well-ventilated areas when possible		Wash hands and face prior to eating and drinking and at end of shift

1

000117

7-4654

4654

9.0 DRAWINGS

Process Flow Diagrams	
Drawing Number	**Title**
Drawings Legends	
94X-3900-N-01161	Piping Valves and Miscellaneous Notes
94X-3900-N-01162	Instrumentation
94X-3900-N-01163	Equipment and Miscellaneous
Process Flow Diagrams	
94X-3900-F-01100	Container Receipt and Handling System
94X-3900-F-01101	Container Receipt and Handling System
94X-3900-F-01102	Container Receipt and Handling System
94X-3900-F-01103	Internal Inspection System
94X-3900-F-01104	Absorbent Addition System
94X-3900-F-01105	Remote Handling System
94X-3900-F-01107	Container Receipt and Handling System
94X-3900-F-01153	Slurry Receipt Tank System
94X-3900-F-01154	Chemical Feed Preparation System
94X-3900-F-01155	Slurry Conditioning and Dewatering System
94X-3900-F-01156	Slurry Feed Systems
94X-3900-F-01157	Product Stabilization System
94X-3900-F-01158	Sluice/Flush Water System
94X-3900-F-01159	Supernatant Water System
94X-3900-F-01160	Dry Additive System
94X-3900-F-01185	Material Balance Tables

Process Flow Diagrams	
Drawing Number	**Title**
94X-3900-F-01190	Vessel Vent System
94X-3900-F-01362	Slurry Receipt and Feed Tank Sumps
94X-3900-F-01363	Clarifier/Flush/Supernatant/Chemical Sumps
94X-3900-F-01364	Mixer/Container Fill Area Sumps
94X-3900-F-01446	Roof Shields/ Reaction Tank Sumps
94X-3900-F-02908	Chilled Water System
HVAC Drawings	
94X-3900-H-01140	Process Area Airflow Diagram
94X-3900-H-01141	Process Area Airflow Diagram
94X-3900-H-01142	Process Area Airflow Diagram
94X-3900-H-01143	General Notes, Systems and Equipment Designators
94X-3900-H-01144	Airflow Diagram Remediation Building HVAC
94X-3900-H-01426	Legend, Symbols, and Abbreviations
94X-3900-H-01448	Systems and Equipment Designators
94X-3900-H-01473	Electrical Room Airflow Diagram
94X-3900-H-01474	Cold Chemical Male-up Room Airflow Diagram
94X-3900-H-01632	Container Railcar Loading Area Airflow Diagram
94X-3900-H-01633	Empty Container Staging Area Airflow Diagram
General Arrangement Drawings	
94X-3900-M-01590	Plot Plan
94X-3900-M-01592	1st Floor Columns 1-6.5 and A-C
94X-3900-M-01593	1st Floor Columns 1-5 and E.5

Process Flow Diagrams	
Drawing Number	**Title**
94X-3900-H-01474	Cold Chemical Male-up Room Airflow Diagram
94X-3900-H-01632	Container Railcar Loading Area Airflow Diagram
94X-3900-H-01633	Empty Container Staging Area Airflow Diagram
General Arrangement Drawings	
94X-3900-M-01590	Plot Plan
94X-3900-M-01592	1st Floor Columns 1-6.5 and A-C
94X-3900-M-01593	1st Floor Columns 1-5 and E.5
94X-3900-M-01594	1st Floor Columns 1-5 and E-H.2
94X-3900-M-01595	1st Floor Columns 1-5 and K-J
94X-3900-M-01596	1st Floor Columns 5-9 and C-E
94X-3900-M-01597	1st Floor Columns 5-8 and E.5- G.5
94X-3900-M-01598	1st Floor Columns 5-11 and H-J
94X-3900-M-01599	1st Floor Columns 9-13 and C-E
94X-3900-M-01600	1st Floor Columns 8-12 and E.1-H
94X-3900-M-01601	1st Floor Columns 13- 18 and C-E
94X-3900-M-01602	1st Floor Columns 1-5 and C-E.5
94X-3900-M-01603	2nd Floor Columns 1-5 and E-H.2
94X-3900-M-01604	2nd Floor Columns 5-8 and D-E.5
94X-3900-M-01605	2nd Floor Columns 5-8 and E.5-H
94X-3900-M-01606	3rd Floor Columns 5-8 and D-E.5
94X-3900-M-01607	Section A Columns 1-5
94X-3900-M-01608	Section B Columns 1-5

 4654

Process Flow Diagrams	
Drawing Number	**Title**
94X-3900-M-01609	Section C Columns 1-5
94X-3900-M-01610	Section D Columns 5-9
94X-3900-M-01611	Section E Columns C-E.1
94X-3900-M-01612	Section F Columns E.1-H
94X-3900-M-01613	Section G Columns 5-11
94X-3900-M-01614	Section H Columns 8-12
94X-3900-M-01615	Section I Columns 9-13
94X-3900-M-01616	Section J Columns 13-18
Site Plans, Excavation and Drainage	
94X-3900-G-01148	General Notes and Legend
94X-3900-G-01290	Site/Paving Plan
94X-3900-G-01367	Foundation Mat Demolition Plan
94X-3900-G-01368	Overall Site/ Future Railroad Plan
94X-3900-G-01370	Grading, Drainage, and Erosion Control Plan
94X-3900-G-01371	Utility Plan
94X-3900-G-01373	Site Details – 2
94X-3900-G-01376	Grading, Drainage and Erosion Control Plan
94X-3900-G-01377	Foundation Mat Sections
94X-3900-G-01378	Foundation Mat Details - 1
94X-3900-G-01942	Railroad Design Demolition Plan
94X-3900-G-01943	Railroad Design Track Plan
94X-3900-G-01944	Railroad Design Site/Utility Plan

000121

Process Flow Diagrams	
Drawing Number	**Title**
94X-3900-G-01945	Railroad Design Grading, Drainage and Erosion Control Plan
94X-3900-G-01946	Railroad Design Profiles - 1
94X-3900-G-01947	Railroad Design Profiles - 2
94X-3900-G-01948	Railroad Design Details - 1
94X-3900-G-01949	Railroad Design Details - 2

4654

APPENDICES

APPENDIX A-1: CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Radionuclide Emissions (Except Airborne Radon-222)	Title 40 of the Code of Federal Regulations (CFR) Part 61, Subpart H. Emissions of radionuclides to ambient air from a US Department of Energy (DOE) facility shall not exceed an amount that might cause a member of the public to receive an effective dose equivalent (EDE) of 10 mrem/yr. Monitoring is required at release points having potential to discharge radionuclides that could cause an EDE in excess of 1% of standard (0.1 mrem/ year) to any member of the public.	Radioactive air emissions from Silos 1 and 2 Remediation Facility activities might contribute to the dose to members of the public from the air pathway during implementation of remedial actions.	Emissions from materials received from the TTA will be minimized by using sealed tanks and piping. These areas and all processing areas will vent to the RCS. The RCS is designed to operate at a negative pressure. The RCS stack will have an isokinetic sampling system and all discharges will be continuously monitored for radioactivity. Stack alarms and backup power is also provided. All other areas will be controlled by the remediation facility HVAC System, which will filter all emissions through HEPA filter prior to release. The HVAC stack will have an isokinetic sampling system and all discharges will be continuously monitored for radioactivity. Stack alarms and backup power are also provided.	See Section 6.0 of this document "Silos 1 and 2 Project Environmental Control Plan" Section 6.1.1, Air Emissions Control. Also see sections on the Radon Control System (RCS) and the Heating, Ventilating, and Air Conditioning (HVAC) Systems in Sections 2, and 5 of this document, for additional information.
Radon-222 Emissions	40 CFR 61, Subpart Q. No source at a DOE facility shall emit more than 20 pCi/m^2 of Radon-222 as an	Short-term staging of the silo material while remedial actions are in process do not	N/A	

000124

4654

APPENDIX A-1: CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
	average for the entire source into the air. Source is defined as "any building, structure, pile, impoundment, or area used for interim storage or disposal...."	constitute interim storage for the purposes of NESHAP Subpart Q; therefore the Remediation Facility does not qualify as a source.		

000125

4654

APPENDIX A-1: CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Radon-222 Emissions (fenceline)	10 CFR 834 (proposed) – maximum annual average fenceline radon concentration may not exceed 0.5 pCi/l above background.	Radon Emissions from the Silos 1 and 2 Remediation Facility must not contribute to fenceline concentration in excess of this limit	Emissions from materials received from the TTA will be minimized by using sealed tanks and piping. These areas and all processing areas will vent to the RCS. The RCS is designed to operate at a negative pressure. The RCS stack will have an isokinetic sampling system and all discharges will be continuously monitored for radioactivity. Stack alarms and backup power are also provided. All other areas will be controlled by the Remediation facility HVAC System, which will filter all emissions through HEPA filter prior to release. The HVAC stack will have an isokinetic sampling system and all discharges will be continuously monitored for radioactivity. Stack alarms and backup power are also provided. Dispersion modeling of expected emissions confirm compliance	See Section 6.0 of this document "Silos 1 and 2 Project Environmental Control Plan" Section 6.1.1, Air Emissions Control. Also see sections on the Radon Control System (RCS) and the Heating, Ventilating, and Air Conditioning (HVAC) Systems in Sections 2, and 5 of this document, for additional information. Expected Stack emissions and ambient air concentrations are discussed in Section 6.0 of this document "Silos 1 and 2 Project Environmental Control Plan" Section 6.1.2, Estimated Point Source Air Emission Data.

000126

4654

APPENDIX A-1: CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Protection of Air from Residual Radioactive Material	DOE Order 5400.5, Chapter IV, 6.b (Proposed 10 CFR 834). ***Interim Storage:*** The above-background concentration of radon-222 in air above an interim storage facility must not exceed 100 pCi/L at any point, an annual average of 30 pCi/L over the facility, or an annual average of 3 pCi/L at or above any location outside the site.	Portions of DOE Order 5400.5 were selected as TBCs to ensure adequate protection of the public during and following remediation. Management of radium and thorium bearing wastes might result in the release of radon gas to the environment.	See above discussion of Radon Emissions	See above.
Ohio Water Quality Standards Use Designation and Criteria	OAC 3745-1-07. All pollutants or combinations of pollutants shall not exceed, outside the mixing zone, the Numerical and Narrative Criteria for Aquatic Life Habitat and Water Supply Use Designation listed in Tables 7-1 through 7-15 of this rule.	This requirement is met by compliance with the FEMP National Pollutant Discharge Elimination System (NPDES) permit.	The process both recycles water used for slurry transport and consumes water in the stabilization process, thereby minimizing the wastewater discharge to the AWWT. Water sent to the AWWT is first sampled, analyzed, and radiologically surveyed to meet the AWWT WAC, and therefore, meets the requirements of the site NPDES permit limits.	See Sections 2.1.9 of the Systems Description for discussion of wastewater sampling. Section 6.2 of the Environmental Control Plan discusses Erosion and Stormwater Controls.

000127

4654

APPENDIX A-1: CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Ohio Water Quality Standards "Five Freedoms" for Surface Water	OAC 3745-1-04. All surface waters of the state shall be free from: • Objectionable suspended solids; • Floating debris, oil and scum; • Materials that create a nuisance; • Toxic, harmful or lethal substances; and • Nutrients that create nuisance growth.	Requires compliance with the FEMP NPDES permit.	See above discussion relating to control of wastewater and storm water discharges associated with the Silo 1 and 2 Remediation Facility Project. Surface water quality will be maintained during construction by segregation of clean water from potentially contaminated sources, installation of silt fences, and check dams where required.	Section 6.2 and Appendix B-1 of the Environmental Control Plan for Silos 1 and 2 discuss Erosion and Stormwater Controls. Also see drawings 94X-3900-G-1370 and 94X-3900-G-1373 in Section 9 of this document.
OEPA NPDES Permit No. 1I000004*FD	Wastewater associated with the Silos 1 and 2 Remediation Facility project must be treated if necessary to ensure compliance with the terms and conditions of the FEMP NPDES permit. DOE is required to notify the Ohio Environmental Protection Agency (OEPA) of any activities or changes at the site which have the	Wastewater must be eliminated, recycled, or minimized during the Silos 1 and 2 Remediation Facility Project to the extent practicable.	Wastewater will be recycled in the AWR and the Remediation facility through the Supernatant Water Systems and the Sluice/ Flush Water System. Wastewater discharges associated with the Silos 1 and 2 Remediation Project and AWR wastes will meet AWWT waste acceptance criteria prior to batch discharge. Expected wastewater generation from the AWR project is specifically included in the NPDES permit renewal	See Section 2 of this document, Systems Description Sections 2.1.6 and 2.1.7.

000128

4654

APPENDIX A-1: CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
	potential to significantly alter the character of the wastewater streams being discharged under its existing NPDES permit. A NPDES permit modification is required if the discharge is deemed significant enough to cause a change in the character of the wastewater stream. The existing NPDES permit must also be modified to reflect the addition of any new point source discharges of process wastewater and storm waters.		application submitted to OEPA in May 2002.	

APPENDIX A-2: LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Endangered Species Protection	50 CFR Part 402; Ohio Revised Code (ORC) 1518, 1513.25; and OAC 1501-18-1-01. Federal agencies must not jeopardize the continued existence of any endangered or threatened species, or destroy and adversely modify critical habitat of such species.	Although the FEMP is located within the range of the Indiana bat, a federally listed endangered species, no sighting has occurred on the FEMP. Therefore, this requirement is relevant and appropriate. Any potential impacts of the remedial actions on this species must be evaluated and appropriate actions taken.	No existing structures or areas potential used as Indiana Bat roosts are expected to be impacted as part of the Silos 1 and 2 Remediation Facility Project.	N/A
National Environmental Policy Act (NEPA) Evaluations	10 CFR 1021.2 DOE actions must be subjected to NEPA evaluation as outlined by the Council on Environmental Quality in regulations 40 CFR 1500-1508.	NEPA requirements for the Operable Unit 4 remediation were originally met by the OU4 FS/PP/EIS, approved through issuance of the ROD on December 7, 1994.	NEPA requirements for the Revised Silos 1 and 2 Remediation Facility were addressed by the Revised FS/PP for Silos 1 and 2 (February 2000) and the ROD Amendment for Silos 1 and 2 (July 2000).	N/A
Compliance with Floodplains/ Wetlands Environmental Review Requirements	10 CFR Part 1022; and Executive Order 11990. DOE actions in a wetland must first evaluate the potential adverse effects those actions might have on the wetland and	This requirement is applicable because the FEMP is a DOE facility. Several alternatives might result in destruction or modification of wetland areas.	Wetlands are not being impacted by the project. All work occurs in areas that have been historically used for OU 4 construction and operations.	N/A

0001130

4654

APPENDIX A-2: LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
	consider the natural and beneficial values served by the wetlands.			

000131

4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Nationwide Permit Program	33 CFR 330. The US Army Corps of Engineers (USACE) can issue a Nationwide Permit (NWP) as a general permit for certain classes of actions that involve dredge or fill activities in wetlands or navigable waters. Discharges of dredged or fill material into wetlands may require wetland delineation.	This requirement is applicable to remediation activities that may require construction of access roads and utility lines resulting in minor wetland disturbances. All dredge and fill activities related to construction of these access roads and utility lines will be conducted in accordance with the substantive terms and conditions of NWP 14 (Road Crossing) and NWP 12 (Utility Line Backfill and Bedding). OEPA has been granted Section 401 State Water Quality Certification for NWP 12 and NWP14.	All of the intrusive work for the Silos 1 and 2 Remediation Facility Project takes place within the of the already developed Silos Project area. No wetlands are to be disturbed. No trees are to be removed. All work occurs in areas that have historically been used for OU 4 construction and operations, and therefore, permitting is not anticipated to be required.	N/A

000132

4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Discharge of Storm Water Runoff	40 CFR 122.26; and OAC 3745-38. Storm water runoff from landfills, construction sites, and industrial activities must be monitored and controlled. A Storm Water Pollution Prevention Plan (SWPPP) is required for construction activities, which result in a total land disturbance of 5 or more acres.	This requirement is applicable to industrial sites and construction site of greater than 5 acres that discharge storm water runoff to the waters of the US. This requirement is applied through the FEMP NPDES Permit.	Stormwater and erosion controls will be implemented in accordance with PL-3083, FEMP Stormwater Pollution Prevention Plan.	Section 6.2 and Appendix B-1 of the Environmental Control Plan for Silos 1 and 2 discusses Erosion and Stormwater Controls. Also see drawings 94X-3900-G-1370 and 94X-3900-G-1373 in Section 9 of this document.
Discharge of Treatment System Effluent	40 CFR 125.100; and 40 CFR 125.104. <u>Best Management Practices</u>: Develop and implement a BMP program to prevent the releases of toxic or hazardous pollutants to waters of the US. Development and implementation of a site-wide BMP Program is also required as a condition of the FEMP NPDES Permit.	The purpose of the BMP program is relevant and appropriate to prevent release from spills or runoff during implementation of remedial actions. The current FEMP NPDES permit does not contain a BMP Plan requirement. BMP requirements have been superseded by the SWPPP.	BMP requirements for management of hazardous materials stored or used in the Silos 1 and 2 Remediation Facility Project (e.g., storage of fuel for an emergency generator) are implemented through the FEMP site SWPPP.	Not applicable.

000133

14654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Ohio Water Well Standards	OAC 3745-9-10. Abandonment of Test Holes and Wells Upon completion of testing, a test hole or well shall be either completely filled with grout or such materials as will prevent contaminants from entering groundwater.	This requirement is applicable to any test borings and wells that might be installed and/or closed as part of these remedial alternatives.	No test holes or monitoring wells are to be abandoned as part of the Silos 1 and 2 Remediation Facility.	See drawing 94 X-3900-G-01367

000134

4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Implementation of Health and Environmental Protection Standards for Uranium Mill Tailings	40 CFR 192, Subpart C. This subpart contains guidance, criteria, and supplemental standards for compliance with Subparts A and B of 40 CFR 192.	This requirement is relevant and appropriate to remediation activities involving Silos 1 and 2 material. Radioactive materials in this operable unit are primarily byproduct residues from uranium processing. Requirements for design of controls should be consistent with design of controls for other residual radioactive materials such as mill tailings.	Appropriate design controls, as discussed for compliance with other ARARs related to controlling and monitoring radon air emissions, are being provided for the RCS. These controls also meet the requirements of this ARAR. Groundwater monitoring is not within the scope of the Silos 1 and 2 Remediation Facility Project.	See Section 6.0 of this document "Silos 1 and 2 Project Environmental Control Plan" Section 6.1.1, Air Emissions Control. .Also see sections on the Radon Control System (RCS) and the Heating, Ventilating, and Air Conditioning (HVAC) Systems in Sections 2, and 5 of this document, for additional information. Expected Stack emissions and ambient air concentrations are discussed in Section 6.0 of this document "Silos 1 and 2 Project Environmental Control Plan" Section 2.2, Estimated Pont Source Air Emission Data.

000135

4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Empty Containers	40 CFR 261.7; and OAC 3745-51-7. Containers that have held hazardous wastes are "empty" and exempt from further RCRA regulations if one or more of the following are met: • No more than 2.5 cm (1 in) of residue remains on bottom of inner liner; • Less than 3% by weight of total capacity remains (≤ 110-gal container); and • Less than 0.3% by weight of total capacity remains (> 110-gal container). Exemption requirements for containers that have held acutely hazardous ("P" listed) wastes are somewhat more restrictive.	The materials in Silos 1 and 2 are specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the materials stored in Silos 1 and 2 are sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibits a hazardous characteristic.) Containers used to treat or store the contents of Silos 1 and 2 might contain residues that exhibit hazardous waste characteristics that may be removed before the containers might be reused or disposed.	Hazardous waste containers are not emptied and reused as part of the work scope under the Silos 1 and 2 Remediation Facility Project.	See the Environmental Control Plan for Silos 1 and 2 Section 6.4 Waste Management Plan.

000136

7-4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Generators Who Transport Hazardous Waste for Off-site Treatment, Storage, or Disposal	40 CFR 262.20 – 262.33; 40 CFR 263.20 – 263.31; OAC 3745-52-20 through 33; and OAC 3745-53-20 through 31. Any generator who transports hazardous waste for off-site treatment, storage or disposal must originate and follow-up the manifest for off-site shipments.	The materials in Silos 1 and 2 are specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silos 1 and 2 are sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibits a hazardous characteristic.) Any wastes determined to be RCRA hazardous waste removed from this operable unit for off-site treatment, storage, or disposal are subject to the manifest requirement.	The generation of secondary waste for the Silos 1 and 2 Remediation Facility Project is to be minimized as much as possible. Newly generated hazardous or mixed waste is not expected from the Silos 1 and 2 Remediation Facility Project that would require off-site treatment, storage or disposal. Stabilized Material from Silos 1 and 2 will insure that lead is chemically bound to meet TCLP standards. Routine sampling of stabilized product for lead will be completed	See the Sampling and Analysis Plan for the Silos 1 and 2 Remediation Facility Project (40750-PL-0006).

000137

4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Treatment, Storage, or Disposal Facility Standards	40 CFR 264, Subpart B; and OAC 3745-54-13 through 16. ***General Standards:*** These include: ***Waste Analysis (OAC 3745-54-13)*** Operators of a facility must obtain a detailed chemical and physical analysis of a representative sample of each hazardous waste to be treated, stored, or disposed of at the facility prior to treatment, storage, or disposal. ***Security (OAC 3745-54-14)*** Operators of a facility must prevent the unknowing or unauthorized entry of persons or livestock into the active portions of the facility, maintain a 24-hr surveillance system, or surround the facility with a controlled access barrier and maintain appropriate warning signs at facility approaches. ***Inspections (OAC 3745-54-15)*** Operators of a facility must develop a	The material in Silos 1 and 2 are specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate to the management and treatment of Silos 1 and 2 materials. Waste removed from this operable unit which exhibits a hazardous characteristic, similar to RCRA hazardous waste, must be treated, stored, and disposed in accordance with treatment, storage, or disposal (TSD) facility standards.	RCRA TSD facility standards apply to the design and operation of the Silos 1 and 2 Remediation Facility, and as such, has been reflected in appropriate design drawings and specifications, as well as operating and maintenance procedures. Representative samples of waste are to be collected in accordance with OAC 3745-54-13 and the Sampling and Analysis Plan for the Silos 1 and 2 Remediation Facility Project Security is provided through the FEMP site security program and inspections performed as appropriate. Attention to ALARA principles is applied to all appropriate Silos 1 and 2 Remediation Facility Project activities.	See the Sampling and Analysis Plan for the Silo 1 and 2 Remediation Facility Project (40750-PL-006).

000138

P-4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Treatment, Storage or Disposal (TSD) Facility Preparedness and Prevention	40 CFR 264, Subpart C; OAC 3745-54-31 through 35; and OAC 3745-54-17. ***OAC 3745-54-31*** – TSD operators must design, construct, maintain, and operate facilities to minimize the possibility of a fire, explosion, or any unplanned sudden or non-sudden release of hazardous waste to air, soil, or surface water which might threat-en human health or the environment. ***OAC 3745-54-32*** – All facilities must be equipped with an internal communication or alarm system, a telephone, or a 2-way radio for calling outside emergency assistance, fire control, spill control, and decontamination equipment and water at an adequate volume and pressure to supply water hose streams, foam producing equipment, automatic sprinklers, or water spray systems. ***OAC 3745-54-33*** – All fire protection and spill control	The material in Silos 1 and 2 are specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silos 1 and 2 are sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibits a hazardous characteristic.) Waste removed from this operable unit which exhibits a hazardous characteristic must be treated, stored, or disposed in accordance with TSD facility standards.	The relevant and applicable TSD facility requirements have been incorporated into the design and operation of the Silos 1 and 2 Remediation Facility Project. Applicable OAC requirements for emergency preparedness and prevention have also been incorporated into the design of the Silos 1 and 2 Remediation Facility Project facilities, as well as the operating and maintenance procedures for the Silos 1 and 2 Remediation Facility Project. These procedures included the testing and maintenance of emergency systems.	See Section 8 Silos Project Health and Safety Controls Document (40000-PL-0014).

000139

7-4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Treatment, Storage, or Disposal Facility Contingency Plan and Emergency Procedures	40 CFR 264, Subpart D; OAC 3745-54-51 through 52; and OAC 3745-54-55 though 56. ***OAC 3745-54-51*** Each facility operator must have a contingency plan designed to minimize hazards to human health or the environment due to fire, explosions, or any unplanned releases of hazardous waste constituents to the air, soil, or surface/groundwater. ***OAC 3745-54-52*** Contingency plans should address procedures to implement a response to incidents involving hazardous waste, and provide for internal and external communications, arrangements with local emergency authorities, and emergency coordinator list, a facility emergency equipment list indicating equipment descriptions and locations, and a facility personnel evacuation plan. ***OAC 3745-54-55 through***	The material in Silos 1 and 2 are specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate to the management of Silo 1 and 2 materials and any secondary waste that exhibit hazardous waste characteristics. Wastes removed from this operable unit which exhibits a hazardous characteristic must be treated, stored, or disposed in accordance with TSD facility standards.	RCRA TSD facility standards apply to the design and operation of the Silos 1 and 2 Remediation Facility Project, and as such, has been reflected in appropriate design drawings and specifications, as well as operating and maintenance procedures. Applicable OAC requirements for emergency preparedness and prevention have also been incorporated into the design of the Silos 1 and 2 Remediation Facility Project facilities, as well as the operating and maintenance procedures for the Silos 1 and 2 Remediation Facility Project. These procedures included the testing and maintenance of emergency systems.	Silos Project Health and Safety Controls (40000-PL-0014, March 2002). FEMP Emergency Plan (PL-3020). Spill Prevention Containment and Countermeasure Plan (PL-2194).

000140

7-4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Closure	40 CFR 264, Subpart G; OAC 3745-55-11; OAC 3745-55-14; and OAC 3745-55-16. Operators must close the facility in a manner that: • Minimizes the need for further maintenance; • Minimizes post-closure escape of hazardous constituents; and • Complies with specific unit type closure requirements. All contaminated equipment, structures and soils must be properly disposed or decontaminated. Following closure, a survey plot showing the location of hazardous waste disposal units with respect to surveyed benchmarks must be filed with the legal total zoning authority.	The material in Silos 1 and 2 are specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate to the management of Silo 1 and 2 materials and any secondary waste that exhibit hazardous waste characteristics.	Closure and D&D of the TTA, RCS and remediation facility will be conducted within the scope of the OU3 D&D activities and is outside the scope of this RD Package.	N/A

000141

4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Container Storage	40 CFR 264, Subpart I; and OAC 3745-55-71 through 78. Containers of RCRA hazardous waste must be: • Maintained in good condition; • Compatible with hazardous waste to be stored; • Closed during storage (except to add or remove waste); and • Managed in a manner that will not cause the container to rupture or leak. Storage areas must be inspected weekly for leaking and deteriorated containers and containment systems. Place containers on a sloped, crack-free base, and protect from contact with accumulated liquid. Provide a containment system with a capacity of 10% of the volume of the largest container of free liquids. Remove spilled or leaked waste in a timely manner.	The materials in Silos 1 and 2 are specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate if the remediated material from Silos 1 and 2 exhibit hazardous characteristics.	The material treated is anticipated to meet TCLP requirements for lead and be devoid of free liquids. The requirements of OAC 3745-55-71 through OAC 3745-55-78 will be addressed in the design and operation of the Silos 1 and 2 Remediation Project.	Section 2.0, Systems Description

0001142

4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Tank Systems	40 CFR Part 264, Subpart J; and OAC 3745-55-91 through 96. Design, operating standards, and inspection requirement for tank units within which hazardous waste is stored or treated. • Tank design must be compatible with the material being stored; • Tank must be designed and have sufficient strength to store or treat waste to ensure it will not rupture or collapse; and • Tank must have secondary containment that is capable of detecting and collecting releases to prevent migration of wastes or accumulated liquids to the environment.	The material in Silos 1 and 2 are specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate to the management of Silos 1 and 2 materials and any secondary waste that exhibit hazardous waste characteristics. Design criteria, operating standards, and inspections for tank treatment units will be relevant and appropriate for alternatives utilizing treatment or storage in a tank prior to disposal.	The tanks and equipment used to store silos material in the Remediation Facility are designed for material compatibility and strength, and also provide secondary containment capable of detecting and collecting releases. Operating standards are to meet FEMP requirements; including the inspection of tank integrity and leak detection systems that are performed by remote closed circuit television (CCTV) technology.	See Section 2 Systems Design Description Document (40750-RP-0001).

000143

4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Closure Requirements for Tanks	40 CFR 264.197; and OAC 3745-55-97. At closure, the facility owner must do the following: • Remove all waste residues; • Remove or decontaminate all tank system components; • Remove or decontaminate all contaminated soils and structures; and • Manage all of the above as hazardous wastes. If all contaminated soils cannot be removed, the landfill requirements of 40 CFR 264.310 apply.	These standards pertain to closure of any tanks and appurtenances used to store or treat Silos 1 and 2 material during remediation. These requirements are relevant and appropriate because circumstances and wastes subject to potential release are similar to those RCRA is designed to address.	Tanks that are used to store or treat silo material are not to be closed under the Silos 1 and 2 Remediation Facility Project scope of work. Equipment or items used in performance of work that require decontamination are to be cleaned per approved plans.	N/A

000144

4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Miscellaneous Units	40 CFR 264, Subpart X; and OAC 3745-57-91 through 92. Environmental performance standard, monitoring, inspection, and post-closure care for treatment in miscellaneous units as defined in 40 CFR 260.10.	The material in Silos 1 and 2 are specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate to the management of Silos 1 and 2 materials and any secondary waste that exhibit hazardous waste characteristics. Miscellaneous units might be utilized under various alternatives to stabilize waste that is sufficiently similar to hazardous waste.	The use of RCRA miscellaneous units is not proposed for the Silos 1 and 2 Remediation Facility Project, and therefore, this requirement does not apply.	N/A

000145

4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Corrective Action for Solid Waste Management Units	40 CFR 264, Subpart S; and 40 CFR 264.552 and 264.553. Corrective Action Management Units might be designated at the site as areas where remediation wastes (solid, hazardous, or contaminated media and debris) might be placed during the process of remediation. Temporary units consisting of tanks and container storage units might be used to store and treat hazardous waste during the process of corrective action.	The material in Silos 1 and 2 are specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate to the management of Silos 1 and 2 materials and any secondary waste that exhibit hazardous waste characteristics. During the process of remediation, waste materials might require temporary management for the purpose of staging or treating material.	While the materials from Silos 1 and 2 are being treated in the Remediation Facility, they could be eligible to be designated as a Corrective Action Management Unit (CAMU). There are no plans to designate any CAMU's for this project. The containerized stabilized product from the Remediation Facility is not anticipated to be a hazardous waste under CERLA. There are no plans to designate the Remediation Facility Containerized Waste Warehouse as a Temporary Unit at this time. These requirements are therefore not applicable.	N/A

000146

F-4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Containment Building	40 CFR 264, Subpart DD. Hazardous waste and debris might be placed in units known as containment buildings for the purpose of interim storage or treatment. Containment buildings must be fully enclosed to prevent exposure to the elements and ensure containment of managed wastes. Floor and containment walls must be designed and constructed of material of sufficient strength and thickness to support themselves, the waste contents, and any personnel and heavy equipment that operate within the operable unit. All surfaces coming in contact with hazardous waste must be chemically compatible with the waste. Primary barriers must be constructed to prevent migration of hazardous constituents into the barrier. Secondary containment systems including secondary barrier and leak detection systems must also be constructed for containment buildings used to man-age wastes	The material in Silos 1 and 2 are specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate to the management of Silos 1 and 2 materials and any secondary waste that exhibit hazardous waste characteristics.	The Silos 1 and 2 Remediation Facility meets the requirements for containment buildings by providing a fully enclosed facility that prevents exposure to the elements while ensuring containment of the waste materials. Compatible materials of sufficient strength and secondary containment and leak detection are provided.	See Section 2 System Design Description Document.

000147

F-4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Radiation Dose Limit (All Pathways)	DOE Order 5400.5, Chap. II, Sec. 1.a (Proposed 10 CFR 834). The exposure of members of the public to radiation sources as a consequence of all routine DOE activities shall not cause, in a year, an effective dose equivalent greater than 100 mrem from all exposure pathways.	DOE Orders are identified as TBCs only when no promulgated ARARs exist, to ensure adequate protection of human health and the environment. Portions of DOE Order 5400.5 were selected as TBCs to ensure adequate protection of public during and following remediation. Radiation sources within this operable unit might contribute to the total dose to members of the public from this DOE facility.	The wastes to be handled as part of the AWR Project exhibit characteristics that may be radiological in nature; however, appropriate design controls, including shielding and layers of containment of the waste features that isolate workers and the public from these wastes, have been applied to the design of the appropriate systems. The law (10 CFR 835) also requires administrative controls to further reduce radiation exposure levels to as low as reasonably achievable (ALARA). ALARA principles are accomplished by radiological protection practices such as maximizing distance between the workers and the radiation source, shielding the workers from the radiation source, or minimizing the time or duration of the workers' exposure to the radiation source.	See Section 3 Silos 1 and 2 Remediation Facility Process Control Plan

000148

7-4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Control of Fugitive Dust	OAC 3745-17-08. Requires the minimization or elimination of visible emissions of fugitive dust generated during grading, loading, or construction operations and other practices, which emit fugitive dust.	The implementation of remedial action alternatives may require the movement of dirt and other material likely to result in fugitive dust emissions. This requirement is relevant and appropriate because the FEMP is not located in an area subject to this regulation.	Potential dust-generating activities that are conducted as part of the Silos 1 and 2 Remediation Facility Project are to be closely monitored for visible emissions, while being controlled using best management practices (BMPs) as necessary. For example, the use of water or other suitable dust suppression chemicals are to be used for controlling dust from activities associated with demolition, construction operations, grading roads, or clearing land. Open trucks are covered when transporting materials likely to become airborne. Also, soil stockpile areas are covered with canvas, plastic, or other suitable material during stockpiling and staging operations. RM-0047 contains the BAT determination for the FEMP site, including the applicable emission standards.	See Section 6. 0 of this Document. Environmental control Plan for Silos 1 and 2 Project (40750-PL-005, Section 6.3 Fugitive Dust Control Plan).

000149

F-4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Prevention of Air Pollution Nuisance	ORC 3704.01-.05; and OAC 3745-15-07. Measures shall be taken to adopt and maintain a program for the prevention, control, and abatement of air pollution in order to protect and enhance the quality of the state's air resource so as to promote the public health, welfare, and economic vitality of the people of the state. The emission or escape into open air from any source whatsoever of smoke, ashes, dust, dirt, grime, acids, fumes, gases, vapors, odors, and combinations of the above in such a manner or in such amounts as to endanger the health, safety, or welfare of the public or to cause unreasonable injury or damage to property shall be declared a public nuisance and is prohibited.	This requirement is applicable to the Silos 1 and 2 Remediation Facility Project activities. Some potential exists for emissions of radionuclides and toxic chemicals to the air, which might endanger individuals or damage property.	Emissions of all materials in the silos are minimized by using sealed hatches and piping. All process vessel vent to the RCS. The RCS is designed to operate at a negative pressure. The RCS stack has an isokinetic sampling system and all discharges are continuously monitored for radioactivity. Stack alarms and backup power are also provided.	See Section 6 of this document. Environmental control Plan for Silos 1 and 2 Project (40750-PL-005, Section 6.1, Air Emissions Control Plan).

000150

7-4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Control of Visible Particulate Emissions from Stationary Sources	OAC 3745-17-07. Discharge of particulate emissions into ambient air from any stack of a shade or density greater than 20% opacity is prohibited. Transient exceedence limits are included in this regulation.	This requirement is applicable to the Silos 1 and 2 Remediation Facility Project activities.	Particulate emissions greater than 20% opacity are not anticipated for the Silos 1 and 2 Remediation Facility Project.	
Permit to Install (PTI)	OAC 3745-31-05 (A)(3). The Director of Ohio Environmental Protection Agency (EPA) shall issue a permit to install if he determines that the installation or modification and operation of the air contaminant source will employ the best available technology, not prevent or interfere with the attainment or maintenance of ambient air quality standards, and not result in a violation of any applicable air pollution control laws.	An administrative PTI is not required for the Silos 1 and 2 Remediation Facility Project. However, the substantive requirements of this section must be met by employing Best Available Technology for treating particulate and off-gas emissions during treatment operations. Ohio EPA may also require stack performance testing to evaluate controls.	Air emissions are controlled via the RCS, which is designed to operate at a negative pressure and includes BAT such as carbon beds and HEPA filtration. Emission monitoring equipment is provided per 40 CFR 61 requirements. HVAC emissions will also meet BAT through HEPA filtration of HVAC exhausts.	Environmental control Plan for Silos 1 and 2 Project (40750-PL-005, Section 6.1, Air Emissions Control Plan).

000151

4654

APPENDIX A-3: ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) REQUIREMENTS

Category	ARAR/TBC Requirement	Requirement Assessment	Compliance Strategy	Cross Reference Index
Ohio EPA Air Toxics Policy [used in conjunction with OAC 3745-31-05 (A)(3)]	The current PTI regulations provide the Director of Ohio EPA with a mechanism to require the evaluation of toxic air contaminants from new sources. The Ohio EPA Air Toxics Policy provides a mechanism for calculating the Maximum Acceptable Ground-Level Concentration for a toxic substance. This value at the site boundary will be modeled to the stack to determine a stack limit. All toxic compounds that will exceed the stack limit shall be controlled administratively or by BAT to lower emissions to below the calculated stack limit.	For toxic compound emissions that are calculated to exceed the established stack limit, administrative controls shall be implemented or emissions shall be controlled by implementing BAT for toxic emissions. Performance of these control measures may be verified through performance testing during operation.	The AWR air pollution control systems are designed and installed per applicable codes, standards, and regulations. Emission monitoring equipment is provided per 40 CFR 61 requirements (Exhibit 3-1 for ARARs relating to radionuclide emissions).	Environmental control Plan for Silos 1 and 2 Project (40750-PL-005, Section 6.1 Air Emissions Control Plan).

000152

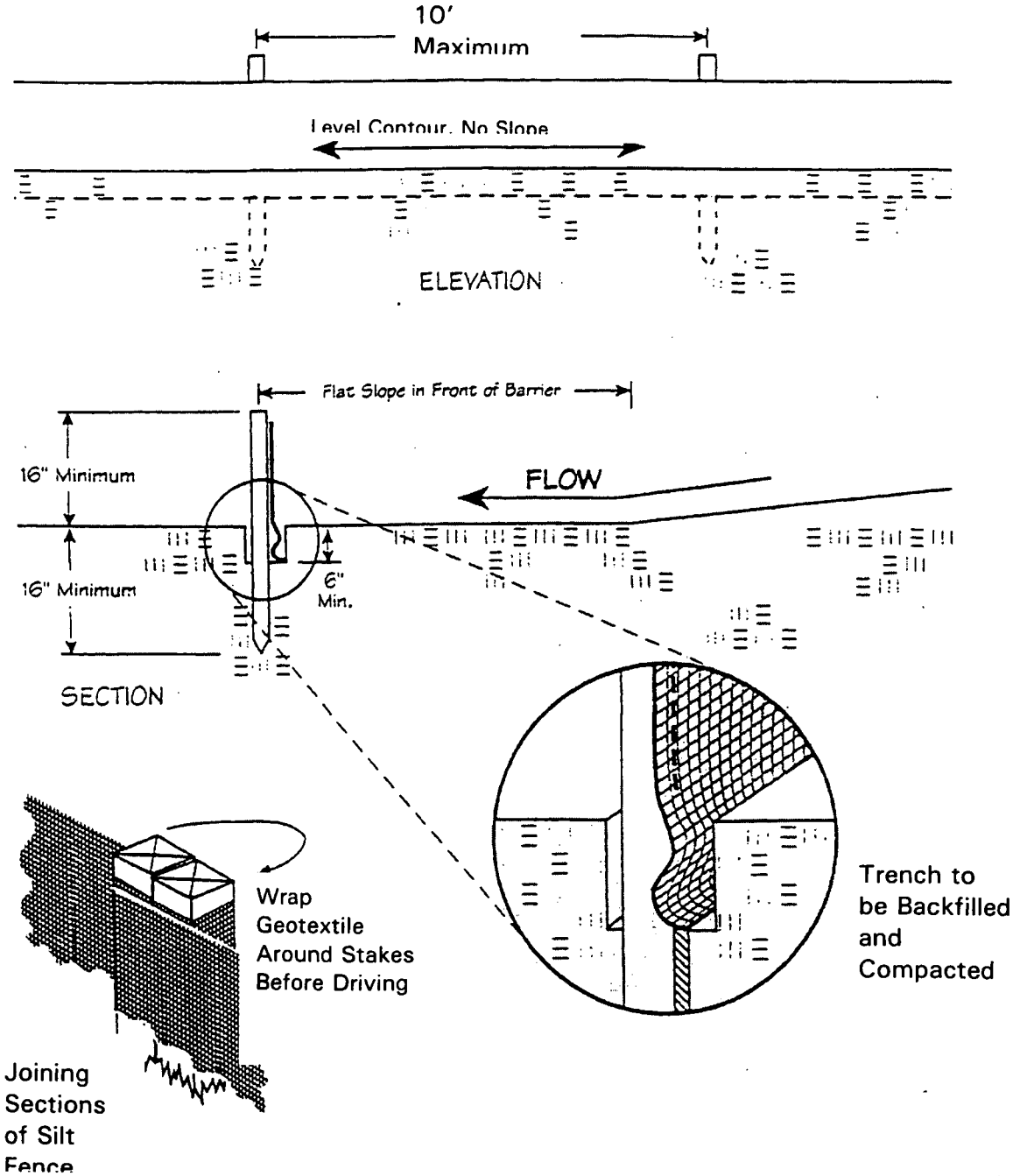
F-4654

-4654

APPENDIX B-1
SILOS 1 AND 2 ENVIRONMENTAL CONTROL PLAN (40750-PL-0005)
EROSION AND STORMWATER CONTROL
FEATURES DETAILS

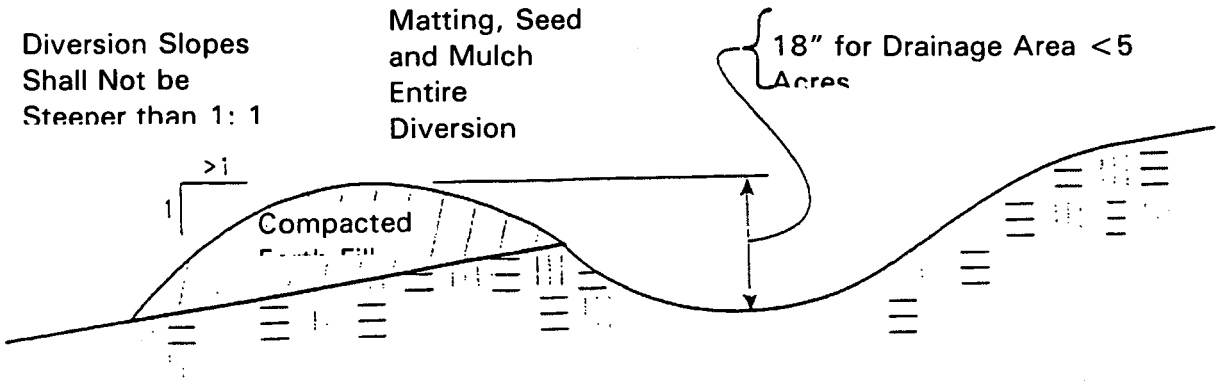
Silt Fence

4654



Temporary Diversion

4654



Diversion shall be compacted by traversing with tracked earth-moving equipment. Diversions shall not be breached or lowered to allow construction traffic to cross; instead, the top width may be made wider and side slopes made flatter than specified above. Diversions shall be stabilized with check dams.

Specifications for Check Dam

4654

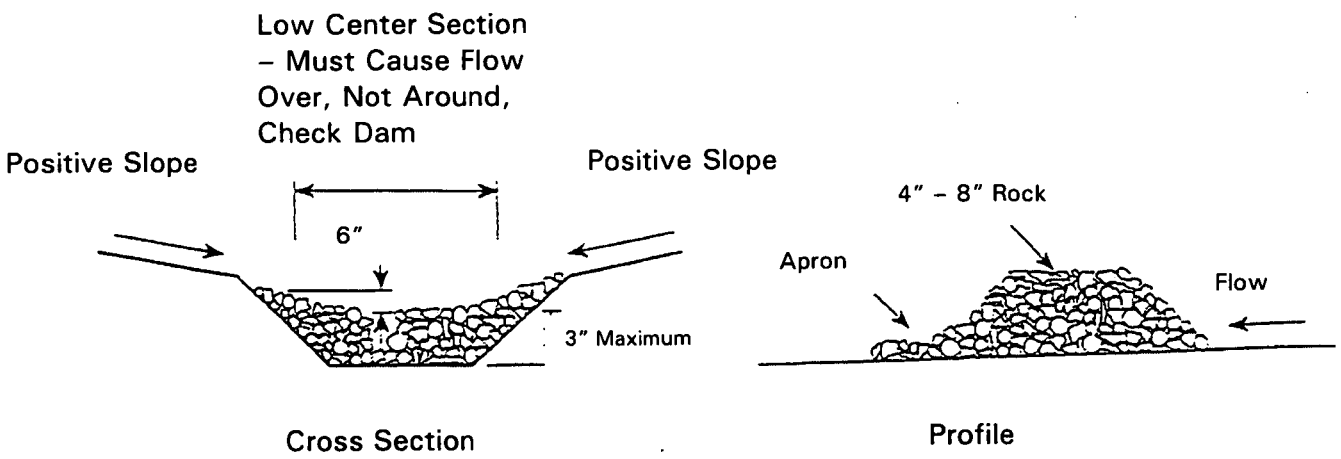
1. The check dam shall be constructed of 4-8 inch diameter stone, placed so that it completely covers the width of the channel.

2. The top of the check dam shall be constructed so that the center is approximately 6 inches lower than the outer edges, so water will flow across the center and not around the ends.

3. The maximum height of the check dam at the center of the weir shall not exceed three feet.

4. Spacing between dams shall be as shown in the plans or by the following table:

Check Dam Spacing				
Dam Height (feet)	**Channel Slope**			
	<5%	**5 – 10%**	**10 – 15%**	**15 – 20%**
1	65 ft.	30 ft.	20 ft.	15 ft.
2	130 ft.	65 ft.	40 ft.	30 ft.
3	200 ft.	100 ft.	65 ft.	50 ft.



000156

4654

APPENDIX B-2
SILOS 1 AND 2 ENVIRONMENTAL CONTROL PLAN (40750-PL-0005)
DAILY RECORDS CONTROL OF FUGITIVE EMISSIONS

000157

Date_____

TIME	AREA TREATED (see sketch)	TREATMENT METHOD	APPLICATION RATE	TOTAL WATER VOLUME	EQUIPMENT OPERATOR/ SUPERINTENDENT	COMMENTS

000158

4654

-4654

APPENDIX B-3
SILOS 1 AND 2 ENVIRONMENTAL CONTROL PLAN (40750-PL-0005)
OFF-HOURS DUST CONTROL PROCEDURE

4654

OFF-HOURS DUST CONTROL PROCEDURE
SILOS 1 AND 2 CONSTRUCTION

Contractor personnel or their subcontractors with responsibilities for the off-hour dust control coverage will retain a copy of the Off-Hour Dust Alert Schedule and a Employee Contact Sheet, both at the Fluor Fernald Site Office and in their vehicle or home, i.e., the schedule and contact sheet should be readily available at all reasonable times.

Contractor personnel or their subcontractors working on Silos 1 and 2 Project construction activities are responsible for being aware of their duties and responsibilities regarding off-hour dust control.

If a scheduling conflict arises, personal or otherwise, the affected person is responsible for making the required revisions to the Off-Hour Dust Alert Schedule to ensure adequate personnel coverage is maintained at all times. The responsible person within Contractor or his designee must approve all revisions to this schedule. A copy of the modified schedule must be distributed to all affected Contractor and Fluor Fernald personnel no later than the Thursday before the affected week in the schedule.

Each week, the Contractor will designate one person as the qualified water wagon operator and one person as the sprinkler system operator. The Contractor DPC and the designated operators must be fully trained and medically cleared to operate in a Controlled Area.

When the Contractor is notified by Fluor Fernald that Off-Hour Dust Control is required, the Contractor DPC or his/her equivalent will contact the designated operators and coordinate the implementation of this dust control procedure, as detailed in approved Fugitive Dust Control Plan.

If either of the designated operators have not responded within 15 minutes of initial attempts to contact them, alternative operators will be contacted until available operators can be found. These operators must also be fully trained and medically cleared to operate in a Controlled Area.

It is the responsibility of the Contractor DPC to keep the designated Fluor Fernald Management Contact informed of all efforts to contact operators and to give details concerning their estimated arrival times at the Silos 1 and 2 Project site.

Once on-site, the Contractor DPC and operators, together with the designated Fluor Fernald contact will implement the Emergency Dust Control measures including, but not necessarily limited to, the Fugitive Dust Control Plan and the preparation of a Safe Work Plan.

4654

The Contractor DPC is responsible for documenting Contractor's efforts, including contacts and response times, and communicating the same to Fluor Fernald and the Silos 1 and 2 Project Management. The Off-Hour Dust Alert Work Order must be filled out by the Contractor and countersigned by the designated Fluor Fernald representative prior to the Contractor leaving the Silos 1 and 2 Project site. Note: Off-Hours Dust Control is an additive unit pay item to the Silos 1 and 2 Project contract and must be properly documented for payment.

OFF-HOURS DUST ALERT WORK ORDER

4654

Date of Response: _____

Time of First Contact by Fluor Fernald: _____

Management Person Responding: _____

Operators/Laborers Contacted

_____ _____ _____

_____ _____ _____

_____ _____ _____

Operators/Laborers Responding

_____ _____ _____

Time Manager on Site: _____

Time Operator/Laborer on Site: _____

Time Suppression Activities End: _____

Total Elapsed Site Time: _____

Description of Situation Causing Alert:

_____

_____

Suppression Material and Equipment Utilized (including quantities):

_____

_____

Describe Area Treated (attach sketch if necessary):

_____

_____

By: Contractor's Representative
Fluor Fernald

Concurrence of Response Completion by

4654

APPENDIX B-4
SILOS 1 AND 2 ENVIRONMENTAL CONTROL PLAN (40750-PL-0005)
MATERIAL SEGREGATION AND CONTAINERIZATION CRITERIA

Material Segregation and Containerization Criteria
SWIFTS Project # **Revision #**

Task	Waste Stream	Preferred Containers								Size Criteria
		Large Metal Box (top loader)	Small Metal Box		ISO	Drum	Roll-off Box	Dumpster	No. Containers	
			B-12	B-25						

Categories:
A – Accessible metals
B – Inaccessible metals including projections)
C – Process-related metals
D – Painted, light gauge material
E – Concrete
F – Acid brick
G – Non-regulated ACM
H – Regulated ACM
I – Miscellaneous materials
J – Special materials

Footnotes:

Size Criteria:
1 – Maximum size = 10′ long x 4′ wide x 1′ high (including projections)
2 – Maximum size = 10′ long with 1′ projection (max height: 1.5′
3 – Maximum size = 6′ long x 4′ wide x 1.5′ high
4 – Transit bundles 8′ long x 4′ wide x 1.5′ high
5 – Piping w/> 12″ diameter must be split in half lengthwise
6 – Cut tires in half radially
7 – Leave intact

000164

F-4654

4654

APPENDIX B-5
SILOS 1 AND 2 ENVIRONMENTAL CONTROL PLAN (40750-PL-0005)
ESTIMATED AMOUNTS OF EACH TYPE OF WASTE STREAM

4654

ESTIMATE OF WASTE DURING CONSTRUCTION

Waste Type	Estimated Volume (yd^3)
Soft Waste	50
Construction Debris	60
Soil	25,000[R]
Caulking, sealers	15
Underground Debris	30[R]

[R]Denotes potential radiological contamination

ESTIMATE OF WASTE DURING OPERATIONS

Waste Type	Estimated Volume (ft^3)
Sampling Waste	800[R]
PPE	3,585[R] 5,040
Spent Pre-filters	384[R] 1,416
Spent Primary Filters	768[R] 1,332
Spent HEPA Filters	384[R] 96
Chemical Additive Drums	180
Containerizing Waste	1058[R]
Failed Equipment	1,200[R]
Miscellaneous and Maintenance Waste	1,000[R]

000166

APPENDIX C

4654

SAMPLING AND ANALYSIS PLAN FOR THE SILOS 1 AND 2 REMEDIATION FACILITY PROJECT

Document No. 40750-PL-0006
August 2, 2002
Revision A

FERNALD
Environmental Management Project

Prepared Under DOE

Contract No. DE-AC24-01OH20115

Revision	Prepared By:	Reviewed By:	Approved By:	Date:	Pages Affected:
A					

Revision Sheet			
Revision	**Date**	**Pages Affected**	**Reason for Revision**
A	8/1/02		

4604

TABLE OF CONTENTS

ACRONYMS v

1.0 INTRODUCTION 1
- 1.1 BACKGROUND 1
- 1.2 SCOPE AND PURPOSE OF PLAN 1
- 1.3 ORGANIZATION OF PLAN 1

2.0 DQOs AND QC 3
- 2.1 DQOs AND INTENDED USE OF ACQUIRED DATA 3
  - 2.1.1 Slurry Receipt Tanks 3
  - 2.1.2 Slurry Feed Tanks 3
  - 2.1.3 Wastewater 3
  - 2.1.4 Stabilized product ..... **Error! Bookmark not defined.**
  - 2.1.5 Air Emissions 4
- 2.2 ELEMENTS OF QC 5
  - 2.2.1 Field QC Samples 5
  - 2.2.2 Laboratory QC Samples 5
  - 2.2.3 Method Blank 6
  - 2.2.4 Matrix Spike/Matrix Spike Duplicate 6
  - 2.2.5 Analytical Methods 6

3.0 SAMPLING MEDIA AND SOURCES 8
- 3.1 SLURRY 8
- 3.2 WASTEWATER 9
- 3.3 STABILIZED PRODUCT ..... **ERROR! BOOKMARK NOT DEFINED.**
- 3.4 HVAC STACK ..... **ERROR! BOOKMARK NOT DEFINED.**

4.0 SAMPLING AND ANALYTICAL METHODS 10
- 4.1 SLURRY 10
  - 4.1.1 Sample Collection and Field-Screening 10
  - 4.1.2 Analytical Methods 10
- 4.2 WASTEWATER 11
  - 4.2.1 Sample Collection and Field-Screening 11
  - 4.2.2 Analytical Methods 11
  - 4.2.3 Remaining Analytical Methods 13
- 4.3 STABILIZED PRODUCT SAMPLES 13
  - 4.3.1 Sample Collection and Field-Screening 13
  - 4.3.2 Analytical Methods 13
- 4.4 AIR EMISSIONS 14
  - 4.4.1 Stack Monitoring 14

000170

4654

5.0 DOCUMENTATION AND RECORD KEEPING 16
5.1 LOGBOOK 16
5.2 SAMPLE CONTAINER LABELING 17
5.3 SAMPLE PACKAGING AND SHIPPING 18
5.4 CHAIN-OF-CUSTODY 19
5.5 RECORDS STORAGE 20
5.6 ANALYTICAL DATA 20
5.6.1 Slurry Samples 20
5.6.2 Wastewater Samples 20
5.6.3 Stabilized product Samples 21
5.6.4 Air Emission Samples 21
6.0 REFERENCES 22

APPENDIXES

APPENDIX A Advanced Wastewater Treatment Facility Acceptance Criteria
APPENDIX B Summary of Analytical Procedures, Containers, Preservatives, and Holding Time Requirements for Project Samples

000171

4654

ACRONYMS

ALARA	as low as reasonably achievable
ASL	Analytical Support Level
AWR	Accelerated Waste Retrieval
AWWT	Advanced Wastewater Treatment
CFR	Code of Federal Regulations
COC	chain-of-custody
CSL	Contract Services Laboratory
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQO	data quality objectives
EML	Environmental Measurements Laboratory
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
HVAC	heating, ventilation , and air conditioning
IS	Internal Standards
LCS	laboratory control samples
MD	matrix duplicate
MS	matrix spike
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
SAP	Sampling and Analysis Plan
TCLP	Toxicity Characteristic Leaching Procedure
TTA	Transfer Tank Area
WAC	waste acceptance criteria

000172

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) addresses the requirements for the collection and analysis of slurry and wastewater samples associated with the Silos 1 and 2 Remediation Facility Project at the U.S. Department of Energy (DOE) Fernald Environmental Management Project (FEMP) site near Cincinnati, Ohio. This SAP has been developed and shall be executed in accordance with the Sitewide Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Quality Assurance Project Plan (QAPP) (FD-1000).

1.1 BACKGROUND

The source of contamination for the Silos 1 and 2 Remediation Facility Project is the residues in Silos 1 and 2 subsequent to their transfer to the Transfer Tank Area (TTA). The goal of the Silos 1 and 2 Remediation Facility Project is to stabilize these residues into a stabilized product. Since the Silos 1 and 2 Remediation Facility Project involves wet mining or sluicing of material, water contacting the residues will also require sampling and analysis to evaluate treatment options.

The Silos 1 and 2 material is transferred by adding water through a sluicing device and pumped as a slurry through the transfer line from the shielded TTA to the Silos 1 and 2 Remediation Facility. The excess water used for sluicing will be recycled with the Silos 1 and 2 Remediation Facility until the end of treatment operations. Excess water remaining after treatment will be sampled and analyzed for transfer to the Advanced Wastewater Treatment (AWWT) facility. The Silos 1 and 2 material will be encapsulated in the stabilized product and transported to Envirocare, Inc., of Utah or other suitable disposal facility for burial. The SAP is developed using the data quality objective process recognized by the U.S. Environmental Protection Agency (EPA). The data quality objectives (DQOs) described in Document No. 624-P621-12, Data Quality Objectives will be followed to the extent applicable for the Silos 1 and 2 Remediation Facility Project.

1.2 SCOPE AND PURPOSE OF PLAN

The purpose of this SAP is to describe the sampling and analysis efforts associated with process control, waste acceptance, and emission monitoring for the Silos 1 and 2 Remediation Facility. The goals of sampling efforts for the Silos 1 and 2 Remediation Facility Project are:

- Collect sufficient data to maintain process control, thereby eliminating the need for repetitive analytical procedures,
- Ensure that the waste product and secondary wastewater meet the acceptance criteria of their respective treatment/disposal facilities, and
- Meet environmental criteria for releases.

1.3 ORGANIZATION OF PLAN

This SAP and its implementation will comply with the FEMP Sitewide Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) QAPP (FD-1000) and applicable local, state, and federal regulatory requirements.

Section 1 of this SAP describes project background and the purpose and scope of this Plan. Section 2 describes the DQOs and quality control (QC) associated with the sampling and analysis activities for the project. Section 3 describes the sampling media and sources, while Section 4 provides an overview of the field sampling procedures. Section 5 discusses the appropriate documentation and record keeping related to sampling for the project, including chain-of-custody (COC) and records management, and Section 6 lists the references used in the preparation of this Plan. In addition to the text of this SAP, supporting technical information is provided in appendices to this Plan, as listed below:

- Appendix A — Advanced Wastewater Treatment Facility Acceptance Criteria
- Appendix B — Summary of Analytical Procedures, Containers, Preservatives, and Holding Time Requirements for Project Samples

The guidelines presented in the appendices relating to sample collection methods will be used in the development of detailed project procedures. Detailed sampling procedures will be prepared as part of the operational procedures associated with operations.

4654

2.0 DQOs AND QC

This section provides an overview of the DQOs and QC elements associated with the sampling and analysis efforts. The treatment process has been designed to be flexible enough to handle variable feeds, and based on treatability study results, field screening for percentage of solids and pH provides sufficient information to make chemical or dry additive dosing decisions. However, to quantify the radium-226 levels to ensure compliance with disposal facility's WAC, definitive measurements will be required until in-line instrumentation can be baselined reliable. Initially, a sample will be collected and analyzed for every batch until process control can be established. At the point where process control is established (i.e., in-line radiation detection equipment provides consistent radiological signature compared to definitive results), the definitive sampling frequency will be reduced in accordance with ALARA principles.

2.1 DQOs AND INTENDED USE OF ACQUIRED DATA

As defined by EPA, DQOs are qualitative and quantitative statements developed to specify the quality of data from field and laboratory data collection activities needed to support specific decisions. The DQOs describe the required quality level of data needed, why the data are needed, and how the data will be used to support process operations. DQOs also ensure that the data collected are of sufficient quality and quantity for the data user's application. The DQOs outlined for the Accelerated Waste Retrieval (AWR) Project in Document No. 624-P621-12, Data Quality Objectives, will be followed to the extent applicable. The quantity of samples expected to verify process control and subsequently verify waste acceptance are presented in Table 1 located in Section 3.

2.1.1 Slurry Receipt Tanks

Screening level data will be used to make treatment decisions at various points throughout the process. Screening level data will be used to make decisions regarding the amount of flocculation and/or stabilization chemicals to add, as well as determining percentage of solids to estimate the mass flow of slurry during the transfer of slurry from the slurry receipt tanks to the clarifier.

During the treatment process, representative samples are needed for each batch in sufficient time to adjust flow rates, chemical dosing, etc. This is the primary reason screening level analyses have been selected over definitive data analyses that would require off-site laboratory testing. These screening level data points will be collected in accordance with the Fernald QAPP.

2.1.2 Slurry Feed Tanks

Definitive data will be required for comparison to the disposal facility WAC. Based on preliminary indications, radium-226 analysis will be the only parameter subject to definitive data analysis. Screening level data will also be used to validate the mass flow meters by means of a percent solids analysis. The Fernald QAPP will be the governing protocol for this sampling event.

2.1.3 Wastewater

Definitive data from an off-site laboratory will be used in determining whether wastewater is acceptable for transfer to the AWWT facility. Typical sources of wastewater on the

4654

Silos 1 and 2 Remediation Facility project include excess water from processing, condensate drains, fire suppression water. The laboratory will then perform a two-step confirmation process. The laboratory will first determine whether the radionuclide criteria are met, and if so met, will then conduct the metals and general chemistry analyses. A summary of analytical procedures, containers, preservatives, and holding time requirements for wastewater samples is provided in Appendix B of this SAP.
Representative samples are needed from each batch of wastewater in sufficient time prior to planned discharge. This time frame must allow field screening, sample packaging, and shipment to the laboratory for analysis, data receipt and reporting, etc., as required, to determine that the AWWT facility's waste acceptance criteria (WAC) are met. The transfer of wastewater to the FEMP AWWT facility cannot occur until the approval of AWWT Operations is obtained.
The WAC for transfer of wastewater to the AWWT facility is provided in Appendix A of this SAP.

2.1.4 Stabilized product

Definitive data will be generated from the analyses of the stabilized product samples for isotopic alpha and gamma and Toxicity Characteristic Leaching Procedure (TCLP) lead analyses when needed. The data will be used to demonstrate compliance with the disposal facility's WAC.

2.1.5 Air Emissions

Air emissions associated with the Silos 1 and 2 Remediation Facility Project must meet applicable DOE and EPA environmental regulations. Air emissions from the building's heating, ventilation , and air conditioning (HVAC) system stack will be monitored to ensure that appropriate air emission standards are not exceeded for radon or particulate. Monitoring the radon concentrations in the HVAC stack is required to demonstrate compliance with requirements for on-site and off-site concentrations. Monitoring the particulate emissions in the HVAC stack using an isokinetic sampler [supplemented by Contract Services Laboratory (CSL) analyses of filter paper composites] is required to demonstrate compliance with the dose limit in Title 40 of the Code of Federal Regulations (CFR) Part 61, Subpart H. Emissions from the HVAC stack will also be monitored for compliance with other applicable emissions standards. The monitors used for this sampling (both radon and particulate emissions) are described in Section 4 of this SAP.
As stated, monitoring of particulate emissions will be conducted using an isokinetic sampler in the HVAC stack. The filter from the continuous monitor will be changed every 2 weeks or monthly if it can be shown that there is no significant buildup of particulates. Also, the monitor will be inspected when the filter is changed. These filter papers will then be analyzed using the methods identified in Appendix B of this Plan to confirm data from the monitor, as well as to document compliance with 40 CFR 61. In addition, semiannual composites of these filters will be analyzed, with resulting data used in the calculation of the total effective dose equivalent. This value is combined with the dose values from other Fluor Fernald activities at the FEMP site to demonstrate compliance with 40 CFR 61 and DOE Order 5400.5. The semiannual composites will also be analyzed for lead to demonstrate compliance with Ohio Administrative Code 3745-31-05(A)(3), "Permit to Install New Sources of Pollution."

4654

Air emissions from the process ventilation system will be treated using the existing Radon Control System. Sampling and analysis pertinent to this system is addressed in the Accelerated Waste Retrieval SAP.

The continuous air monitoring systems, as later described in Sections 3 and 4 of this SAP, are used to assess HVAC system operations and process control, as well as to signal any need for corrective actions to prevent on-site or public exposures to air emissions exceeding established limits. These monitoring systems will have alarms that are preset to provide timely warnings to operations staff. Mitigation measures and corrective actions will be implemented accordingly. In the same sense, if the radon concentrations do not exceed the preset alarm level for the stack monitors, then the HVAC system is functioning within limits and no mitigative actions are required.

2.2 ELEMENTS OF QC

This section presents QC requirements relevant to the analysis of slurry, wastewater, stabilized product, and air emission samples that shall be followed during analytical activities producing definitive data (i.e., data not measured using on-site instruments) for the project. The purpose of these requirements is to produce data of known quality that satisfy the project's DQOs and that meet or exceed the requirements of the standard methods of analysis. These requirements provide a mechanism for ongoing control and evaluation of data quality measurements.

QC samples [e.g., blanks and laboratory control samples (LCSs)] will be included in the preparation batch with the field samples. The preparation batch is a number of samples (not to exceed 20) that are similar in composition and that are extracted or digested at the same time and with the same lot of reagents. The identity of each preparation batch will be unambiguously reported with the analyses so that a reviewer can identify the QC samples and the associated slurry, wastewater, stabilized product, or air emission sample. The type of QC samples used for spiking will include the analytes of interest. Additional QC samples may be added to those required by the method to ensure accurate and precise data.

2.2.1 Field QC Samples

2.2.1.1 Field Duplicate

A field duplicate sample is a second sample collected at the same location as the original sample. Duplicate sample results are used to assess precision, including variability associated with both the laboratory analysis and the sample collection process. Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. Field duplicates shall be collected and analyzed for 10 percent of the samples per matrix. The sample containers will be assigned a control number so that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel performing the analysis.

2.2.2 Laboratory QC Samples

2.2.2.1 Laboratory Control Sample

An LCS is an aliquot of a contaminant-free matrix fortified (spiked) with a known concentration of compound. Samples shall have an LCS spiked with all appropriate

4654

analytes of interest. An LCS shall be prepared and analyzed with each batch of samples. The LCS is subjected to the entire analytical procedure to evaluate method performance. Percent recovery determinations from these control samples shall be monitored to provide a continuous measure of each method's accuracy.

When an analyte in an LCS is outside the acceptable recovery limit, corrective action must be performed. After the system problems have been resolved and system control has been reestablished, samples in the analytical batch will be reanalyzed. When an analyte in an LCS exceeds the upper or lower control limits and no corrective action is performed, an appropriate validation flag shall be applied to affected results.

2.2.2.2 Internal Standards

Internal Standards (ISs) are measured amounts of certain compounds added prior to analysis of samples. These standards are used in an IS calibration method to correct sample results by columns injection losses or viscosity effects. ISs shall be added to environmental samples, controls, and blanks in accordance with method requirements. When the IS results are outside the acceptance limits, corrective action must be performed. If corrective actions are not performed, then an appropriate validation flag shall be applied to the sample results.

2.2.2.3 Method Blank

A method blank is defined as a laboratory-demonstrated, analyte-free matrix that is carried through the entire analytical procedure. A method blank is prepared and analyzed for each batch of samples for applicable parameters. The method blank is used to determine the level of laboratory background contamination. Unfavorable method blank results render associated data suspect and require corrective action and/or data qualification.

The presence of analytes in a method blank at concentrations greater than the practical quantification limit indicates a need for corrective action. Corrective actions shall be performed to eliminate the source of contamination prior to proceeding with analyses. No analytical data will be corrected for the presence of analytes in blanks. When an analyte is detected in the blank and in the associated samples and corrective actions are not necessary, an appropriate validation flag shall be applied to the sample results.

2.2.2.4 Matrix Spike/ Matrix Duplicate

An aliquot of a matrix (e.g., water) is fortified, or spiked, with a known concentration of target compounds. The spike solution will consist of the same compounds used for the LCS. The matrix spike (MS) is subjected to the entire analytical procedure to indicate accuracy of the method for the matrix by measuring the percent recovery. A matrix duplicate (MD) is subjected to the entire analytical procedure as an unspiked duplicate aliquot of the original sample. The MD results are compared to the original sample results to measure precision of the analytical process. These samples are also used to assess matrix interference effects on the method, as well as to evaluate instrument performance. MS/MD shall be analyzed for each analytical batch to maintain continuous surveillance of acceptable method performance.

2.2.3 Analytical Methods

Analysis of the slurry, wastewater, stabilized product, and air emission samples shall comply with methods approved or recognized by EPA and/or other regulatory agencies.

The analytical methods for the slurry, wastewater, stabilized product, and air emission samples are identified in Appendix B per the Fernald QAPP.

4654

4654

3.0 SAMPLING MEDIA AND SOURCES

Slurry, wastewater, stabilized product, and air emission samples will be collected and analyzed as part of the project. This section describes these samples and their respective sources. Section 4 and related appendices of this SAP provide details regarding the respective guidelines used for sample collection and methods of analysis for the slurry, wastewater, stabilized product, and air emission samples for the project.

Sample collection and analysis will be performed using a graded approach because of the radiological hazards associated with the Silos 1 and 2 material. During initial process operations, samples will be taken on a relatively frequent basis, and once stable process control has been achieved, sampling frequency will be decreased. During initial startup and following upset conditions, all slurry batches will be sampled and analyzed. Once stable process conditions are achieved for at least three days of operation (approximately 90 batches), the sampling frequency will be reduced. Screening-level and definitive data will be used to verify process instrument readings. When it is demonstrated that process instruments provide accurate and reliable measurements of process conditions (after approximately 2 weeks), sample frequencies are further reduced to maintain ALARA concepts. If it is determined that an instrument is no longer providing accurate measurements, this would be considered an upset condition, followed by increased sampling. This graded approach is presented in Table 1, Sampling and Analysis.

Initial slurry percent solids and pH will be determined to set the process to a prescribed recipe. While not a typical QC hold point, a sample is drawn and analyzed to provide data on the initial conditions.

Likewise, the composition of the intermediate slurry feed is needed so that the recipe can be adjusted to ensure that the final product will meet all of the process objectives. Slurry feed material is tested to verify the percent solids content and radium-226 content.

Testing and calibration of the additive measurement equipment is also necessary to ensure that the amount of material added to the process as prescribed by the recipe is accurate. Provisions have been made to randomly sample the final product during container filling operations.

3.1 SLURRY

The slurry matrix consists of K-65 solid residues, BentoGrout®, and water. The slurry will be sampled in two locations within the facility: the Slurry Receipt Tank sampling loop and the Slurry Feed Tank sampling loop. In the Slurry Receipt Tank sampling loop slurry samples will be collected with solids concentrations ranging from 5–15 weight percent where as the Slurry Feed Tank sampling loop will have solids concentrations ranging from 20–40 weight percent solids.

Table 1. Sampling and Analysis

Sample Location	Analyses Performed	Graded Approach	Sample Frequency	QC Verification

4654

Slurry Receipt Tank Sampling Loop	% solids pH	Startup/Upset	1 sample/tank	FE-PMP-13-1000A/B/C (flow) DE-TNK-13-1000A/B/C (density)
		Initial Control	1 sample/day	
		Verified Control	1 sample/week	
Slurry Feed Tank Sampling Loop	% solids Radium-226	Startup/Upset	1 sample/tank	AE-PMP-16-1001A/B/C (flow/density) AE-TNK-16-1000A/B/C (radiation)
		Initial Control	1 sample/day	
		Verified Control	1 sample/week	
Product Mixer Fill Chute	% solids Radium-226 TCLP Lead	Startup/Upset	1 sample/batch	Treatability Test Results Waste Acceptance Criteria
		Initial Control	1 sample/15 batches	
		Verified Control	1 sample/30 batches	

3.2 WASTEWATER

Water will be used to hydraulically transport silo residues from the TTA into the Silos 1 and 2 Remediation Facility. During the treatment process, the slurry will be thickened in a clarifier. The resulting clarifier overflow water will be collected and recycled for further sluicing operations. Following treatment operations the remaining water will require disposal. The AWWT facility has been identified as the primary treatment facility for this waste stream. Wastewater samples will be collected from a sampling system located adjacent to the Sluice/Flush Water and Supernatant Tanks. If attainment of the AWWT facility's WAC is not initially feasible, pre-treatment may be required followed by resampling to verify attainment of the AWWT WAC.

3.3 STABILIZED PRODUCT

The Silos 1 and 2 Remediation Facility is designed to treat silo material by stabilizing the material in a concrete matrix for off-site disposal. The stabilized matrix will consist of K-65 solids, BentoGrout®, water, Type F fly ash, and Type I portland cement.

3.4 AIR EMISSIONS

Air emissions from the Silos 1 and 2 Remediation Facility are controlled using a ventilation system that ensures that air flow is from uncontaminated areas through potentially contaminated areas to the HVAC stack. To ensure compliance with the regulations listed in Section 2.1.5, air emissions will be monitored continuously using a continuous emission monitor.

4.0 SAMPLING AND ANALYTICAL METHODS

4654

Representative samples must be collected to appropriately characterize process slurry, wastewater, stabilized product, and air emissions from the project in accordance with this SAP. Collection, handling, and shipment of samples will be performed according to project procedures, as low as reasonably achievable (ALARA) practices, and applicable U.S. Department of Transportation (DOT) shipping guidelines.

4.1 SLURRY

To ensure that representative samples are collected, each tank system is continuously agitated, normally at two to three tank volume turnovers a minute to maintain solids suspension.

Prior to sample collection, the slurry sampling loop will be pumped to ensure that at least one-line volume of material has been removed from the sampling loop piping prior to collection of a sample. Following the initial sampling loop purge, slurry will be recirculated through the sampling loop until the desired sample volume has been collected.

Slurry samples will be collected from specially designed samplers with hardened construction. These sampling systems have been designed specifically for abrasive solids applications and consist of a pneumatically operated piston that retrieves small aliquots (e.g., 5- to 25-mL) from each cycle depending on sample volume requirements. Depending on the nature of the analysis, multiple piston cycles will be required to retrieve sufficient sample material. Typically sample collection will last approximately one minute.

4.1.1 Sample Collection and Field-Screening

Slurry samples will be collected using a dedicated in-line sampler for each sampling loop. The in-line samplers will be contained within glove boxes to eliminate radon emissions during sample handling. Samples will be collected in a polyethylene bottles. Following sample collection, the sample containers will be detached from the in-line sampler and sealed with a lid. The filled sample container will be transferred out of the sampling glove box to an analysis glove box located in the sampling area.

In the analysis glove box, a small aliquot of slurry will be used to test for the mixture's percentage of solids using a microwave analyzer. The remaining unused slurry mixture will be analyzed using a pH probe to estimate solution pH. In the Slurry Feed Tank sampling loop, additional sample volume, approximately 100 mL, will be collected for gamma spectroscopy analysis. The intent of the gamma spectroscopy analysis is to quantify the level of radium-226 in the slurry and confirm the accuracy of the in-line radiation detector.

4.1.2 Analytical Methods

Samples offered for gamma spectroscopy will be analyzed using high-resolution gamma spectrometry with a large, sensitive germanium detector system. This system will use a multichannel analyzer and sophisticated software to identify the energy of specific gamma peaks and quantify the concentrations of radionuclides (e.g., protactinium-231, radium-226, thorium-228, thorium-230, thorium-232, uranium-234, and uranium-235). This system will be calibrated in accordance with applicable standards using a weighted mean methodology and will have sufficient sensitivity and accuracy to measure the concentration of radium-226 in activity concentrations ranging from 35,000 to over 300,000 pCi/g. Since the quantity of radium-226 in the slurry is abundant, the sample

000182

4654

size and count time can be reduced to minimize exposures to analysis technicians. Preliminary calculations have identified a sample size of approximately 100 mL and a count time of 10–25 minutes. Results from these analyses will be used to make decisions on the dry additive quantities required for solidification and attainment of disposal facility's WAC.

4.2 WASTEWATER

The design of the sampling loop for the Sluice/Flush Water and Supernatant Tanks facilitates the collection of wastewater samples. Each tank is considered a batch release and will be circulated or agitated, as required, to ensure a representative sample of tank contents.

To ensure a representative wastewater sample is collected from the tanks, the tank volume will be agitated for at least 1 hour to ensure uniform suspension of settled solids, if present. In addition to agitation, the sampling loop will be purge with at least one line volume of agitated tank contents. This one line volume will include water held in the piping from the individual tank to the sampling port.

4.2.1 Sample Collection and Field-Screening

Wastewater samples will be collected from glove box sampling stations located on the recirculation loop of the Sluice/Flush Water and Supernatant Tanks. The wastewater sampler will consist of a purgeable flow through design similar to a Dopak DPM Process Sampler. The DPM type sampler has ability to purge the sample point ensuring optimal retrieval of a representative and contamination free sample. The DPM type sampler in system purge configuration allows product to flow continuously through the sampler ensuring a fresh sample.

For field screening of wastewater samples, the samples need to be properly collected and analyzed by gamma spectroscopy to determine the presence of specific radionuclides and, if present, determine the quantities for each nuclide present. Samples of wastewater (approximately 1 liter or less) will be collected in plastic (or glass) bottles. The outside of the bottles will be cleaned and bagged to prevent cross contamination, and the bottles will be field-screened with a gamma spectroscopy system. This system will consist of a sodium iodide detector and a multichannel analyzer. Procedure Ga-01-R of DOE's Environmental Measurements Laboratory (EML) Procedures Manual, HASL-300, will be used for this screening analysis. Gamma spectrum analysis software will be used to estimate the concentration of predominant radionuclides present (e.g., radium-226, thorium-228, etc.). Samples passing the screening analyses should have a high probability of meeting the AWWT facility's WAC.

In summary, those samples that are likely to meet AWWT facility's WAC (i.e., they pass the field screening) will be submitted to the laboratory for more definitive confirmatory analysis. Those samples that are likely not to meet the WAC (i.e., they fail the field screening) may be used to plan further treatment of the wastewater.

4.2.2 Analytical Methods

Samples that pass the field screening evaluations are sent to a laboratory for a more definitive determination using high-resolution gamma spectrometry analysis with a large, sensitive germanium detector system. This system will use a multichannel analyzer and sophisticated software to identify the energy of specific gamma peaks and quantify the

concentrations of radionuclides (e.g., protactinium-231, radium-226, thorium-228, thorium-230, thorium-232, uranium-234, and uranium-235). This system will be calibrated in accordance with applicable standards using a weighted mean methodology and will have sufficient sensitivity and accuracy to measure the concentration of the radionuclides in the wastewater samples to levels approximately one-half of the specified AWWT facility's WAC. 4654

Both typical and alternative analytical methods, or approved equivalents, to be used by the laboratory are presented in Tables 4-1 and 4-2.

Table 4-1. Typical Analytical Methods for Wastewater Analyses

Parameter	Analytical Method[1]
Radionuclide	
Actinium-227	G-01 and A-01-R
Lead-210	Pb-01-RC
Polonium-210	Po-01-RC
Protactinium-231	G-01 and A-01-R
Radium-226	Ra-06-RC
Radium-228	Th-01-RC
Thorium-228	
Thorium-230	Th-01-RC
Thorium-232	
Uranium-234	
Uranium-235/-236	U-02-RC
Uranium-238	

[1]EML procedure specifies test methods and detection limits, as provided in the HASL-300.

Table 4-2. Alternative Analytical Methods for Wastewater Analyses

Parameter	Analytical Method[1]
Radionuclide	
Gross alpha	A-01-R
Gross beta	B-01-R
Gamma isotopic	Ga-01-R

[1]EML procedure specifies test methods and detection limits, as provided in HASL-300.

4.2.3 Remaining Analytical Methods

Upon confirmation that the analytical data indicate that the respective samples meet the AWWT facility's WAC for radionuclides, the laboratory will use the methods prescribed in Table 4-3, or approved equivalents, for the analyses of metals and general chemistry parameters.

4.3 STABILIZED PRODUCT SAMPLES

Based on results of the treatability study, the primary process parameter affecting stabilization of waste is the percentage of solids in the final waste form. To verify the percentage of solids, an aliquot of product will be collected. In addition to screening-level analysis of percentage of solids, definitive sample results may be required for compliance to disposal facility's WAC.

4.3.1 Sample Collection and Field-Screening

A small aliquot, less than 15 grams, will be segregated for measurement of percentage of solids using a microwave analyzer for percentage of solids. The remaining product will be allowed to cure in the sample container. The sample containers will be stored at an appropriate location for curing.

4.3.2 Analytical Methods

Initially, product samples will be collected from each batch and analyzed for leachable lead and radium-226. Samples for lead analysis will be prepared in accordance with the TCLP

SW846 Method 1311 and analyzed using inductively coupled plasma-atomic emission spectrometry SW846 Method 6010B for lead. Samples for radium-226 analysis will be prepared and analyzed using gamma spectroscopy to quantify isotopic levels. 4654

Table 4-3. Analytical Methods for Metals and General Chemistry Parameters

Parameter	Analytical Method
Metal	
Arsenic	6010B[1]
Barium	6010B[1]
Cadmium	6010B[1]
Chromium	6010B[1]
Iron	6010B[1]
Lead	6010B[1]
Mercury	7470A[1]
Selenium	6010B[1]
Silver	6010B[1]
General Chemistry	
Total suspended solids	160.2[2]
Chloride[3]	325.1[2]
Nitrate[3]	352.1[2]
Carbonate (Hardness)[3]	130.1[2]
Sulfate[3]	375.1[2]

[1]Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA Report Number SW-846 (EPA 1998), specifies test methods and detection limits.
[2]Methods for Chemical Analysis of Water and Wastes, EPA Report Number 600/4-79-020 (EPA 1979) specifies test methods and detection limits.
[3]Parameter is required to be monitored and reported in accordance with AWR Contract Technical Requirements Document, Document No. 40710-RP-0001, Feb. 3, 1999, Rev. 1.

As process control is established, the frequency of samples will diminish to a frequency determined by the disposal facility (e.g., one definitive sample a week). However, the sampling system is designed to collect a sample for archive from each batch, if necessary.

4.4 AIR EMISSIONS

HVAC stack air emissions will be sampled and continuously monitored using isokinetic sampling to ensure that a representative composite particulate sample is obtained. The isokinetic sampler will be inspected and the filter changed as described below. The air emissions will also be monitored for radon.

4.4.1 Stack Monitoring

The HVAC stack must be continuously monitored as required by the Clean Air Act regulations (40 CFR 61) and DOE Order 5400.5. The continuous monitor serves two functions: (1) to collect a sample of the stack gas for measurement of the concentration of radon and (2) to collect a representative sample of particulates to assess the concentrations of other radionuclides and toxic chemicals (e.g., lead) present. An isokinetic sampler meeting American National Standards Institute N13.1-1999 is required to get a representative sample of particulates. The same sampling system will be used to collect the air sample for radon.

4654

In addition to the real-time monitoring of particulate radioactivity and radon concentration, the filter paper sample is changed bi-weekly (or monthly, if justified by DQOs), and the monitor is inspected at that time. Approved DOE or EPA sampling and analytical methods must be followed in the field and by the laboratory. Both typical and alternative analytical methods to be used by the laboratory are presented in Appendix B of this SAP.

Further explanation relating to the use of field monitoring methods for radon and particulate emissions is provided below. Collection, handling, and shipment of samples will be performed according to approved project procedures, ALARA practices, and applicable DOT shipping guidelines.

Radon concentrations in the building's air effluent will be measured in the HVAC stack. The type of monitor to be used will be a continuous monitor such as a Pylon CRM-1 Radon Measurement System, or equivalent. The Pylon monitor will have the capability to draw in a sample of air from the stack and give a real-time measurement of the radon concentration present.

The "High" alarm will be set at 2,000 pCi/L, and the "High-High" alarm will be set at 6,000 pCi/L. A concentration of 6,000 pCi/L in the stack airflow of approximately 48,000 CFM corresponds to an instantaneous on-site concentration of 0.15 working levels, which is the "worst-case" concentration, and a maximum annual off-site concentration of 0.015 pCi/L (if maintained at 6,000 pCi/L for the entire year).

For particulate monitoring of the building's air effluent, the type of isokinetic sampler to be used in the HVAC stack is a Ludlum Model 177-62-1 Beta Monitor, or equivalent. The sampler will have the capability to continuously draw an isokinetic sample from the stack, pass the sample through a filter paper, and continuously analyze the emissions from the particulate material collected.

4654

5.0 DOCUMENTATION AND RECORD KEEPING

This section provides information regarding the documentation and record keeping associated with the sampling efforts for the project.

5.1 LOGBOOK

A logbook shall be maintained and shall document the sampling activities associated with collecting wastewater and air emissions samples for the project. Logbooks will be bound with lined, consecutively numbered pages. Entries shall be made in permanent, waterproof black ink. No pages shall be removed from the logbook for any reasons.
The following information shall be recorded inside the front cover of the logbook:

- Document control number
- Activity
- Telephone number
- Site contact

The first five pages of the logbook will be reserved for a table of contents. Each page of the Table of Contents will be designated as such with "Table of Contents" written on the top center of each page.
The following requirements must be followed when using a logbook:

- The date must be recorded at the top of each page.
- If data collection forms are specified by an activity-specific plan or procedure, the information need not be duplicated, but forms must be referenced in the logbook.
- All changes must be made with a single line through the deletion. Changes must be initialed and dated.
- A diagonal line must be drawn through any space left at the bottom of each page.
- The bottom of each page shall be signed by the author.
- Do not remove any pages from the logbook.
- When relinquishing your logbook to another individual, you must record a statement below your last entry indicating who will be receiving the logbook. Sign and date this statement.

Entries into the field logbook shall be preceded with the time (written in military units) of the observation. The time should be recorded frequently and at the point of events or measurements that are critical to the activity being logged.
Events and observations that should be recorded include, but are not limited to:

- Deviations from procedures outlined in any governing documents. Also record the reason for any noted deviation.

4654

- Problems, downtime, or delays.
- Upgrade or downgrade of personal protective equipment.
- All equipment models and serial numbers used for that day's activities.
- All team members and visitors.
- Actual and background readings of health and safety monitoring equipment.
- Identification of equipment used, including property and/or serial identification numbers.
- Start and end times of work performed at sampling locations.
- Decontamination times and methods.

When samples are collected, the following should be recorded:

- Sample location
- Sample number
- Sample methodology
- Sample description
- Sample collector
- Sample type
- Sample analyses requested
- Sample preservation and confirmation
- Manufacturer and lot number of preservatives
- QC sample numbers and types
- COC number
- Name and individual to whom samples are relinquished.

5.2 SAMPLE CONTAINER LABELING

Each sample will be labeled, chemically preserved (if required), sealed immediately after collection, and placed on ice or refrigerated (if required). To minimize handling of sample labels, labels will be completed prior to sample collection. The sample container label will be filled in using waterproof ink and will be firmly affixed to the sample containers and protected by clear tape.

000189

At a minimum, each sample will have a sample label or tag containing the information in the following list: 4654

- Project name,
- Sample identification,
- Date of sample collection,
- Time of sample collection,
- Analyses to be performed,
- Preservatives, and
- Initials of individual collecting the sample.

5.3 SAMPLE PACKAGING AND SHIPPING

For samples requiring off-site shipment for analysis, samples will be placed in a sturdy ice chest. Each sample will be sealed in a plastic bag. The samples will be packed with shock-absorbent materials, such as bubble wrap, to prevent movement of sample containers during transport. The ice chest will be packed with resealable, double-bagged ice packs and sealed with packaging tape. Custody seals will be affixed over the front and back of the ice chest lid to prevent or indicate tampering.

Samples and ice will be placed in a cooler along with the appropriate COC records. The COC sample log sheet(s) will be filled out in indelible ink, placed in a resealable plastic bag, and taped to the inside lid of the cooler. Each collected sample fraction contained in the cooler will be specified on the COC records by the field sampling identification number. Sample containers will be packaged to minimize potential breakage. Sample packaging for off-site laboratory shipping will meet DOT requirements.

At least three bands of strapping tape will be wrapped completely around the laboratory-supplied cooler to secure the lid. The cooler will be sealed with evidence tape and labeled "Fragile" and "This End Up." The containers will be shipped to the laboratory for analysis in accordance with DOT regulations and procedures. Shipping air bills will be properly completed; copies will be retained and placed in the project file.

Coolers will be of metal or rigid plastic construction, with sufficient structural strength to withstand repeated dropping from a 4-foot height without cracking. Coolers will be constructed to provide insulation during shipment so that sample preservation with ice will be sufficient to maintain the contents within the range of temperatures required by the QAPP for sample preservation. The inner liner of the cooler will be of a material (such as plastic) resistant to damage by sample contents (including acidic or basic sample preservatives) and will not result in sample contamination (e.g., due to out-gassing of organic vapors from the plastic).

Samples to be shipped to an off-site laboratory (i.e., CSL) will be packaged and shipped in a DOT-approved container, which is provided by the CSL for that purpose. Prior to packaging, shipping containers will be scanned by radiological control personnel to ensure that the external surfaces of the containers are within DOE Order 5400.5 free release

criteria. Assurance must be made that the container is shipped in accordance with DOT requirements. Material is considered radioactive by the DOT at $\geq$ 2 nCi/g. Any container exceeding the free release criteria limit will be rejected for shipment, and corrective measures will be taken before the samples are shipped. Samples will be shipped for overnight delivery.

5.4 CHAIN-OF-CUSTODY

The treatment facility operator will maintain COC records for all field and field QC samples. A sample is defined as being under a person's custody if any of the following conditions exist:

- It is in their possession.
- It is in their view, after being in their possession.
- It was in their possession and they locked it up.
- It is in a designated secure area (an area controlled and restricted to authorized individuals or those accompanied by authorized individuals).

A COC record will be completed for every cooler containing fixed or on-site laboratory samples. The COC record will accompany every shipment of samples to the laboratory to establish the documentation necessary to trace sample possession from time of collection. The record will contain the following information:

- Sample or station identification number
- Signature of collector, sampler, or recorder
- Date and time of collection
- Place of collection
- Sample matrix
- Type of preservative
- Number of containers making up the sample
- Analysis requested for sample
- COC serial numbers
- Additional notes pertaining to suspected high contaminant concentrations
- Bill of lading or transporter tracking number (if applicable)
- Signatures of persons involved in COC

- Inclusive times/dates of possession.

Samples will be accompanied by COC records. When transferring the samples, individuals relinquishing and receiving the samples will sign, date, and note the time on the COC record. The Project Sample Manager will notify the laboratory coordinator when samples are shipped to the off-site laboratory for analysis.

All sample containers shall be sealed in a manner that shall prevent or detect tampering if it occurs. In no case shall tape be used to seal sample containers. Samples shall not be packaged with activated carbon unless prior approval is obtained from the client.

COC documentation will be prepared and maintained in accordance with procedure EW-0002, "Chain of Custody/Request of Analysis Record for Sample Control."

If samples are known to require rapid turnaround because of project time constraints or analytical concerns (e.g., extraction time or sample retention period limitations), then the person completing the COC record will note these constraints in the remarks section of the custody record. The relinquishing individual will record shipping data (e.g., air bill number, organization, time, and date) on the original COC record, which will be transported with the samples to the laboratory and retained in the laboratory's file.

5.5 RECORDS STORAGE

Sampling activities will be recorded in the field logbook, which will be maintained in the field office. Copies of COC forms, as well as analytical data from field-screening and from the laboratory, will be retained by project document control.

5.6 ANALYTICAL DATA

This section provides information related to the required analytical laboratory documentation levels and analytical turnaround times for wastewater and slurry samples collected as part of the project.

5.6.1 Slurry Samples

For slurry samples, the laboratory is to provide a data package consistent with the quality assurance (QA)/QC requirements of the laboratory's approved QA Program. It is anticipated that a CSL will meet the FEMP-defined analytical level of "Analytical Support Level (ASL) E" (non-standardized protocols) for the parameters listed in Appendix B of this SAP. Field-screening will meet the FEMP-defined analytical level "ASL A," which provides qualitative field-analyses. Analytical laboratory audits will be conducted to assess CSL performance.

5.6.2 Wastewater Samples

For wastewater samples, the laboratory is to provide a data package consistent with the QA/QC requirements of the laboratory's approved QA Program. It is anticipated that a CSL will meet the FEMP-defined analytical level of "ASL E" (non-standardized protocols) for the parameters listed in Appendix B of this SAP. Field-screening will meet the FEMP-defined analytical level "ASL A," which provides qualitative field-analyses.

Analytical laboratory audits will be conducted to assess CSL performance. Analytical turnaround times will vary upon request, depending on the specific time requirement for transferring wastewater from the project facilities to the AWWT facility. If needed, a 48-hour turnaround time will be requested for analytical results.

5.6.3 Stabilized product Samples

For stabilized product samples, the laboratory is to provide a data package consistent with the quality assurance (QA)/QC requirements of the laboratory's approved QA Program. It is anticipated that a CSL will meet the FEMP-defined analytical level of "ASL E" (non-standardized protocols) for the parameters listed in Appendix B of this SAP. Field-screening will meet the FEMP-defined analytical level "ASL A," which provides qualitative field analyses. Analytical laboratory audits will be conducted to assess CSL performance.

5.6.4 Air Emission Samples

For radon process monitoring (both upstream and downstream of the carbon beds), this monitoring will meet the FEMP-defined analytical level "ASL A," which provides qualitative field analyses. The radon monitors will be calibrated in accordance with manufacturer's requirements and at the established frequencies that measurements of radon concentrations are recorded and reviewed at a frequency sufficient to detect performance trends and/or situations requiring mitigation. Radon monitoring for the stack will also meet the FEMP-defined analytical level of "ASL E."

For air emission monitoring, the isokinetic particulate filter sample is collected once every 2 weeks (or a month if justified) for the analysis of long-lived alpha and beta emitters. The initial/ending sampling dates and times, sample volume, and stack flow for that period of time are recorded.

The filter paper from the particulate stack monitor is essentially analyzed three times. The in-line monitor will meet the FEMP-defined analytical level of "ASL A," which provides qualitative field-analyses (for radionuclides only). The bi-weekly on-site or laboratory analysis will meet the FEMP-defined analytical level of "ASL E," and the semiannual composites are also considered "ASL E" (non-standardized protocols), subject to concurrence by Fluor Fernald.

6.0 REFERENCES

4654

Table 6-1 provides a list of the applicable FEMP plans and procedures related to this SAP.

Table 6-1. List of Referenced FEMP Plans and Procedures

Number	Title
EP-0005	Controlling Wastewater Discharges into the FEMP Wastewater Treatment System
EP-0010	Responding to Stack Monitoring Alarms
EW-0002	Chain of Custody/Request of Analysis Record for Sample Control
EW-0012	Tank/Sump Contents Removal
EW-1021	Preparation of PWID Report
FD-1000	Sitewide CERCLA Quality Assurance Project Plan
PT-0005	Packaging Low Level Radioactive Waste (LLRW) in Drums
PT-0007	Packaging LLRW in Metal Boxes
PT-0009	Collection of Contaminated Trash for Disposal
PT-0014	FEMP Approved Packaging and Shipping Containers
PT-0018	Preparation of Document for Offsite Shipment of Hazardous Materials
RP-0009	Radiological Requirements for the Release of Materials at the Fernald Environmental Management Project
RP-0010	Identification and Movement of Radioactive Materials
RP-0017	Liquid Radioactive Standards Survey Requirements

Other references used in the development of this SAP include:

American Public Health Association, American Water Works Association, and Water Environment Federation, *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998.

American National Standards Institute, "Sampling And Monitoring Releases Of Airborne Radioactive Substances From The Stacks And Ducts Of Nuclear Facilities", 1999, ANSI N13.1-1999.

American Society of Testing and Materials, "Standard Practice for Generation of Environmental Data to Waste Management Activities: Quality Assurance and Quality Control Planning and Implementation", 1992, ASTM D 5283-92.

American Society of Testing and Materials, "Standard Practice for Generation of Environmental Data to Waste Management Activities: Development of Data Quality Objectives", 1995, ASTM D 5792-95.

Code of Federal Regulations, Title 40, Part 61, Appendix B, "Method 114 – Test Methods for Measuring Radionuclide Emissions from Stationary Sources."

U.S. Environmental Protection Agency, *Methods for Chemical Analysis of Water and Wastes*, EPA 600/4-79-020, 1979.

U.S. Environmental Protection Agency, *Prescribed Methods for Measurement of Radioactivity in Drinking Water*, EPA-600/4-80-032, August 1980.

U.S. Environmental Protection Agency, "Determination of Lead-210 in Drinking Water, Method 909.0" (May 1982) and "Determination of Polonium-210 in Drinking Water by Alpha Particle Counting, Method 912.0" (October 1983), EPA Region I Library Local Call Number 01A0004860.

U.S. Environmental Protection Agency, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, 1998, EPA SW-846.

4654

APPENDIX A
ADVANCED WASTEWATER TREATMENT FACILITY ACCEPTANCE CRITERIA

000195

4654

AWWT Acceptance Criteria for the Project

Parameter	Discharge Limit (pCi/L)[1]
Radionuclide	
Actinium-227	10
Lead-210	30
Polonium-210	80
Protactinium-231	10
Radium-226	100
Radium-228	100
Thorium-228	400
Thorium-230	300
Thorium-232	50
Uranium-234	5 ppm
Uranium-235/-236	
Uranium-238	
General Chemistry	
Total suspended solids (TSS)	1,000 ppm

[1]Concentration calculated assuming flow of 7,200 gpd.

000196

4654

APPENDIX B
SUMMARY OF ANALYTICAL PROCEDURES, CONTAINERS, PRESERVATIVES, AND HOLDING TIME REQUIREMENTS FOR PROJECT SAMPLES

000197

Summary of Analytical Procedures, Containers, Preservatives, and Holding Time Requirements for Slurry Samples 4654

Parameter	Analytical Procedure[1]	Holding Time	Preservative Requirements	Number/Type Containers Per Sample
Percent Solids	ASTM D2216-98	Note 2	None	Note 3
pH	9045C	Note 2	None	Note 3
Radium-226	Ga-01-R	1 Year	None	100-milliliter Plastic

[1]EPA or DOE procedures specify test methods and detection limits.
[2]Analyze as soon as possible following collection.
[3]Sample aliquots will be collected from the 100-milliliter sample bottle removed from the sampler (i.e., only 100-milliliters of slurry will be collected during any sampling event.

000198

4654

Summary of Analytical Procedures, Containers, Preservatives, and Holding Time Requirements for Wastewater Samples

Parameter	Analytical Procedure[1]	Holding Time	Preservative Requirements	Number/Type Containers Per Sample
Actinium-227	Ga-01 and A-01-R	1 Year	HNO_3 to pH < 2	1-Liter Plastic or Glass
Lead-210	Pb-01-RC	1 Year	HNO_3 to pH < 2	1-Liter Plastic or Glass
Polonium-210	Po-01-RC	1 Year	HNO_3 to pH < 2	1-Liter Plastic or Glass
Protactinium-231	Ga-01 and A-01-R	1 Year	HNO_3 to pH < 2	1-Liter Plastic or Glass
Radium-226	Ra-06-RC	1 Year	HNO_3 to pH < 2	1-Liter Plastic or Glass
Radium-228	Th-01-RC	1 Year	HNO_3 to pH < 2	1-Liter Plastic or Glass
Thorium-228				
Thorium-230	Th-01-RC	1 Year	HNO_3 to pH < 2	1-Liter Plastic or Glass
Thorium-232				
Uranium-234				
Uranium-235/-236	U-02-RC	1 Year	HNO_3 to pH < 2	1-Liter Plastic or Glass
Uranium-238				
Gross alpha	A-01-R	1 Year	HNO_3 to pH < 2	1-Liter Plastic or Glass
Gross beta	B-01-R	1 Year	HNO_3 to pH < 2	1-Liter Plastic or Glass
Gamma isotopic	Ga-01-R	1 Year	HNO_3 to pH < 2	1-Liter Plastic or Glass
Arsenic	6010B	6 Months	HNO_3 to pH < 2	1-Liter Plastic or Glass
Barium	6010B	6 Months	HNO_3 to pH < 2	1-Liter Plastic or Glass[2]
Cadmium	6010B	6 Months	HNO_3 to pH < 2	1-Liter Plastic or Glass[2]
Chromium	6010B	6 Months	HNO_3 to pH < 2	1-Liter Plastic or Glass[2]
Iron	6010B	6 Months	HNO_3 to pH < 2	1-Liter Plastic or Glass[2]
Lead	6010B	6 Months	HNO_3 to pH < 2	1-Liter Plastic or Glass[2]
Mercury	7470A	28 Days	HNO_3 to pH < 2	1-Liter Plastic or Glass[2]
Selenium	6010B	6 Months	HNO_3 to pH < 2	1-Liter Plastic or Glass[2]
Silver	6010B	6 Months	HNO_3 to pH < 2	1-Liter Plastic or Glass[2]
Total suspended solids (TSS)	160.2	7 Days	Cool to 4°C	1 100-mL Plastic or Glass
Chloride	325.1	7 Days	None Required.	1 50-mL Plastic or Glass
Nitrate	352.1	24 Hours	Cool to 4°C	1 100-mL Plastic or Glass
Carbonate (Hardness)	130.1	6 Months	Cool to 4°C, HNO_3 to pH < 2	1 100-mL Plastic or Glass

000199

Parameter	Analytical Procedure[1]	Holding Time	Preservative Requirements	Number/Type Containers Per Sample
Sulfate	375.1	7 Days	Cool to 4°C	1 50-mL Plastic or Glass

[1]EPA procedures specify test methods and detection limits.
[2]Extracted into same sample container as arsenic.

4654

000200

4654

Summary of Analytical Procedures, Containers, Preservatives, and Holding Time Requirements for Stabilized Product Samples

Parameter	Analytical Procedure[1]	Holding Time	Preservative Requirements	Number/Type Containers Per Sample
Radium-226	Ga-01-R and A-01-R	1 Year	None	1-polyethylene bottle
Lead	1311/6010B[2]	180 days[2]	None	1-polyethylene bottle

[1]EPA procedures specify test methods and detection limits.
[2] TCLP extraction followed by analysis for lead. The TCLP extractant has a holding time of 180 days and once extracted, the extract has the holding time listed in the table.

000201

4654

Typical and Alternative Analytical Methods for Air Emissions Analyses

Parameter	Analytical Method[1]
Lead	7000A[2]
Actinium-227	G-01[3]
Lead-210	Pb-01-RC[3]
Polonium-210	Po-02-RC[3]
Protactinium-231	G-01[3]
Radium-226	Ra-02-RC[3]
Thorium-230	Th-01-RC[3]

[1]For radionuclides, method or approved equivalent must comply with Method 114 of 40 CFR 61, Appendix B, *Test Methods for Measuring Radionuclide Emissions from Stationary Sources*.
[2]*Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, EPA Report Number SW-846 (EPA 1998), specifies test methods and detection limits.
[3]EML procedure specifies test methods and detection limits, as provided in the *Procedures Manual of the EML*, HASL-300.

Alternative Analytical Methods for Air Emissions Analyses

Parameter	Analytical Method[1]
Gross alpha	A-01-R[2]
Gross beta	Ba-01-R[2]
Gamma spectrometry	Ga-01-R[2]

[1]For radionuclides, method or approved equivalent must comply with Method 114 of 40 CFR 61, Appendix B, *Test Methods for Measuring Radionuclide Emissions from Stationary Sources*.
[2]EML procedure specifies test methods and detection limits, as provided in the *Procedures Manual of the EML*, HASL-300.

000202

ABBREVIATIONS

AG	ABOVE GROUND
ASHRAE	AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR CONDITIONING ENGINEERS
ATM	ATMOSPHERE
B/L	BATTERY LIMIT
BTL	BOTTOM TANGENT LINE
BYP	BYPASS
CC	CHEMICAL CLEANOUT
CHR	CHILLER
CL	CENTERLINE
CFM	CUBIC FEET PER MINUTE
CO	CLEANOUT
CONN	CONNECTION
CSC	CAR SEAL CLOSED
CSO	CAR SEAL OPEN
CTR	CENTER
DCS	DISTRIBUTED CONTROL SYSTEM
DES	DESIGN
DIA	DIAMETER
DP	DESIGN PRESSURE
D/P	DIFFERENTIAL PRESSURE
DRN	DRAIN
DT	DESIGN TEMPERATURE
DWG	DRAWING
(E)	EXISTING
EA	EXHAUST AIR
EL	ELEVATION
ESD	EMERGENCY SHUTDOWN
FOF	FACE OF FLANGE
(F)	FURNISHED
FLG	FLANGE
FOB	FLAT ON BOTTOM
FOT	FLAT ON TOP
FP	FULL PORT
FRP	FIBERGLASS REINFORCED PLASTIC
FV	FULL VACUUM
GO	GEAR OPERATED
GPM	GALLONS PER MINUTE
GR	GRADE
HC	HOSE CONNECTION
HDR	HEADER
HEPA	HIGH-EFFICIENCY PARTICULATE AIR
HH	HAND HOLE
HOA	HAND/OFF/AUTOMATIC
HP	HORSE POWER
HPT	HIGH POINT
HT	HEIGHT
HZ	HERTZ
IA	INSTRUMENT AIR
ISBL	INSIDE BATTERY LIMITS
LG	LEVEL GUAGE
LP	LOW PRESSURE
LPT	LOW POINT
MAX	MAXIMUM
MIN	MINIMUM
MOV	MOTOR OPERATED VALVE
MTL	MATERIAL
MW	MANWAY
NNF	NORMALLY NO FLOW
NOZ	NOZZLE
O/C	OPEN/CLOSE
O/O	ON/OFF
OP	OUTPUT
OSBL	OUTSIDE BATTERY LIMITS
OVHD	OVERHEAD
PH	PHASE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PLCS	PLACES
PRESS	PRESSURE
PSIG	POUNDS PER SQUARE INCH, GAUGE
PV	PROCESS VARIABLE
(R)	RELOCATED
REQD	REQUIRED
RTD	RESISTANCE TEMP. DETECTOR
SA	SUPPLY AIR
SC	SAMPLE CONNECTION
SCFM	STANDARD CUBIC FEET PER MINUTE
SCH	SCHEDULE
SD	SHUTDOWN
SG	SPECIFIC GRAVITY
SIS	SAFETY INSTRUMENTED SYSTEM
SO	STEAM OUT
SP	SET POINT
SS	STAINLESS STEEL
S/S	START/STOP
STD	STANDARD
TA	TRANSFER AIR
T/C	THERMOCOUPLE
TDH	TOTAL DIFFERENTIAL HEAD
TEMP	TEMPERATURE
THRD	THREADED
TL	TANGENT LINE
TSO	TIGHT SHUT OFF
TTA	TRANSFER TANK AREA
T/T	TANGENT-TO-TANGENT
TYP	TYPICAL
UG	UNDERGROUND
V	VOLT
VAC	VACUUM
VB	VORTEX BREAKER
VNT	VENT
W/	WITH
W/O	WITHOUT

VALVE SYMBOLS

OPEN / CLOSED

GATE
GLOBE
NEEDLE
PLUG
BALL
PINCH
BUTTERFLY
ANGLE
GATE/DISC DIVERTER
DIVERTER
3-WAY
4-WAY
CHECK
MANUAL CHECK
KNIFE GATE
ROTARY VALVE

NORMAL POSITIONS ALL VALVES

NO-INDICATES NORMALLY OPEN
NC-INDICATES NORMALLY CLOSED

LOCKED POSITIONS ALL VALVES

LO-INDICATES LOCKED OPEN
LC-INDICATES LOCKED CLOSED

FAIL POSITIONS ALL VALVES

FO-INDICATES FAIL OPEN
FC-INDICATES FAIL CLOSED
FL-INDICATES FAIL LAST POSITION
FI- INDICATES FAIL INDETERMINATE

VALVE ACTUATORS

CYLINDER
DIGITAL
SOLENOID
HANDWHEEL
ROTARY MOTOR (SHOWN TYPICALLY WITH ELECTRIC SIGNAL)
PRESSURE DIAPHRAGM
DIAPHRAGM
SPRING

PIPING FITTINGS

FLANGE
SCREWED CAP
WELDED CAP
UNION JOINT
CONCENTRIC (OR GENERIC) REDUCER
ECCENTRIC REDUCER
HOSE CONNECTION (FEMALE)
HOSE CONNECTION (MALE)

PIPING LINE SYMBOLS

PRIMARY (AG & UG)
SECONDARY / UTILITY (AG & UG)
FUTURE & EXISTING ON NEW P&IDs
JACKETED OR DOUBLE CONTAINMENT

PIPING SPECIALTY ITEMS

Y-TYPE STRAINER
CONE STRAINER
DUPLEX STRAINER
BASKET STRAINER
EXPANSION JOINT
FLEXIBLE CONNECTOR
ATMOSPHERIC VENT
FILTER
FILTER-REGULATOR-LUBRICATOR
TRAP
PULSATION DAMPENER
IN-LINE SILENCER
VENT SILENCER
REMOVABLE SPOOL
FLEXIBLE HOSE
BREATHER
VENT COVER
IN-LINE MIXER
BACK DRAFT DAMPER
SIGHT GLASS
BOOSTER AIR FITTING
FUNNEL
SAFETY SHOWER
CARTRIDGE FILTER

LINE IDENTIFICATION

II-JJZZZZ-M-NNN-OO-TT

- TT — HEAT TRACE TYPE (USE ONLY IF REQUIRED)
- OO — INSULATION TYPE (USE ONLY IF REQUIRED)
- NNN — MATERIAL SPECIFICATION
- M — PIPE SIZE (INCHES)
- ZZZZ — LINE SEQUENCE NUMBER
- JJ — SYSTEM NUMBER
- II — LINE SERVICE (SEE BELOW)

LINE SERVICE CODES (II)

BD	--	BLOWDOWN
CA	--	AIR, COMPRESSED
CFD	--	CEMENT/FLY ASH/DUST
CND	--	CONDENSATE
CONC	--	PRODUCT (CONCRETE)
CS	--	CHEMICAL SOLUTION
CWR	--	CHILLED WATER RETURN
CWS	--	CHILLED WATER SUPPLY
DW	--	DOMESTIC WATER
DW3	--	POTABLE WATER
FLT	--	FILTRATE
FLW	--	FLUSH WATER
HF1	--	HYDRAULIC FLUID, 500 PSI OR GREATER
INT	--	INSTRUMENT SIGNAL
LPW	--	PROCESS LIQUID WASTE
MS	--	MISCELLANEOUS SLURRY
POLY	--	POLYMER SOLUTION
RCS	--	RADON CONTROL SYSTEM
REF	--	REFRIGERANT
SA	--	AIR, BREATHING
SEAL	--	SEAL WATER
SLW	--	SLUICE WATER
SPNT	--	SUPERNATANT
SUMP	--	SUMP
TW	--	PROCESS WATER
VA	--	VENTILATION AIR
VE	--	VENT
WASH	--	WASHWATER

MISCELLANEOUS

POINT OF CHANGE IN LINE CLASS OR INSULATION REQUIREMENT
BOUNDARY
PACKAGED EQUIPMENT LIMITS
SUPPLY OR TRANSFER AIR FLOW DIRECTION
EXHAUST OR TRANSFER AIR FLOW DIRECTION
RETURN AIR FLOW DIRECTION
PAGE CONNECTOR
PAGE CONNECTOR
PAGE CONNECTOR BIDIRECTIONAL FLOW
BATTERY LIMITS
SEAL WATER COMPONENTS

NOZZLE IDENTIFICATION

A - 10"

- 10" — NOZZLE SIZE (INCHES)
- A — NOZZLE IDENTIFIER (FROM VESSEL DATA SHEET)

VALVE IDENTIFICATION

AAA-JJ-KKKK

- KKKK — VALVE NUMBER
- JJ — SYSTEM NUMBER
- AAA — VALVE CODE

AIR OPERATED VALVE	--	AOV
AUTOMATIC RECIRCULATION VALVE	--	ARV
BACK FLOW PREVENTER	--	BFP
CHECK VALVE	--	CKV
DOUBLE CHECK VALVE	--	DCV
DIFFUSER CHECK VALVE	--	DFV
DAMPER (BUTTERFLY)	--	DMP
FLOAT OPERATED VALVE	--	FOV
HAND OPERATED VALVE	--	HOV
MOTOR OPERATED VALVE	--	MOV
PRESSURE CONTROL VALVE	--	PCV
PRESSURE REDUCING VALVE	--	PRV
PRESSURE SAFETY ELEMENT	--	PSE
PRESSURE SAFETY VALVE	--	PSV
SOLENOID OPERATED VALVE	--	SOV

INSULATION TYPE CODES (OO)

AS -- ANTI-SWEAT
CC -- COLD SERVICE INSULATION
CP -- CONDENSATION CONTROL
FP -- FIRE PROTECTION INSULATION
HC -- HEAT CONSERVATION INSULATION
PF -- PREVENTION FROM FREEZING INSULATION
PP -- PERSONNEL PROTECTION INSULATION

TRACE TYPE CODES (TT)

ET -- ELECTRIC TRACED
CT -- CHILLED FLUID TRACED

SYSTEM NUMBERING

YY (SEE "EQUIPMENT NUMBER IDENTIFICATION," N0003)

FACILITIES
- 00 REMEDIATION BUILDING
- 01 PRODUCT HANDLING AND STORAGE FACILITY
- 02 WASTE RETRIEVAL FACILITIES
- 03 NOT USED
- 04 WAREHOUSE FACILITIES
- 05 MISCELLANEOUS FACILITIES-SITE
- 06 NOT USED
- 07 NOT USED
- 08 NOT USED
- 09 NOT USED

RETRIEVAL
- 10 NOT USED
- 11 NOT USED
- 12 TRANSFER TANK SYSTEM
- 13 TTA WASTE RETRIEVAL SYSTEM
- 14 NOT USED

PROCESSING
- 15 FEED PREPARATION SYSTEM
- 16 PROCESSOR FEED SYSTEM
- 17 PROCESSOR SYSTEM
- 18 NOT USED
- 19 VESSEL VENT SYSTEM
- 20 RADON CONTROL SYSTEM
- 21 NOT USED
- 22 NOT USED

CONTAINER HANDLING
- 23 CONTAINER RECEIPT AND PREPARATION SYSTEM
- 24 CONTAINER FILLING SYSTEM
- 25 CONTAINER SHIPPING SYSTEM
- 26 NOT USED
- 27 NOT USED
- 28 NOT USED
- 29 NOT USED

ELECTRICAL
- 30 13.2 KV SYSTEM
- 31 480 VOLT DISTRIBUTION SYSTEM
- 32 STANDBY ELECTRICAL SYSTEM
- 33 UNINTERRUPTIBLE POWER SYSTEM
- 34 LIGHTING SYSTEM
- 35 GROUNDING SYSTEM
- 36 MISCELLANEOUS POWER PANELS
- 37 NOT USED
- 38 NOT USED
- 39 MISCELLANEOUS ELECTRICAL

UTILITIES AND CHEMICALS
- 40 COMPRESSED AIR SYSTEM
- 41 BREATHING AIR SYSTEM
- 42 NOT USED
- 43 NOT USED
- 44 PRODUCT ADDITIVE SYSTEM
- 45 NOT USED
- 46 NOT USED
- 47 NOT USED
- 48 NOT USED
- 49 NOT USED

WATER SYSTEMS
- 50 PROCESS WATER SYSTEM
- 51 POTABLE WATER SYSTEM
- 52 FIRE WATER SYSTEM
- 53 COOLING WATER SYSTEM
- 54 SEAL WATER SYSTEM
- 55 SUPERNATANT WATER SYSTEM
- 56 PROCESS CHILLED WATER SYSTEM
- 57 NOT USED
- 58 NOT USED
- 59 NOT USED

WASTE SYSTEMS
- 60 SANITARY SEWER SYSTEM
- 61 NOT USED
- 62 SLUICE/FLUSH WATER SYSTEM
- 63 LABORATORY WASTE SYSTEM
- 64 RADIOACTIVE SOLID WASTE SYSTEM
- 65 STORMWATER SYSTEM
- 66 NOT USED
- 67 NOT USED
- 68 NOT USED
- 69 NOT USED

HVAC SYSTEMS
- 70 REMEDIATION BUILDING SUPPLY AIR SYSTEM
- 71 REMEDIATION BUILDING EXHAUST AIR SYSTEM
- 72 NOT USED
- 73 NOT USED
- 74 NOT USED
- 75 NOT USED
- 76 WAREHOUSE FACILITIES HVAC SYSTEMS
- 77 MISCELLANEOUS FACILITIES HVAC SYSTEM
- 78 NOT USED
- 79 NOT USED

MECHANICAL AND ANALYTICAL SYSTEMS
- 80 MAINTENANCE EQUIPMENT
- 81 MECHANICAL HANDLING EQUIPMENT
- 82 REMOTE HANDLING EQUIPMENT
- 83 RADIATION SHIELDING EQUIPMENT
- 84 SAMPLING SYSTEM
- 85 INSPECTION SYSTEM
- 86 NOT USED
- 87 NOT USED
- 88 NOT USED
- 89 NOT USED

INFORMATION AND CONTROL SYSTEMS
- 90 DISTRIBUTED CONTROL SYSTEM
- 91 MANAGEMENT INFORMATION SYSTEM
- 92 FIRE DETECTION AND ALARM SYSTEM
- 93 HEALTH PROTECTION SYSTEM
- 94 ANALYTICAL LABORATORY SYSTEM
- 95 NOT USED
- 96 NOT USED
- 97 NOT USED
- 98 NOT USED
- 99 NOT USED

4654

REF DWG NO.	DRAWING TITLE

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
D	ISSUE FOR DESIGN	10/07/02	SJC	GCS
C	ISSUE FOR DESIGN	08/28/02	GCS	WET
B	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
A	ISSUE FOR DESIGN	02/19/02	SJM	WET

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JE JACOBS — 175 Broadway Ave., Oak Ridge, Tennessee 37830, Tel: 865-220-6600, Fax: 865-220-6170

PROJECT NAME: SILOS 1 AND 2

DRAWING TITLE: INSTRUMENTATION PIPING AND INSTRUMENT DIAGRAM PIPING, VALVES AND MISCELLANEOUS

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
SUSAN M. SCHAEFER	02/19/02	NICHOLAS P. KOHUT	02/19/02	SUSAN J. MITCHELL	02/19/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	U

SUBMITTED FOR 30% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 60% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 90% ISSUE — TECH LEAD — DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-N-01161	N0001	D

JEC PROJECT NO.	FILENAME
35H19603	94X0N161.dgn

000203

DATE: 00DATE00000 TIME: 00TIME000 USER: 00USER0 DESIGN FILE: 00CONFIGURATION00000000

4654

INSTRUMENT FUNCTION SYMBOLS

/ A ANALOG
B BINARY
D DIGITAL
E VOLTAGE
H HYDRAULIC
I CURRENT
O ELECTROMAGNETIC, SONIC
P PNEUMATIC
R RESISTANCE (ELECTRICAL)

INSTRUMENT LINE SYMBOLS

——	LINE SUPPLY
-AS-	LINE SUPPLY AIR
-IA-	LINE SUPPLY AIR INSTR.
-PA-	LINE SUPPLY AIR PLANT
-ES-	LINE SUPPLY ELECTRIC
-GS-	LINE SUPPLY GAS
-HS-	LINE SUPPLY HYDRAULIC
-NS-	LINE SUPPLY NITROGEN
-SS-	LINE SUPPLY STEAM
-WS-	LINE SUPPLY WATER
	LINE UNDEFINED SIGNAL
	LINE PNEUMATIC SIGNAL
-----	LINE ELECTRIAL SIGNAL A
	LINE ELECTRIAL SIGNAL B
	LINE HYDRAULIC SIGNAL
	LINE CAPILLARY TUBE
	LINE EM SONIC SIGNAL G
~	LINE EM SONIC SIGNAL NG
	LINE INTERNAL SYSTEM LINK
	LINE MECHANICAL LINK
	LINE PNEUMATIC BINARY
	LINE ELECTRIC BINARY A
	LINE ELECTRIC BINARY B

PRIMARY ELEMENT SYMBOLS (FLOW)

ORIFICE PLATE
PITOT
VENTURI
FLUME
WEIR
TURBINE
POS-DISP
VORTEX
TARGET
NOZZLE
MAGNET
SONIC

XX — GENERAL SYMBOL IN-LINE ELEMENT XX - FS, FG, FE, FT

FE XXXX — XXXX - MASS, CORIOLIS, THERMAL, INT. ORIFICE IN-LINE FLOW ELEMENT WITH INTEGRAL TRANSMITTER

FT / FE XXXX — XXXX - MASS, CORIOLIS, THERMAL... IN-LINE FLOW ELEMENT WITH SEPARATE TRANSMITTER

MISCELLANEOUS SYMBOLS

CHEMICAL SEAL/DIAPHRAGM
UNDEFINED INTERLOCK LOGIC
DUAL FUNCTION OR INSTRUMENTS SHARING COMMON HOUSING
PILOT LIGHT OR GAUGE GLASS ILLUMINATOR
PI XXX-XXX-XXX — INSTRUMENT WITH LONG TAG NUMBER

SELF ACTUATED DEVICES

FI — FLOW VALVE VARIMETER
FI — ROTAMETER (OR PURGE) WITH INTEGRAL VALVE.
PRESSURE REDUCING REGULATOR (SELF-CONTAINED)
PRESSURE REDUCING REGULATOR W/ EXTERNAL TAP
DIFFERENTIAL PRESSURE REDUCING REGULATOR
BACK PRESSURE REGULATOR (SELF-CONTAINED)
BACK PRESSURE REGULATOR W/ EXTERNAL TAP
PRESSURE RELIEF OR SAFETY VALVE
VACUUM RELIEF VALVE
PRESSURE AND VACUUM RELIEF VALVE OR CONSERVATION VENT
PILOT OPERATED RELIEF VALVE
SAFETY HEAD FOR (EXPLOSION PANEL) PRESSURE RELIEF RUPTURE DISC OR
SAFETY HEAD FOR VACUUM RELIEF (EXPLOSION PANEL) RUPTURE DISC

GENERAL INSTRUMENT SYMBOLS

LOCATION/ACCESSIBILITY	DISCRETE INSTRUMENTS	SHARED DISPLAY AND CONTROL (DCS)	PLC	DISCRETE HARDWARE INTERLOCK
FIELD MOUNTED 1. FIELD OR LOCALLY MOUNTED. 2. ACCESSIBLE TO AN OPERATOR AT DEVICE				
PRIMARY LOCATION NORMALLY ACCESSIBLE TO AN OPERATOR 1. CENTRAL OR MAIN CONTROL ROOM. 2. FRONT OF MAIN PANEL OR CONSOLE MOUNTED 3. VISIBLE ON VIDEO DISPLAY. 4. ACCESSIBLE TO AN OPERATOR AT DEVICE OR CONSOLE.				
PRIMARY LOCATION NORMALLY INACCESSIBLE TO AN OPERATOR 1. CENTRAL OR MAIN CONTROL ROOM. 2. REAR OF PANEL OR CABINET MOUNTED. 3. NOT VISIBLE ON VIDEO DISPLAY. 4. NOT NORMALLY ACCESSIBLE TO AN OPERATOR AT DEVICE OR CONSOLE.				
AUXILIARY LOCATION NORMALLY ACCESSIBLE TO AN OPERATOR 1. SECONDARY OR LOCAL CONTROL ROOM. 2. FIELD OR LOCAL CONTROL PANEL. 3. FRONT OF SECONDARY OR LOCAL PANEL MOUNTED. 4. VISIBLE ON VIDEO DISPLAY. 5. ACCESSIBLE TO AN OPERATOR AT DEVICE OR CONSOLE.				
AUXILIARY LOCATION NORMALLY INACCESSIBLE TO AN OPERATOR 1. SECONDARY OR LOCAL CONTROL ROOM. 2. FIELD OR LOCAL CONTROL PANEL. 3. REAR OF SECONDARY OR LOCAL PANEL OR CABINET MOUNTED. 4. NOT VISIBLE ON VIDEO DISPLAY. 5. NOT NORMALLY ACCESSIBLE TO AN OPERATOR AT DEVICE OR CONSOLE.				

INSTRUMENT IDENTIFICATION LETTERS

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	USER'S CHOICE (TYPICALLY CONDUCTIVITY - ELECTRICAL)		CONTROL		CLOSED
D	USER'S CHOICE (TYPICALLY DENSITY OR SPECIFIC GRAVITY)	DIFFERENTIAL			DIVERT
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			
G	USER'S CHOICE OR GAUGING (DIMENSIONAL)		GLASS, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	USER'S CHOICE (TYPICALLY MOISTURE OR HUMIDITY)	MOMENTARY			MIDDLE, INTERMEDIATE
N	CAMERA		USERS CHOICE	USERS CHOICE	USERS CHOICE
O	USER'S CHOICE		ORIFICE, RESTRICTION		OPEN
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY OR HEAT DUTY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	THROUGH
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

000204

REF DWG NO.	DRAWING TITLE

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
D	ISSUE FOR DESIGN	10/07/02	SJC	GCS
C	ISSUE FOR DESIGN	08/29/02	GCS	WET
B	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
A	ISSUE FOR DESIGN	02/19/02	SJM	WET

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS

PROJECT NAME: SILOS 1 AND 2

DRAWING TITLE: INSTRUMENTATION PIPING AND INSTRUMENT DIAGRAM INSTRUMENTATION

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
SUSAN M. SCHAEFER	02/19/02	NICHOLAS P. KOHUT	02/19/02	SUSAN J. MITCHELL	02/19/02

PLANT/BLDG. NO. | FLOOR | SCALE: NONE | CLASS: U

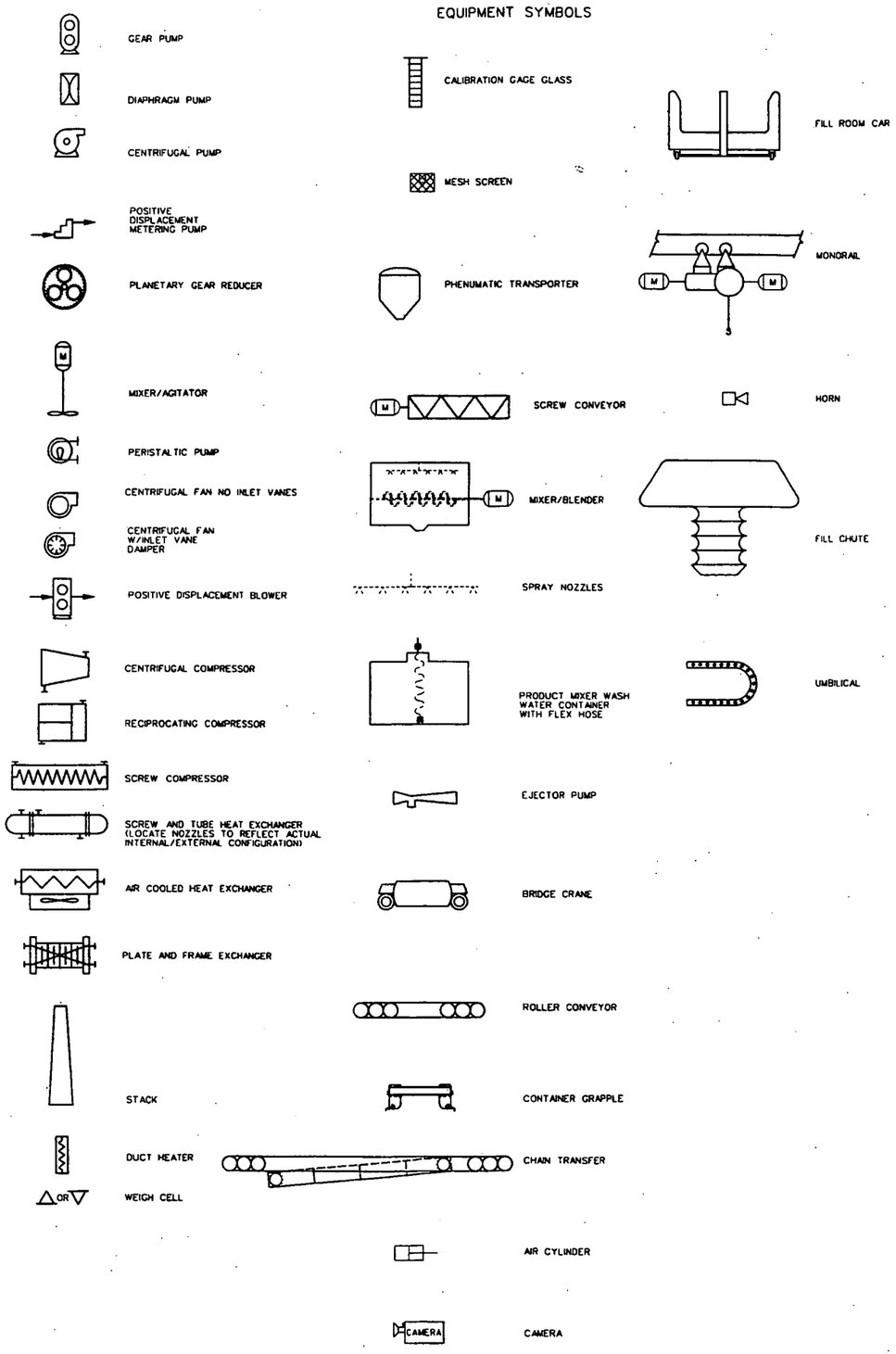
SUBMITTED FOR 30% ISSUE — TECH LEAD, DATE | SUBMITTED FOR 60% ISSUE — TECH LEAD, DATE | SUBMITTED FOR 90% ISSUE — TECH LEAD, DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-N-01162	N0002	D

JEG PROJECT NO.: 35H19603 | FILENAME: 94XN1162.DGN

4654

EQUIPMENT SYMBOLS



EQUIPMENT DESCRIPTION	EQUIPMENT DESIGNATOR (XXX)	EQUIPMENT DESCRIPTION	EQUIPMENT DESIGNATOR (XXX)
ACCUMULATOR	ACC	PACKAGE UNIT	PKU
AIR COMPRESSOR	ACP	PANEL (CONTROL)	PNL
AIR DRYER	ADR	PANELBOARD	PNB
AIR HANDLING UNIT	AHU	PERSONNEL CONTAMINATION MONITOR	PCM
AIR PREHEATER	APH	PHASE SEPARATOR	PHS
AIR RECEIVER TANK	ART	PITCH DRIVE	PTH
AUTO TRANSFER SWITCH	ATS	PLANETARY GEAR REDUCER	PGR
AUTOMATED DOOR	ASD	POLYMER PREPARATION UNIT	PPU
AUTOMATIC PRINTER/LABELER	APL	POWER DISTRIBUTION PANEL	PDP
BACK DRAFT DAMPER	BKD	POWER PANEL	PPN
BAGHOUSE	BGH	POWER PANEL (INSTRUMENTATION)	PWP
BIN (BULK STORAGE)	BIN	PRESSURE SAFETY ELEMENT	PSE
BIN ACTIVATOR	BIA	PRODUCT WEIGH BIN	PWB
BLOWER	BLR	PUMP	PMP
BREATHING AIR STATION	BAS	RACK (INSTRUMENT MOUNTING)	RAC
BRIDGE CRANE	BRC	RECEIVER	RVR
CABLE OR HOSE REEL	CBR	RECEPTACLE-PANELBOARD	RPN
CALIBRATION GAUGE GLASS	CAL	REMOTE LIFTING DEVICE	RLD
CAMERA	CAM	RETURN AIR REGISTER	RAR
CARBON BED	CBD	ROLLER CONVEYOR	RCV
CARBON FILTER BED	CFB	ROTARY AIR LOCK	ROL
CARTRIDGE FILTER	CTF	ROTARY FEEDER	ROF
CIRCUIT	CKT	SAMPLING SYSTEM (GASES)	SSG
CLARIFIER	CLR	SAMPLING SYSTEM (LIQUIDS)	SSL
COMPUTER	CPU	SAMPLING SYSTEM (SOLIDS)	SSS
CONDENSER	CND	SCALE	SCL
CONTAINER	CON	SCREW CONVEYOR (METERING)	SCM
CONTAINER TRANSFER CAR	CRT	SCREW CONVEYOR (TRANSFER)	SCT
CONTINUOUS EMISSION MONITORING	CEM	SHIELD ENCLOSURE OR BOX	SHL
CONTROLLER	CNT	SCRUBBER	SCR
CONVEYOR CHAIN TRANSFER	CCT	SKID	SKD
CRANE/HOIST	CRH	SLIDE GATE	SRS
CYCLONE SEPARATOR	CYS	STACK	STK
DAMPER (BUTTERFLY)	DMP	STATIC MIXER	STM
DAMPER (NON-BUTTERFLY)	DPR	STRAINER	STR
DEMINERALIZER COLUMN	DMC	SUMP	SMP
DEMISTER	DEM	SUPPLY AIR DIFFUSER	SAD
DELUMPER	DLM	SWITCHGEAR	SWG
DESICCANT DRYER SYSTEM	DDS	TANK	TNK
DIESEL GENERATOR	DGN	TANK NOZZLE ADAPTOR	TNA
DIESEL GENERATOR CONTROL PANEL	DGP	THICKENER	THK
DISCONNECT	DIS	TRANSFORMER	XFR
DOUBLE CHECK VALVE	DCV	TRAP	TRP
DOUBLE DUMP VALVE	DDV	ULTRA FILTRATION RACK	UFR
DRUM DUMPER	DDP	UMBILICAL	UMB
DRYER	DRY	UNINTERRUPTIBLE POWER SUPPLY	UPS
DUST COLLECTOR	DCL	UPS BATTERY RACK	UBR
EDUCTOR	EDR	UPS DISTRIBUTION PANEL	UDP
EJECTOR	EJE	VACUUM BREAKER	VBK
ELECTRIC WATER COOLER	EWC	VACUUM RELIEF VALVE	VRV
ENCLOSURE	ENC	VIBRATOR	VIB
END EFFECTOR	EFF	WATER METER PIT	WMP
EVAPORATIVE AIR COOLER	EAC	WATER TREATMENT PLANT	WTP
EVAPORATOR	EVP	WELDING RECEPTACLE	WRT
EXHAUST AIR REGISTER	EAR	WRIST ACTUATOR	WRA
EXPANSION JOINT	EXP	YAW DRIVE	YAW
FAN	FAN		
FEEDER	FDR		
FILL CHUTE	LSR		
FILL HEAD	FLH		
FILTER	FLT		
FLEXIBLE CONNECTION	FLX		
FORK LIFT	FKL		
GANTRY MANIPULATOR	GMN		
GLOVEBOX	GLB		
GRAVITY DAMPER	GDM		
HEAT EXCHANGER	HTX		
HEAT TRACE PANEL	HTP		
HEATER	HTR		
HOPPER/BIN	HBN		
HUMIDIFIER	HUM		
HYDRAULIC ACTUATOR	HYD		
HYDRAULIC SYSTEM SKID	HSS		
ION EXCHANGE COLUMN	IXC		
JUNCTION BOX	JBX		
LIFT TABLE	LFT		
LIGHTING PANEL	LTP		
LIVE ROLLER CONVEYOR	LRC		
LOUVER	LVR		
MAIN CIRCUIT BREAKER	MCB		
MINI POWER ZONE	MPZ		
MIXER / AGITATOR	MXA		
MIXER / BLENDER	MXB		
MOTOR	MTR		
MOTOR CONTROL CENTER	MCC		
MOTOR STARTER PANEL	MSP		
OIL/WATER SEPARATOR	OWS		
ORIFICE PLATE	ORF		

DRIVERS

DIESEL ENGINE

ELECTRIC MOTOR

FILTERS

35% ASHRAE

90% ASHRAE

HEPA

EQUIPMENT NUMBER IDENTIFICATION

XXX-YY-ZZZZ

- ZZZZ — EQUIPMENT SEQUENCE NUMBER
- YY — SYSTEM NUMBER (SEE N0001)
- XXX — EQUIPMENT DESIGNATOR

GENERAL NOTES:

1. ALL MOTORS ARE 3 PHASE, 60 HERTZ, 230/460 VOLTS, AND 1750 RPM UNLESS OTHERWISE NOTED.
2. ALL PROCESS SYSTEMS CHANGE AT INLET TO VALVE ON TOP OF TANKS.
3. ALL BALL VALVES ARE FULL PORT UNLESS OTHERWISE NOTED.
4. CAMERAS LOCATED INSIDE TANKS WILL HAVE WATER AND/OR AIR FLUSHING OF LENSES. DETAILS TO BE DETERMINED LATER.
5. IN GENERAL, FLUSH AND PROCESS WATER LINES WILL BE ROUTED TO TOP OF SLURRY LINES.
6. ONLY MAJOR COMPRESSED AIR USERS ARE FLAGGED. SMALLER AIR CONSUMPTION POINTS SUCH AS SOLENOID OPERATED VALVES ARE NOT DRAWN.

000205

REF DWG NO.	DRAWING TITLE

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
D	ISSUE FOR DESIGN	10/07/02	SJM	GCS
C	ISSUE FOR DESIGN	08/29/02	GCS	WET
B	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
A	ISSUE FOR DESIGN	02/19/02	SJM	WET

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JE JACOBS — 125 Broadway Ave., Oak Ridge, Tennessee 37830, Tel: 865-220-8000, Fax: 865-220-6170

PROJECT NAME: SILOS 1 AND 2

DRAWING TITLE: INSTRUMENTATION PIPING AND INSTRUMENT DIAGRAM EQUIPMENT AND MISCELLANEOUS

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
STERLINGSR	02/19/02	NICHOLAS P. KOHUT	02/19/02	SUSAN J. MITCHELL	02/19/02

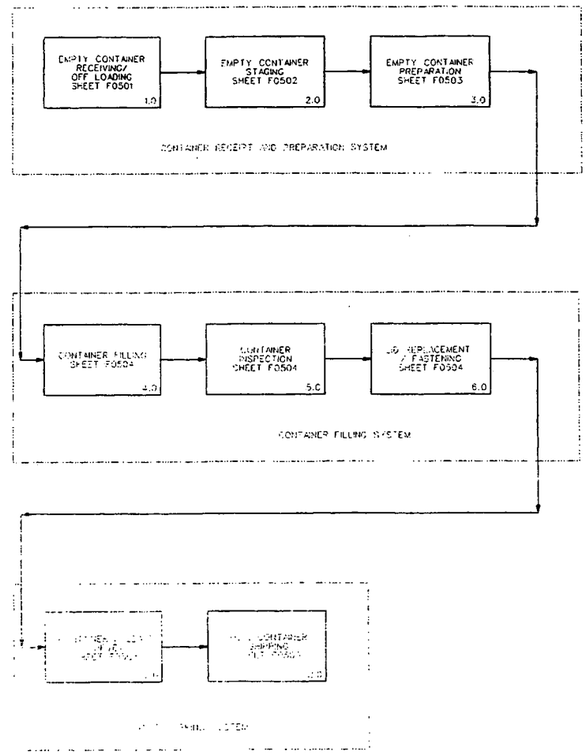
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	U

SUBMITTED FOR 30% ISSUE — TECH LEAD ____ DATE ____
SUBMITTED FOR 60% ISSUE — TECH LEAD ____ DATE ____
SUBMITTED FOR 90% ISSUE — TECH LEAD ____ DATE ____

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-N-01163	N0003	D

JE PROJECT NO.	FILENAME
35H19603	94XN1163.DGN

DATE: 08DATE00000 TIME: 08TIME000 USER: 08USER0 DESIGN FILE: 8NDGN0000000000000000000000



LEGEND

DESCRIPTION	
D * M R	EVENT ID

D=DATA LOGGED IN PLC
*=OPERATOR INTERACTION REQUIRED
M=MANUAL TASK
R=REMOTE OPERATION INTERACTION REQUIRED

000206

PRELIMINARY
NOT FOR CONSTRUCTION

4654

NOTES:

1. SEE GENERAL ARRANGEMENTS FOR CONTAINER HANDLING SYSTEM EQUIPMENT LAYOUTS.
2. HIGH LEVEL FUNCTIONS ONLY ARE SHOWN ON THIS DRAWING. SEE SHEETS REFERENCED IN EVENT BLOCKS FOR DETAILS OF EACH FUNCTION

REF DWG NO.	DRAWING TITLE

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APP
C	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/01/02	[illegible]	[illegible]
B	PRELIMINARY DESIGN ISSUE	04/12/02	RSSR	WT
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	07/27/01	BSM	JVF

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave. Oak Ridge, Tennessee 37830 Tel: 865-220-0000 Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
FLOW DIAGRAMS
MECHANICAL FLOW DIAGRAM
CONTAINER RECEIPT AND PREPARATION SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B.A. LANGLEY	07/27/01	B.A. LANGLEY	07/27/01	B.S.McF ARLANE	07/27/01

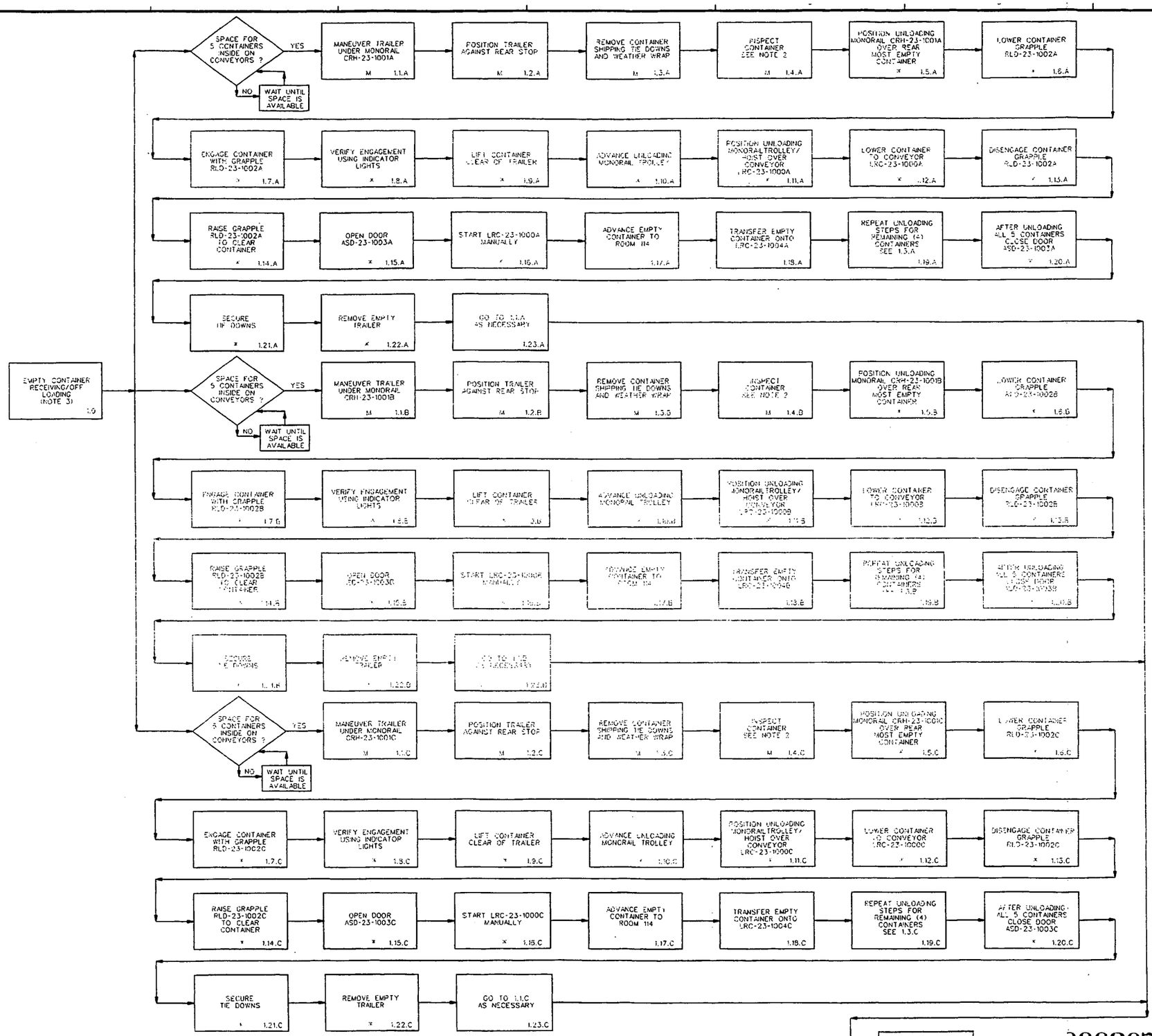
PLANT/BLDG. NO. | FLOOR | SCALE: NONE | CLASS: U

SUBMITTED FOR 30% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 60% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 90% ISSUE — TECH LEAD — DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01100	F0500	C

JEC PROJECT NO.	FILENAME
35H19603	94XF100.DGN

DATE: 07/30/02 TIME: 03:56:41 PM USER: EngrGuest DESIGN FILE: h:\projects\mechanical\dfs\dgns\94XF100.dgn



NOTES:

1. FOR MFD GENERAL NOTES SEE SHEET F0500.
2. DEFECTIVE CONTAINERS WILL BE RED TAGGED AND RETURNED TO VENDOR FOR REPAIR/REPLACEMENT.
3. IT IS ASSUMED THAT FIVE CONTAINERS WILL BE RECEIVED PER TRUCK SHIPMENT.

4654

REF DWG NO.	DRAWING TITLE
N0511	CONTAINER RECEIPT AND PREPARATION SYSTEM
N0512	CONTAINER RECEIPT AND PREPARATION SYSTEM
N0513	CONTAINER RECEIPT AND PREPARATION SYSTEM

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
C	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/01/02	[illegible]	
B	PRELIMINARY DESIGN ISSUE	04/12/02	RSSR	WT
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	07/27/01	BSM	JVF

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JE JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-4170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
FLOW DIAGRAMS
MECHANICAL FLOW DIAGRAM
CONTAINER RECIEPT AND PREPARATION SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B.A. LANGLEY	07/27/01	B.A. LANGLEY	07/27/01	B.S. McFARLANE	07/27/01

PLANT/BLDG. NO. | FLOOR | SCALE: NONE | CLASS: U

SUBMITTED FOR 30% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 60% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 90% ISSUE — TECH LEAD — DATE

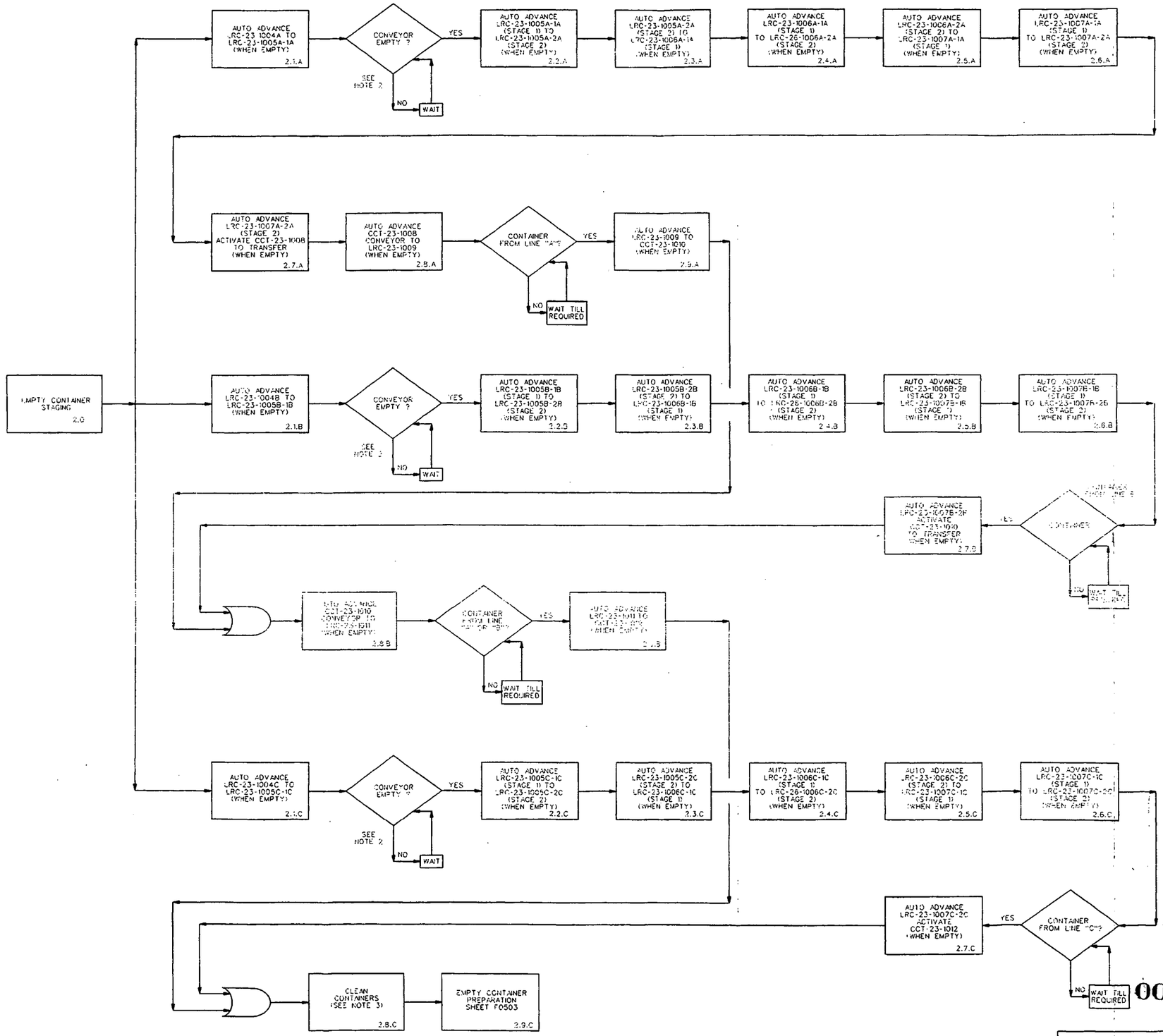
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01101	F0501	C

JEC PROJECT NO. 35H119603 | FILENAME 94XF101LOGN

000207

PRELIMINARY
NOT FOR CONSTRUCTION

DATE: 07/30/02
TIME: 04:26:44 PM
USER: EngrGuest
DESIGN FILE: I:\Proj\Mechanical\Drawings\94xf101.dgn



000205

PRELIMINARY
NOT FOR CONSTRUCTION

NOTES:

1. FOR MFD GENERAL NOTES SEE SHEET F0500.
2. DECISION PROCESS TYPICAL BETWEEN EACH ACCUMULATING CONVEYOR SECTION.
3. CONTAINERS CAN BE CLEANED AT ANY POINT ON THE CONTAINER LINES.

4654

REF DWG NO.	DRAWING TITLE
N0514	CONTAINER RECEIPT AND PREPARATION SYSTEM
N0515	CONTAINER RECEIPT AND PREPARATION SYSTEM
N0516	CONTAINER RECEIPT AND PREPARATION SYSTEM
N0517	CONTAINER RECEIPT AND PREPARATION SYSTEM

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APP'D
C	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/01/02	[illegible]	[illegible]
B	PRELIMINARY DESIGN ISSUE	04/12/02	RSSR	WT
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	07/27/01	BSM	JVF

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JE JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
FLOW DIAGRAMS
MECHANICAL FLOW DIAGRAM
CONTAINER RECEIPT AND PREPARATION SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B.A. LANGLEY	07/27/01	B.A. LANGLEY	07/27/01	B.S. McFARLANE	07/27/01

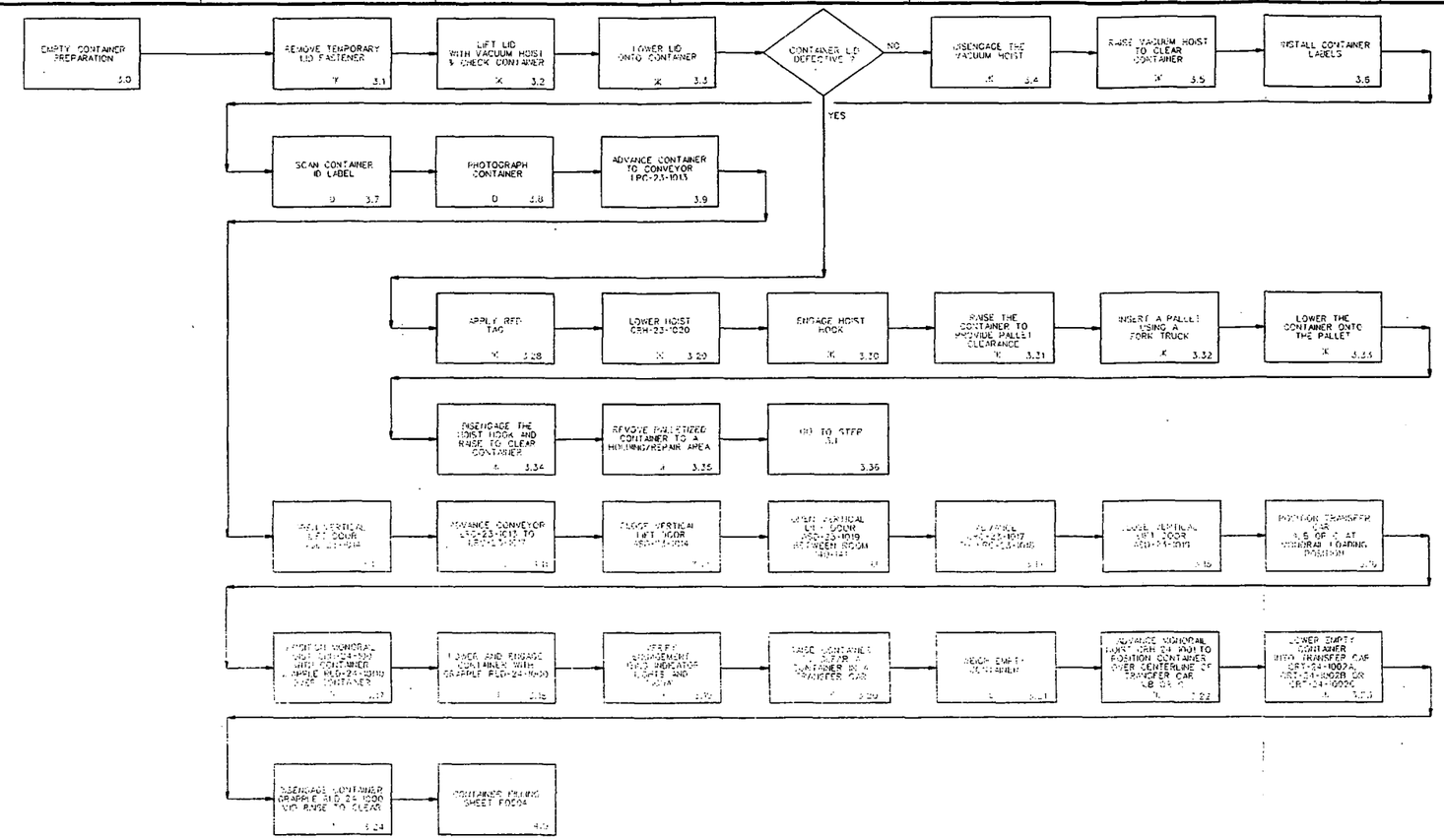
DRAWING/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01102	F0502	C

JEC PROJECT NO.	FILENAME
35H19603	94XF1102.DGN

DATE: 07/31/02
TIME: 06:36:45 AM
USER: Engr Guest
DESIGN FILE: I:\Proc\Mechanical\Drawings\94XF1102.dgn



NOTES:

1. FOR MFD GENERAL NOTES SEE SHEET F0500.

4654

REF DWG NO.	DRAWING TITLE
N0518	CONTAINER RECEIPT AND PREPARATION SYSTEM
N0519	CONTAINER RECEIPT AND PREPARATION SYSTEM

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APP.
C	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/01/02	[illegible]	[illegible]
B	PRELIMINARY DESIGN ISSUE	04/12/02	RSSR	WT
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	07/27/01	BSM	JVF

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JACOBS

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
FLOW DIAGRAMS
MECHANICAL FLOW DIAGRAM
CONTAINER RECEIPT AND PREPARATION SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B.A. LANGLEY	07/27/01	B.A. LANGLEY	07/27/01	B.S. McFARLANE	07/27/01

PLANT/BLDG. NO. | FLOOR | SCALE NONE | CLASS U

SUBMITTED FOR 30% ISSUE | SUBMITTED FOR 60% ISSUE | SUBMITTED FOR 90% ISSUE
TECH LEAD | TECH LEAD | TECH LEAD
DATE | DATE | DATE

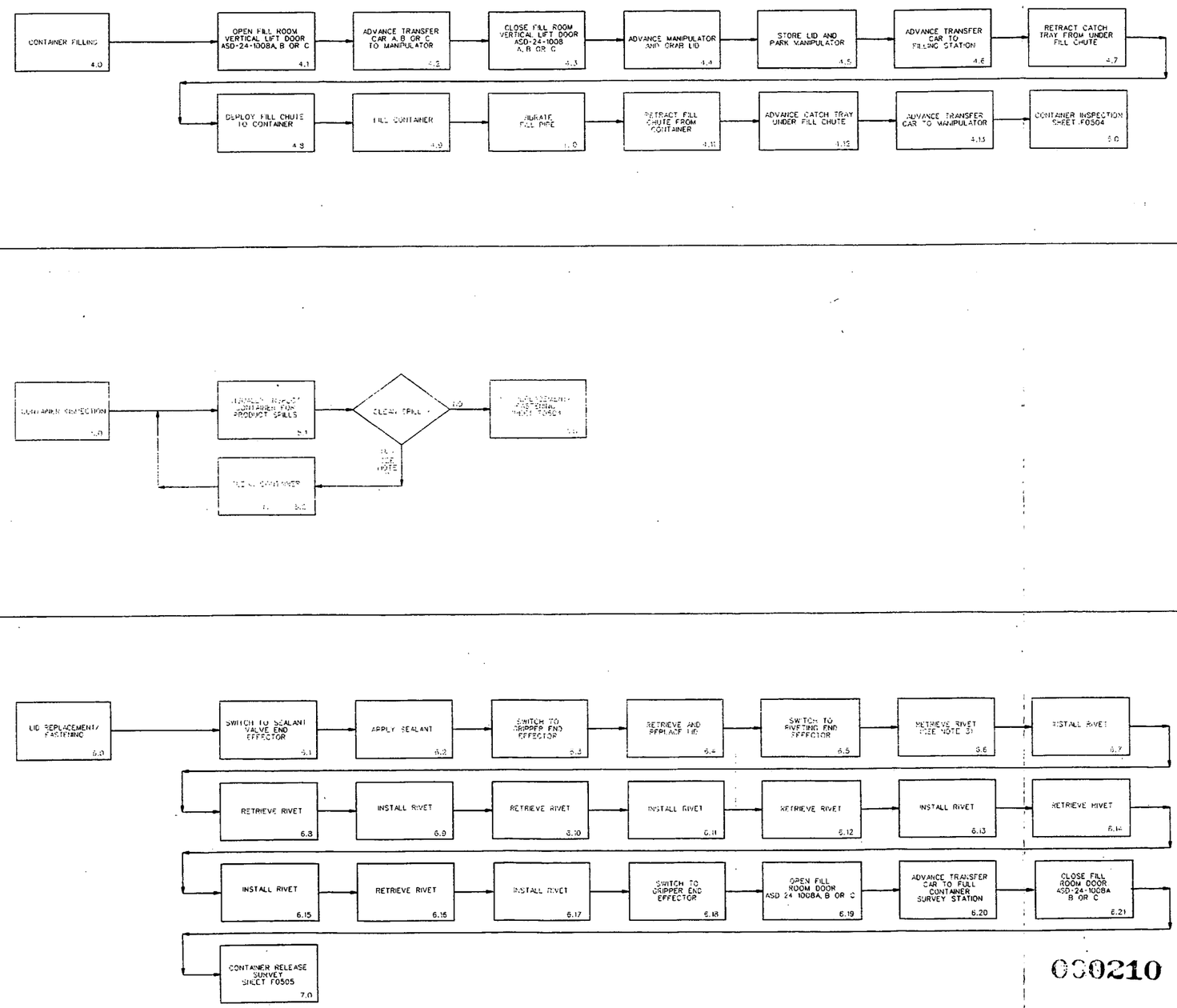
T.D. NUMBER N/A | PROJECT NO. 40750 | DRAWING INDEX CODE NO. 94X-3900-F-01103 | SHEET NO. F0503 | REV. NO. C

J.E.G. PROJECT NO. 35H19603 | FILENAME 94XF1103.DGN

000209

PRELIMINARY
NOT FOR CONSTRUCTION

DATE: 07/30/02 TIME: 04:29:23 PM | USER: EngrGuee | DESIGN FILE: I:\Proc\Mechanical\Drawings\94XF803.dgn



NOTES:

1. FOR MFD GENERAL NOTES SEE SHEET F0500.
2. MINOR SPILLS ON THE CONTAINER TOP ARE MANUALLY WIPED UP PRIOR TO PLACEMENT OF THE LID. MAJOR SPILLS WILL BE ADDRESSED ON A CASE-BY-CASE BASIS.
3. DESIGN BASIS USES 6 RIVETS TO FASTEN THE LID

4654

REF DWG NO.	DRAWING TITLE
N0520	CONTAINER FILLING SYSTEM
N0521	CONTAINER FILLING SYSTEM
N0522	CONTAINER FILLING SYSTEM
N0523	CONTAINER FILLING SYSTEM

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPV
C	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/01/02		
B	PRELIMINARY DESIGN ISSUE	04/12/02	RSSR	WT
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	07/27/01	BSM	JVF

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-270-4800
Fax: 865-270-4175

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
FLOW DIAGRAMS
MECHANICAL FLOW DIAGRAM
CONTAINER FILLING SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B.A. LANGLEY	07/27/01	B.A. LANGLEY	07/27/01	B.S. McFARLANE	07/27/01

PLANT/BLDG. NO. | FLOOR | SCALE NONE | CLASS U

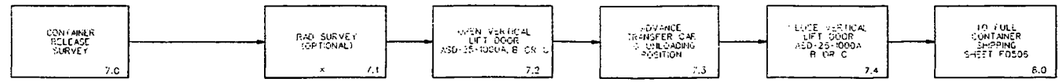
SUBMITTED FOR 30% ISSUE | SUBMITTED FOR 60% ISSUE | SUBMITTED FOR 90% ISSUE
TECH LEAD | TECH LEAD | TECH LEAD
DATE | DATE | DATE

T.D. NUMBER N/A | PROJECT NO. 40750 | DRAWING INDEX CODE NO. 94X-3900-F-01104 | SHEET NO. F0504 | REV. NO. C
JEG PROJECT NO. 35H19503 | FILENAME 94XF1104.DGN

000210

PRELIMINARY
NOT FOR CONSTRUCTION

DATE: 07/30/02 TIME: 03:52:49 PM | USER: EngrGuee | DESIGN FILE: I:\Proc\Mechanical\Drawings\94XF104.dgn



NOTES:

1 FOR MFD GENERAL NOTES SEE SHEET F0500.

4654

REF DWG NO.	DRAWING TITLE
N0700	CONTAINER FILLING SYSTEM
N0701	CONTAINER FILLING SYSTEM
N0702	CONTAINER FILLING SYSTEM

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
C	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/01/02	[illegible]	[illegible]
B	PRELIMINARY DESIGN ISSUE	04/12/02	RSSR	WF
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	07/27/01	BSM	JVF

INITIALS AND DATE

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JACOBS

125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4000
Fax: 865-220-6170

PROJECT NAME

SILOS 1 AND 2

DRAWING TITLE

FLOW DIAGRAMS
MECHANICAL FLOW DIAGRAM
CONTAINER SHIPPING SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B.A. LANGLEY	07/27/01	B.A. LANGLEY	07/27/01	B.S. McFARLANE	07/27/01

PLANT/FIELD NO.	FLOOR	SCALE	CLASS
		NONE	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

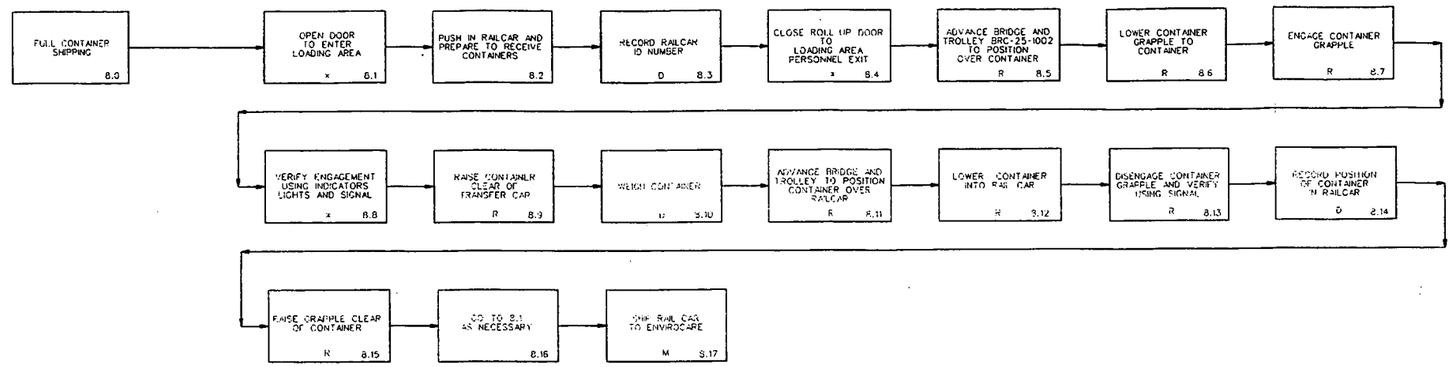
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01105	F0505	C

JEG PROJECT NO.	FILENAME
35H19603	94XF1105.DGN

000211

PRELIMINARY
NOT FOR CONSTRUCTION

DATE: 07/30/02
TIME: 03:36:35 PM
USER: EngrGuee
DESIGN FILE: I:\Proc\Mechanical\Drawings\94XF905.dgn



NOTES:

1. FOR VFD GENERAL NOTES SEE SHEET F0500.

4654

REF DWG NO.	DRAWING TITLE
N0524	CONTAINER SHIPPING SYSTEM

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR
C	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/01/02	[illegible]	[illegible]
B	PRELIMINARY DESIGN ISSUE	04/12/02	RSSR	WT
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	07/27/01	BSM	JVF

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JACOBS

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
FLOW DIAGRAMS
MECHANICAL FLOW DIAGRAM
CONTAINER SHIPPING SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B.A. LANGLEY	07/27/01	B.A. LANGLEY	07/27/01	B.S. McFARLANE	07/27/01

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

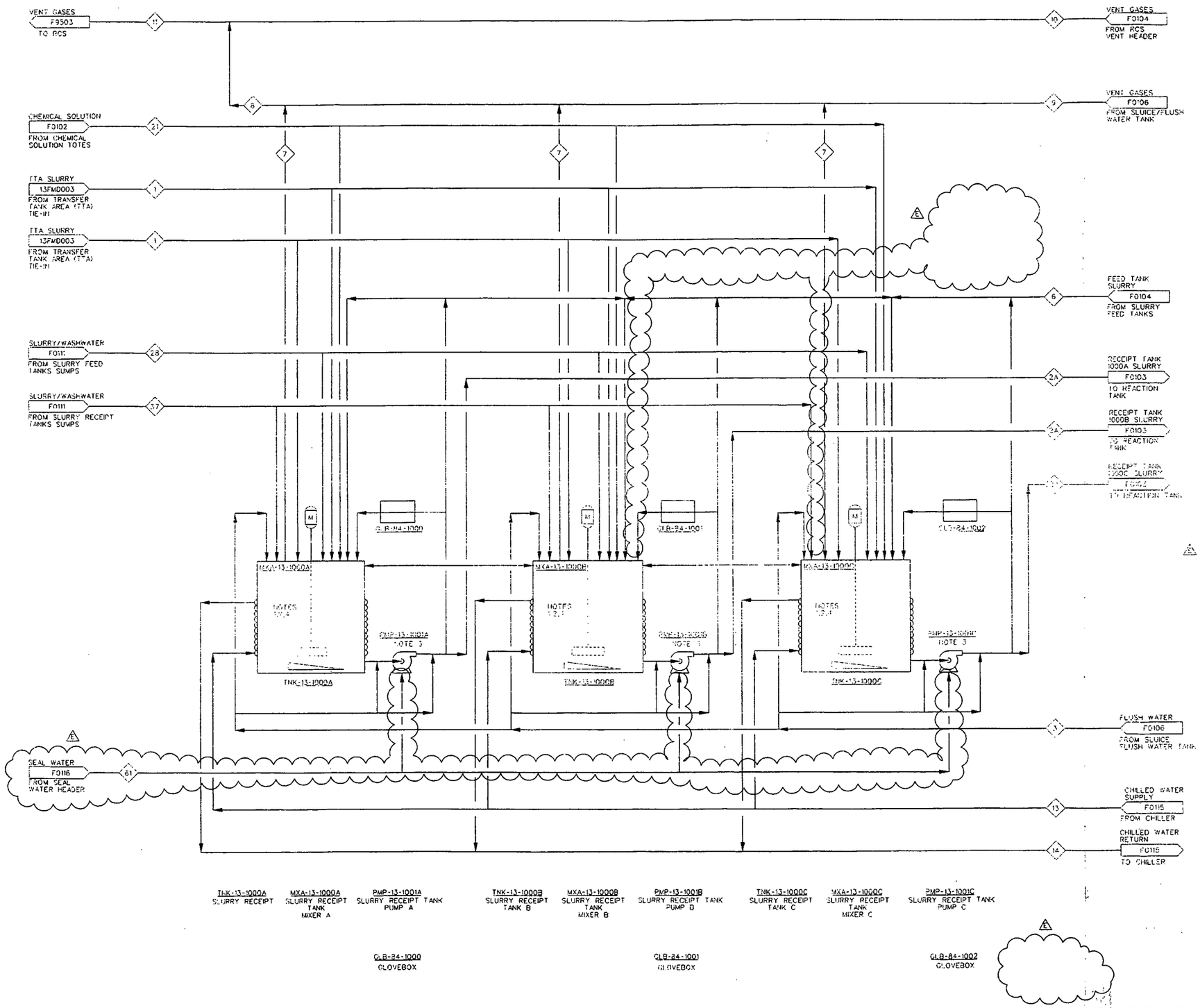
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01107	F0506	C

JEC PROJECT NO.	FILENAME
35H19603	94XF107.DGN

000212

PRELIMINARY
NOT FOR CONSTRUCTION

DATE: 07/30/02 TIME: 03:42:39 PM USER: EnginGuest DESIGN FILE: I:\Proc\Mechanical\Drawings\94XF407.dgn



NOTES:

1. ONLY ONE SLURRY RECEIPT TANK VOLUME IS FILLED AT A TIME.
2. EACH SLURRY RECEIPT TANK IS SIZED TO OPERATE IN THE TOP TWO-THIRDS OF THE TANK VOLUME SO THAT THE AGITATOR IS IN THE LIQUID LEVEL AT ALL TIMES.
3. VARIABLE SPEED MOTORS ARE INSTALLED ON RECEIPT TANK PUMPS TO ALLOW CRITICAL VELOCITY TO BE MAINTAINED DURING FEEDING AND RECYCLE OPERATIONS.
4. TANKS TO HAVE JACKET FOR CHILLED WATER.

4654

REF DWG NO.	DRAWING TITLE
F0100	MATERIAL BALANCE TABLES
N0001	PIPING AND INSTRUMENT DIAGRAM PIPING,VALVES AND MISCELLANEOUS
N0002	PIPING AND INSTRUMENT DIAGRAM INSTRUMENTATION
N0003	PIPING AND INSTRUMENT DIAGRAM EQUIPMENT AND MISCELLANEOUS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
E	ISSUE FOR DESIGN	09/25/02	GCS	WY
D	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/02/02	NPK	GCS
C	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
B	ISSUE FOR DESIGN	02/19/02	SJM	WET
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	07/30/01	MPM	SWH

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JE JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-6000
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

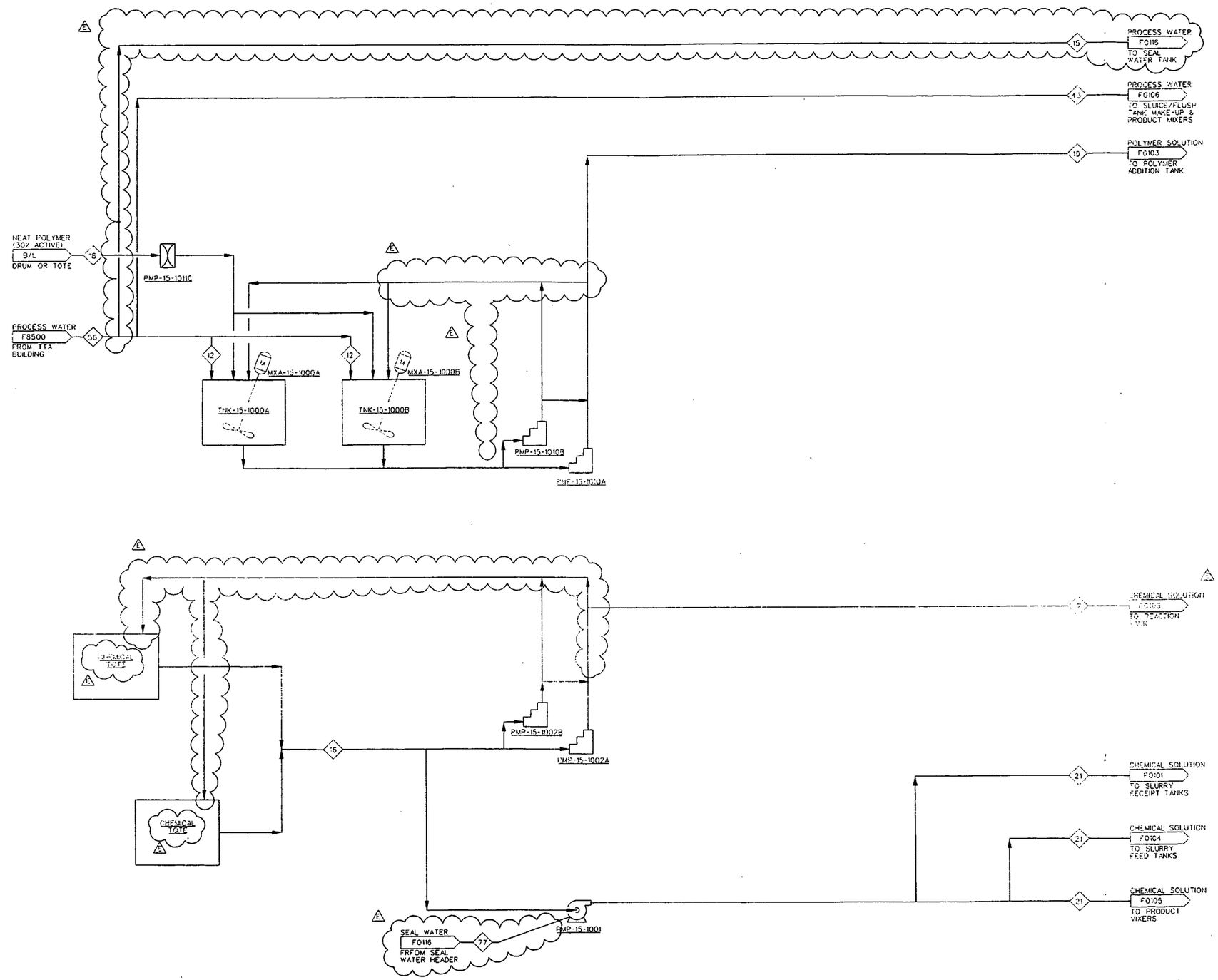
DRAWING TITLE
FLOW DIAGRAMS
PROCESS FLOW DIAGRAM
SLURRY RECEIPT TANK SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PLANT/BLDG. NO.		FLOOR		SCALE NTS	CLASS U
SUBMITTED FOR 30% ISSUE		SUBMITTED FOR 60% ISSUE		SUBMITTED FOR 90% ISSUE	
TECH LEAD		TECH LEAD		TECH LEAD	
DATE		DATE		DATE	

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01153	F0101	E
JEC PROJECT NO. 35H19603	FILENAME 94XF1153.DGN			

000213

DATE: ##DATE#### USER: ##USER#
TIME: ##TIME### DESIGN FILE: ##DGN##########



4654

REF DWG NO.	DRAWING TITLE
F0100	MATERIAL BALANCE TABLES
N0001	PIPING AND INSTRUMENT DIAGRAM PIPING, VALVES AND MISCELLANEOUS
N0002	PIPING AND INSTRUMENT DIAGRAM INSTRUMENTATION
N0003	PIPING AND INSTRUMENT DIAGRAM EQUIPMENT AND MISCELLANEOUS

REV. NO	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR
E	ISSUE FOR DESIGN	09/25/02	GCS	WT
D	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/02/02	NPK	GCS
C	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
B	ISSUE FOR DESIGN	02/19/02	SJM	WET
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	07/30/01	MPM	SWH

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JACOBS

125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-4170

PROJECT NAME

SILOS 1 AND 2

DRAWING TITLE

FLOW DIAGRAMS
PROCESS FLOW DIAGRAM
CHEMICAL FEED PREPARATION SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
JAMES H. ROSENBALM	07/30/01	NICHOLAS P. KOHUT	07/30/01	MICHAEL MALONE	07/30/01

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NTS	U

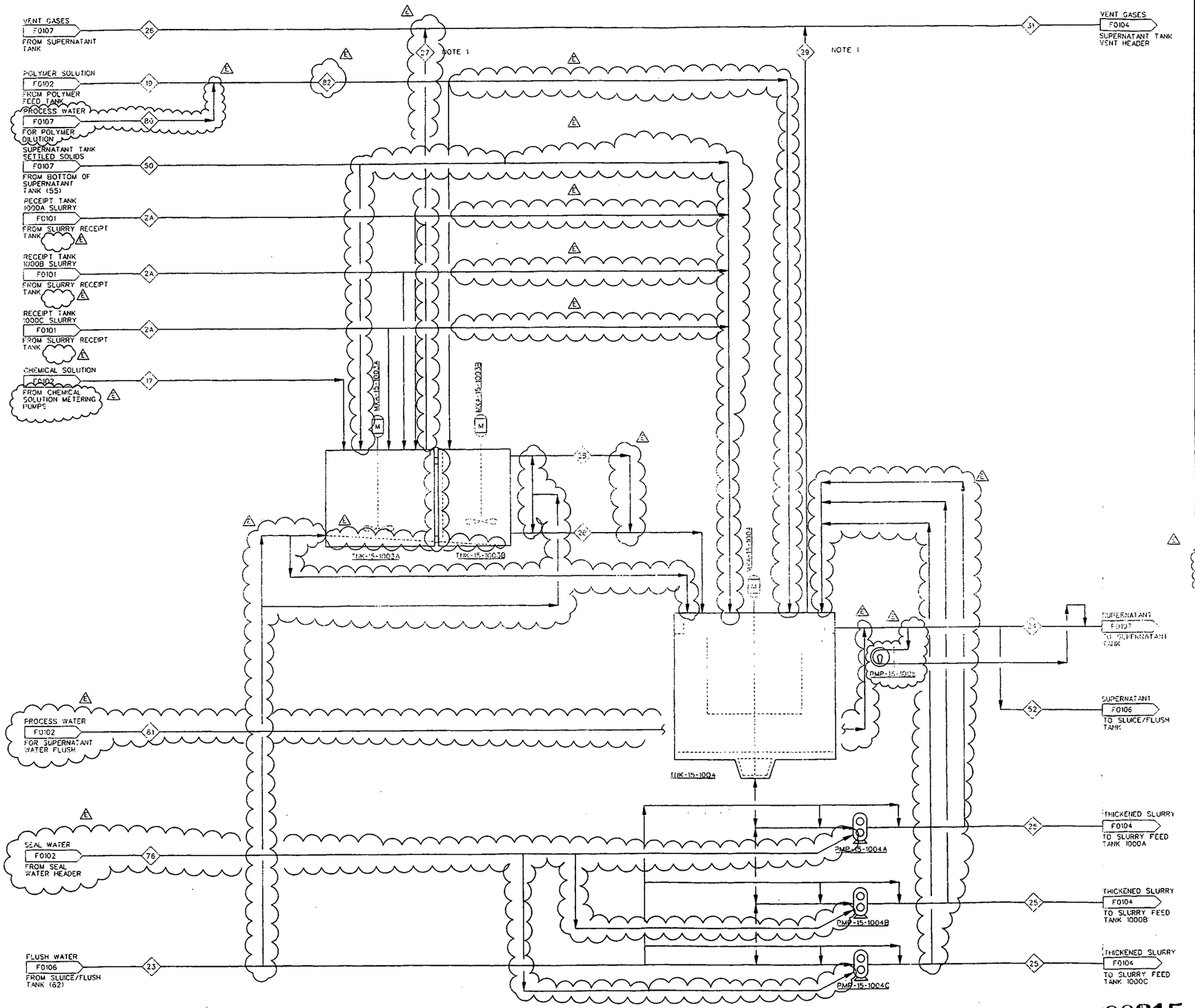
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01154	F0102	E

JEG PROJECT NO.	FILENAME
35H19603	94XF1154.DGN

000214

DATE: **DATE*****
TIME: **TIME***
USER: **USER*
DESIGN FILE: **DGN******************************



NOTES:

1. ALL TANKS ARE AT A STEADY STATE AND THEREFORE THERE IS MINIMUM DISPLACEMENT VENTING EXCEPT AT STARTUP.

4654

REF DWG NO.	DRAWING TITLE
F0100	MATERIAL BALANCE TABLES
N0001	PIPING AND INSTRUMENT DIAGRAM PIPING, VALVES AND MISCELLANEOUS
N0002	PIPING AND INSTRUMENT DIAGRAM INSTRUMENTATION
N0003	PIPING AND INSTRUMENT DIAGRAM EQUIPMENT AND MISCELLANEOUS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
E	ISSUE FOR DESIGN	09/25/02	GCS	WT
D	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/02/02	NPK	GCS
C	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
B	ISSUE FOR DESIGN	02/19/02	SJM	WET
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	07/30/01	MPM	SWH

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JE JACOBS — 125 Broadway Ave., Oak Ridge, Tennessee 37830, Tel: 865-220-4800, Fax: 865-220-6170

PROJECT NAME: SILOS 1 AND 2

DRAWING TITLE: FLOW DIAGRAMS
PROCESS FLOW DIAGRAM
SLURRY CONDITIONING AND DEWATERING SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
JAMES H. ROSENBALM	07/30/01	NICHOLAS P. KOHUT	07/30/01	MICHAEL MALONE	07/30/01

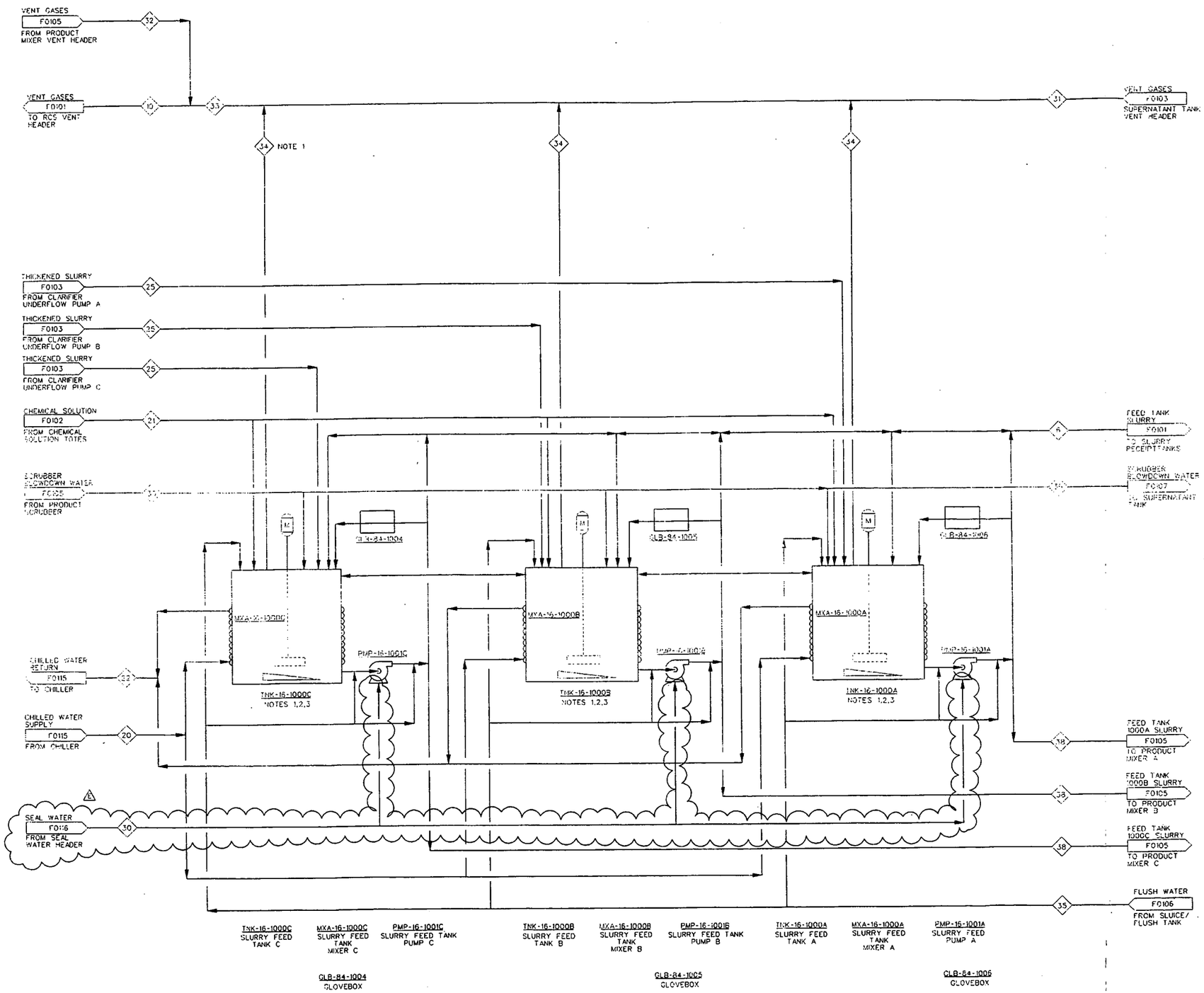
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NTS	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01155	F0103	E

JEC PROJECT NO. 35H119603 — FILENAME 94XF1155.DGN

DATE: ##DATE#### TIME: ##TIME#### USER: ##USER## DESIGN FILE: ##DGN##########################



NOTES:

1. ONLY ONE SLURRY FEED TANK IS FILLED AT A TIME.
2. EACH SLURRY FEED TANK IS TO OPERATE IN THE TOP TWO-THIRDS OF THE TANK VOLUME SO THAT THE AGITATOR IS BELOW THE LIQUID LEVEL AT ALL TIMES.
3. TANKS TO HAVE JACKET FOR CHILLED WATER.

4654

REF DWG NO.	DRAWING TITLE
F0100	MATERIAL BALANCE TABLES
N0001	PIPING AND INSTRUMENT DIAGRAM PIPING, VALVES AND MISCELLANEOUS
N0002	PIPING AND INSTRUMENT DIAGRAM INSTRUMENTATION
N0003	PIPING AND INSTRUMENT DIAGRAM EQUIPMENT AND MISCELLANEOUS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
E	ISSUE FOR DESIGN	09/25/02	GCS	WT
D	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/02/02	NPK	GCS
C	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
B	ISSUE FOR DESIGN	02/19/02	SJM	WET
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	07/30/01	MPM	SWH

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
FLOW DIAGRAMS
PROCESS FLOW DIAGRAM
SLURRY FEED SYSTEMS

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
JAMES H. ROSENBALM	7/30/01	NICHOLAS P. KOHUT	07/30/01	MICHAEL MALONE	07/30/01

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NTS	U

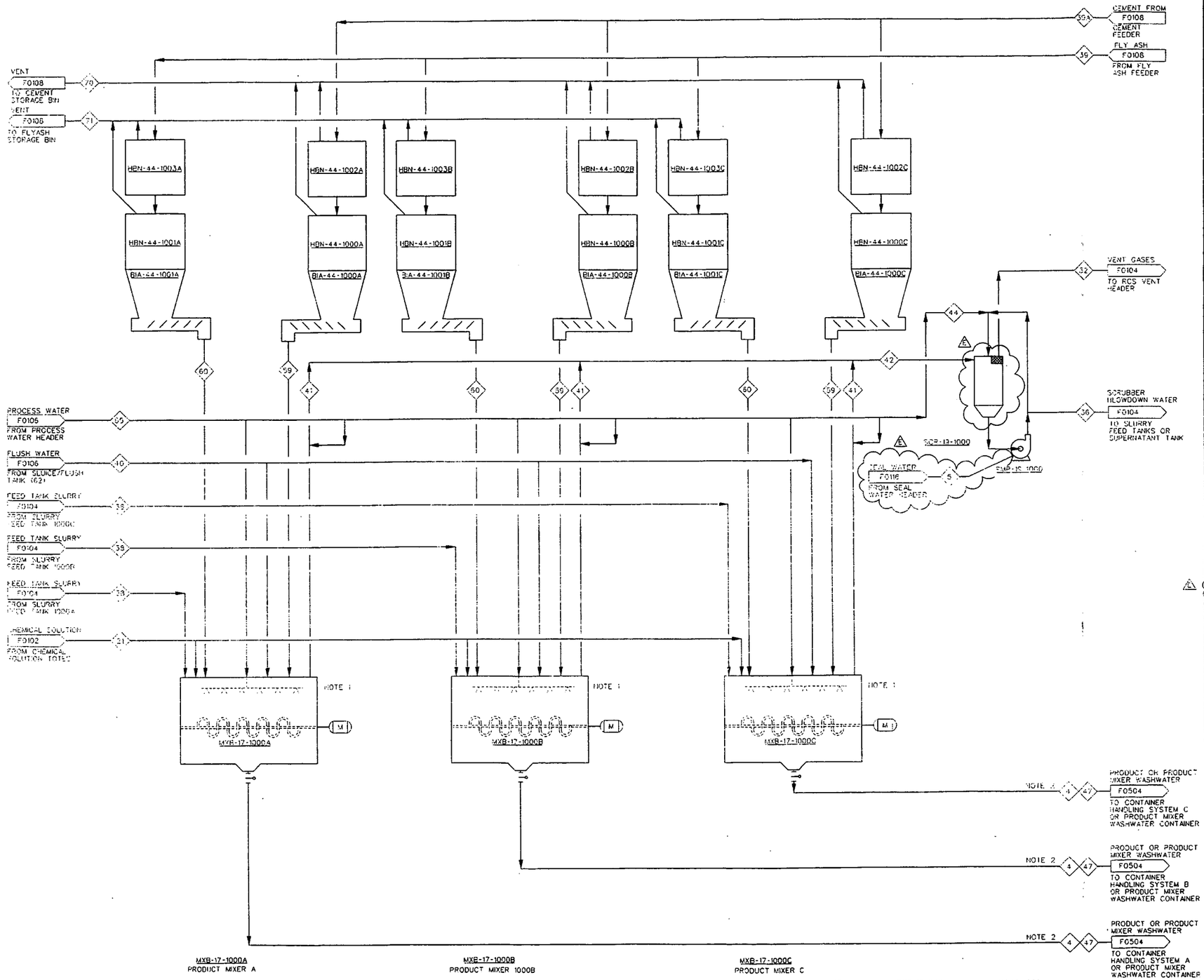
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01156	F0104	E

JEC PROJECT NO.	FILENAME
35H19603	94XF1156.DGN

000216

DATE: @DATE@@@@@ TIME: @STIME@@@ USER: @USER@ DESIGN FILE: @@DGN@@@@@@@@@@@@@@@@@@@@@@@@



NOTES:

1. PRODUCT MIXERS WILL BE FILLED ONE AT A TIME.
2. STREAMS 47 (PRODUCT) AND 4 (MIXER WASHWATER) USE SAME LINE TO DROP TO CONTAINER(S).

4654

REF DWG NO.	DRAWING TITLE
F0100	MATERIAL BALANCE TABLES
N0001	PIPING AND INSTRUMENT DIAGRAM PIPING, VALVES, AND MISCELLANEOUS
N0002	PIPING AND INSTRUMENT DIAGRAM INSTRUMENTATION
N0003	PIPING AND INSTRUMENT DIAGRAM EQUIPMENT AND MISCELLANEOUS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
E	ISSUE FOR DESIGN	09/25/02	GCS	WT
D	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/02/02	NPK	GCS
C	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
B	ISSUE FOR DESIGN	02/19/02	SJM	WET
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	7/30/01	MPM	SWH

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JACOBS

PROJECT NAME: SILOS 1 AND 2

DRAWING TITLE: FLOW DIAGRAMS
PROCESS FLOW DIAGRAM
PRODUCT STABILIZATION SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
JAMES H. ROSENBALM	7/30/01	NICHOLAS P. KOHUT	7/30/01	MICHAEL MALONE	7/30/01

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NTS	U

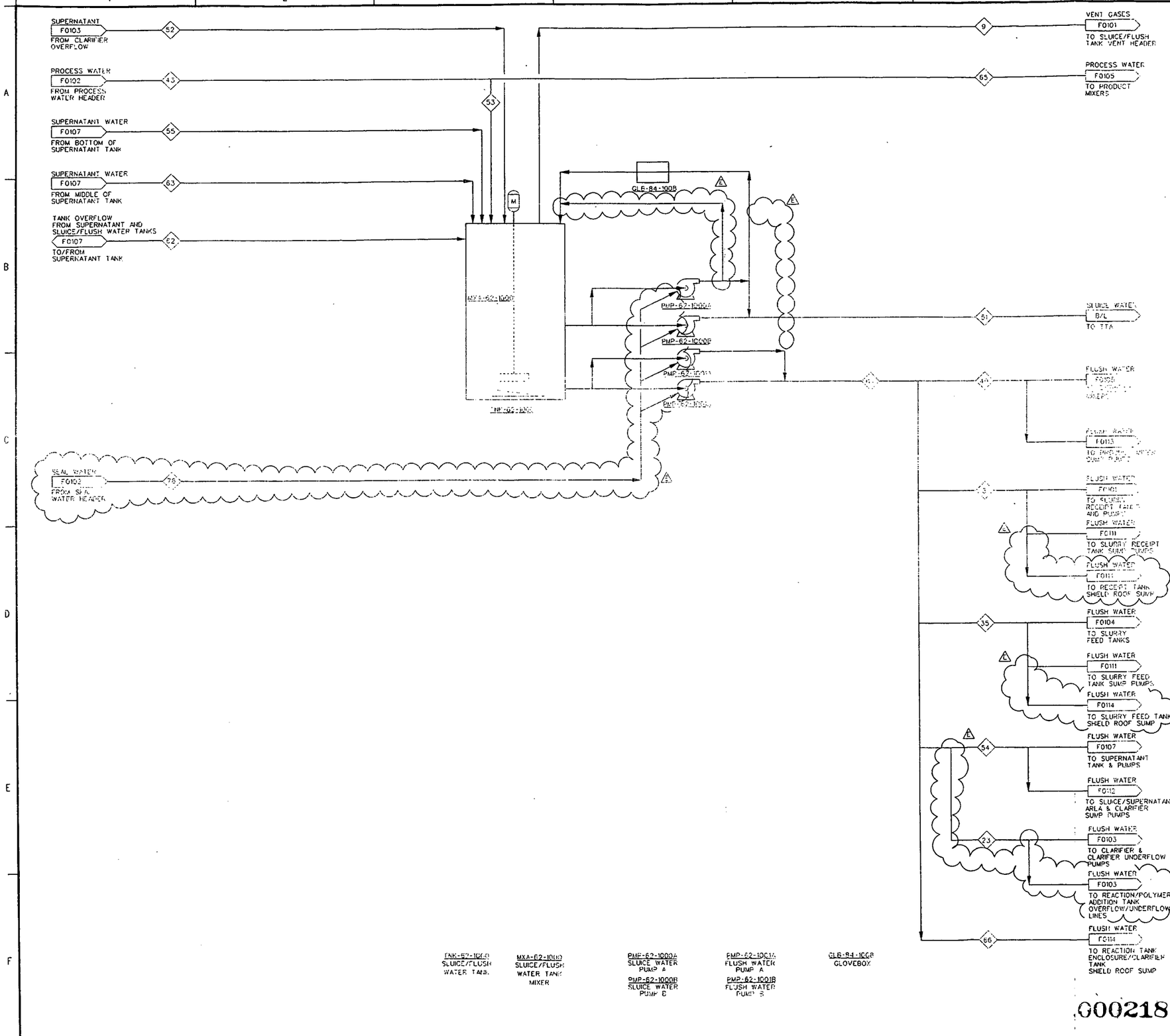
SUBMITTED FOR 30% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 60% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 90% ISSUE — TECH LEAD — DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01157	F0105	E

JEC PROJECT NO. 35H19603 — FILENAME 94XF1157.DGN

000217

DATE: 99DATE99999 TIME: 99TIME999 USER: 99USER9 DESIGN FILE: 99DGN99999999999999999999999



4654

REF DWG NO.	DRAWING TITLE
F0100	MATERIAL BALANCE TABLES
N0001	PIPING AND INSTRUMENT DIAGRAM PIPING, VALVES AND MISCELLANEOUS
N0002	PIPING AND INSTRUMENT DIAGRAM INSTRUMENTATION
N0003	PIPING AND INSTRUMENT DIAGRAM EQUIPMENT AND MISCELLANEOUS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
E	ISSUE FOR DESIGN	09/25/02	GCS	WT
D	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/02/02	NPK	GCS
C	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
B	ISSUE FOR DESIGN	02/19/02	SJM	WET
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	7/30/01	MPM	SWH

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JACOBS

125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-6170

PROJECT NAME

SILOS 1 AND 2

DRAWING TITLE

FLOW DIAGRAMS
PROCESS FLOW DIAGRAM
SLUICE/FLUSH WATER SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
JAMES H. ROSENBALM	7/30/01	NICHOLAS P. KOHUT	7/30/01	MICHAEL MALONE	7/30/01

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NTS	U

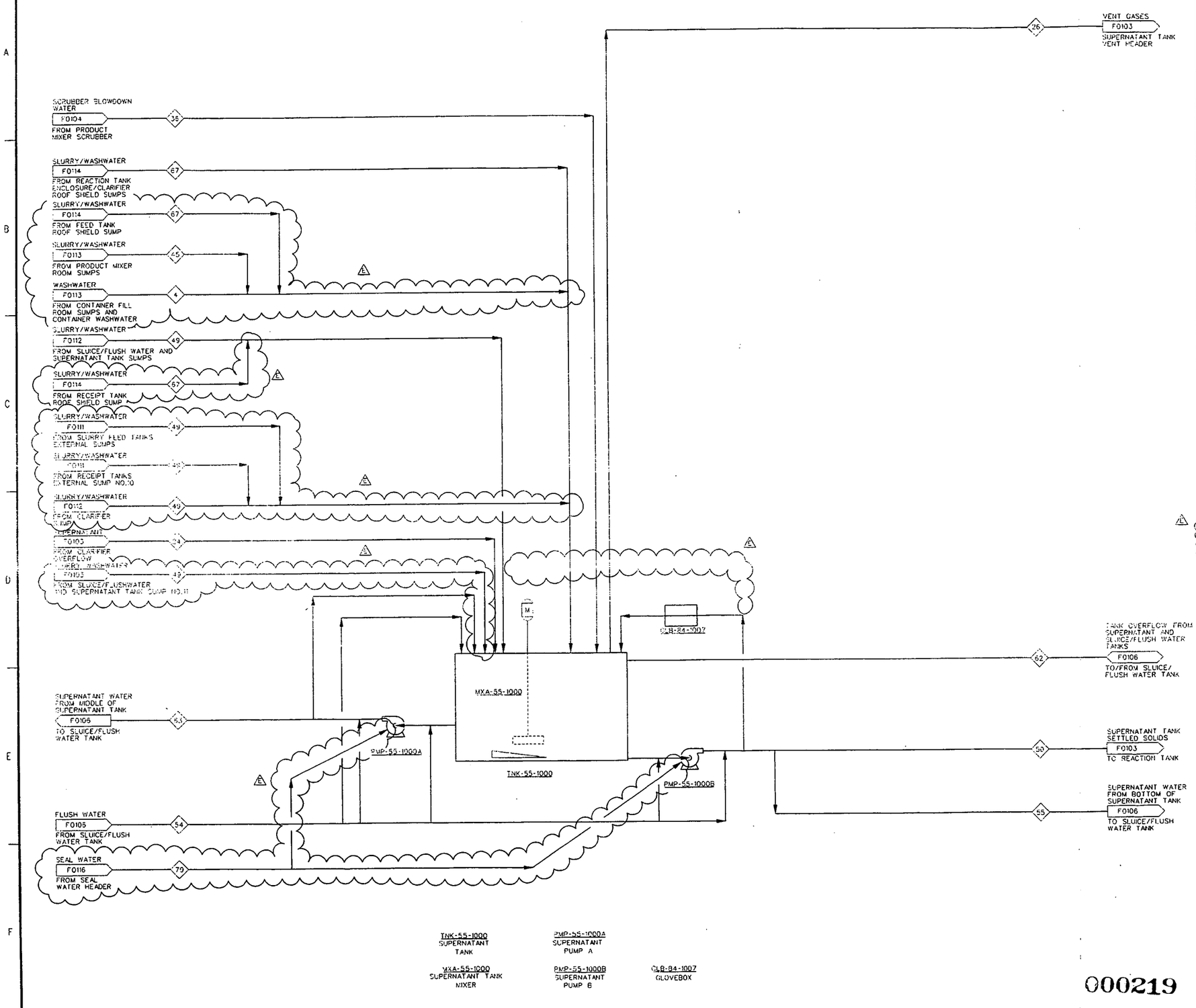
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01158	F0106	E

JEG PROJECT NO. 35H19603 | FILENAME 94XF1158.DGN

000218

DATE: 09/25/02 TIME: 05:03:48 PM USER: KentMa DESIGN FILE: I:\Proc\drawings\94XFRED.dgn



4654

REF DWG NO.	DRAWING TITLE
F0100	MATERIAL BALANCE TABLES
N0001	PIPING AND INSTRUMENT DIAGRAM PIPING,VALVES AND MISCELLANEOUS
N0002	PIPING AND INSTRUMENT DIAGRAM INSTRUMENTATION
N0003	PIPING AND INSTRUMENT DIAGRAM EQUIPMENT AND MISCELLANEOUS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
E	ISSUE FOR DESIGN	09/25/02	GCS	WT
D	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/02/02	NPK	GCS
C	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
B	ISSUE FOR DESIGN	02/19/02	SJM	WET
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	7/30/01	MPM	SWH

REVISIONS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JACOBS

125 Broadway Ave. Oak Ridge, Tennessee 37830 Tel: 865-220-4600 Fax: 865-220-6170

PROJECT NAME

SILOS 1 AND 2

DRAWING TITLE

FLOW DIAGRAMS
PROCESS FLOW DIAGRAM
SUPERNATANT WATER SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
JAMES H. ROSENBALM	7/30/01	NICHOLAS P. KOHUT	7/30/01	MICHAEL MALONE	7/30/01

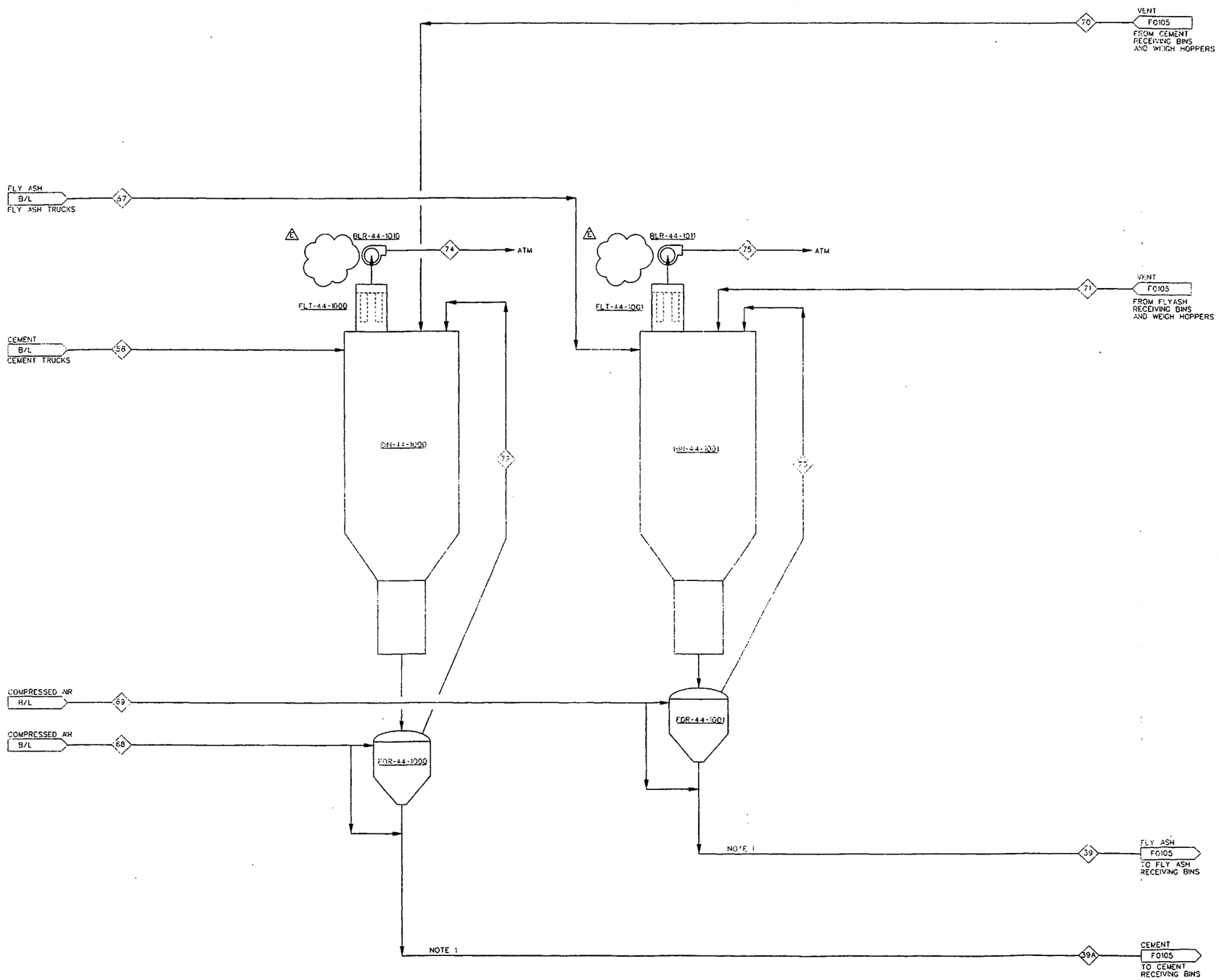
PLANT/BLDG NO.	FLOOR	SCALE	CLASS
		NTS	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01159	F0107	E

JEG PROJECT NO.	FILENAME
35H19603	94XF1159.DGN

000219



NOTES:

1. CEMENT AND FLY ASH ARE TRANSPORTED FROM BIN-44-1000 AND BIN-44-1001 TO THE PRODUCT MIXERS BY A PNEUMATIC CONVEYING SYSTEM.

4654

REF DWG NO.	DRAWING TITLE
F0100	MATERIAL BALANCE TABLES
N0001	PIPING AND INSTRUMENT DIAGRAM PIPING, VALVES AND MISCELLANEOUS
N0002	PIPING AND INSTRUMENT DIAGRAM INSTRUMENTATION
N0003	PIPING AND INSTRUMENT DIAGRAM EQUIPMENT AND MISCELLANEOUS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
E	ISSUE FOR DESIGN	09/25/02	GCS	WT
D	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/02/02	NPK	GCS
C	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
B	ISSUE FOR DESIGN	02/19/02	SJM	WET
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	7/30/01	MPM	SWH

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JE JACOBS 175 Broadway Ave., Oak Ridge, Tennessee 37830 Tel: 865-220-4600 Fax: 865-220-4670

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
FLOW DIAGRAMS
PROCESS FLOW DIAGRAM
DRY ADDITIVE SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
JAMES H. ROSENBALM	7/30/01	NICHOLAS P. KOHUT	7/30/01	MICHAEL MALONE	7/30/01

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NTS	U

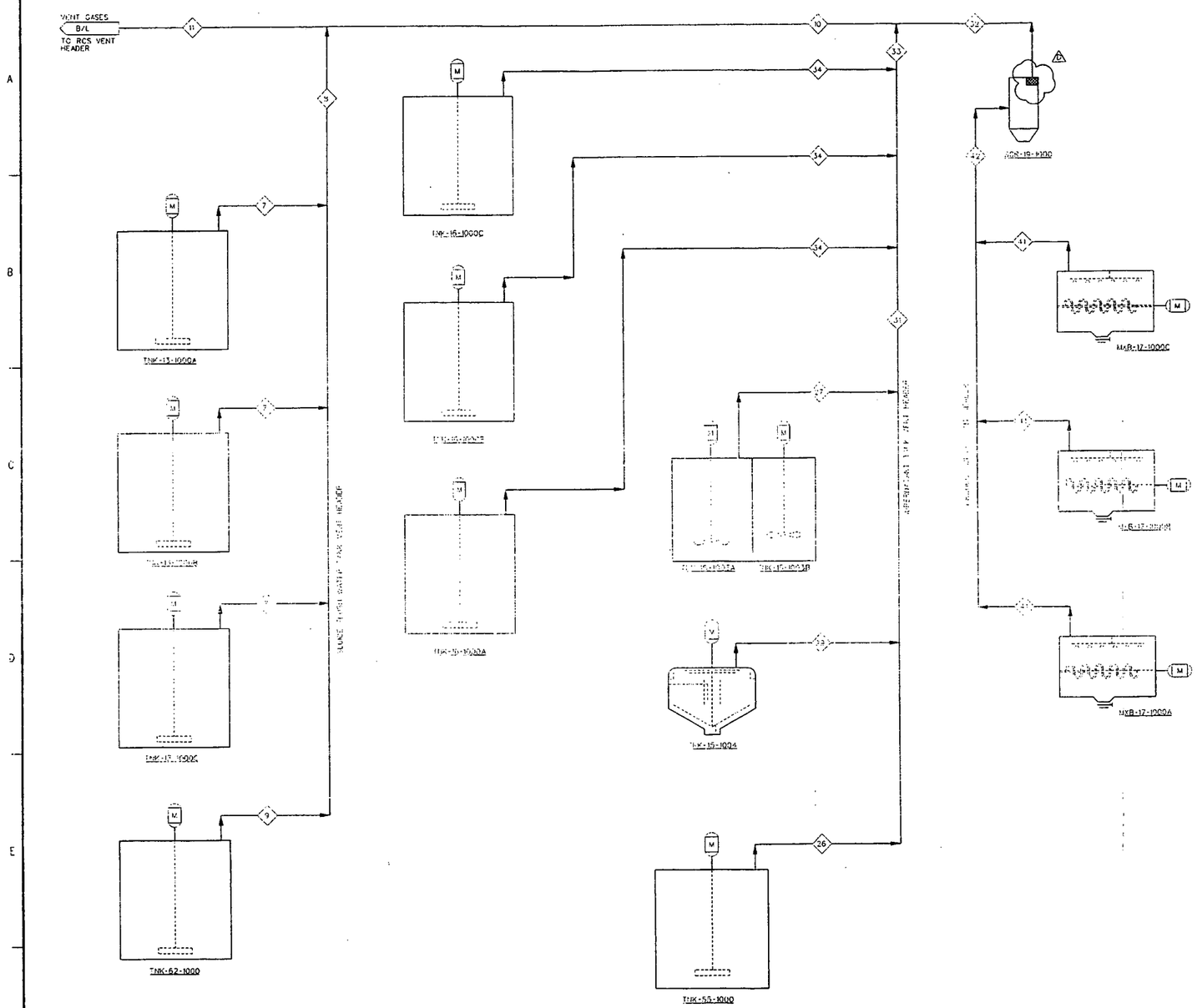
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01160	F0108	E
JE PROJECT NO. 35H19603	FILENAME 94XF160.DGN			

000220

DATE: ##DATE#### TIME: ##TIME#### USER: ##USER# DESIGN FILE: ##DGN##########

4654



TNK-62-1000	TNK-13-1000C	TNK-13-1000B	TNK-13-1000A	TNK-16-1000A	TNK-16-1000B	TNK-16-1000C	TNK-55-1000	TNK-15-1003A	TNK-15-1003B	TNK-15-1004	MXB-17-1000A	MXB-17-1000B	MXB-17-1000C	FOR-19-1000
SLUDGE/FLUSH WATER TANK	SLURRY RECEIPT TANK C	SLURRY RECEIPT TANK B	SLURRY RECEIPT	SLURRY FEED TANK	SLURRY FEED TANK	SLURRY FEED TANK	SUPERNATANT TANK	REACTION TANK	POLYMER ADDITION TANK	CLARIFIER	PRODUCT MIXER A	PRODUCT MIXER 1000B	PRODUCT MIXER 1000C	PRODUCT MIXER VENT SCRUBBER

000221

REF DWG NO.	DRAWING TITLE
F0100	MATERIAL BALANCE TABLES
N0001	PIPING AND INSTRUMENT DIAGRAM PIPING, VALVES AND MISCELLANEOUS
N0002	PIPING AND INSTRUMENT DIAGRAM INSTRUMENTATION
N0003	PIPING AND INSTRUMENT DIAGRAM EQUIPMENT AND MISCELLANEOUS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR
D	ISSUE FOR DESIGN	09/25/02	GCS	WET
C	REMEDIAL DESIGN - ISSUED FOR REVIEW	03/02/02	NPK	GCS
B	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
A	ISSUE FOR DESIGN	02/19/02	SJM	WET

DETAILS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS
125 Broadway Ave., Oak Ridge, Tennessee 37830
Tel: 865-220-9000
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
FLOW DIAGRAMS
PROCESS FLOW DIAGRAM
VESSEL VENT SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	02/19/02	NICHOLAS P. KOHUT	02/19/02	SUSAN J. MITCHELL	02/19/02

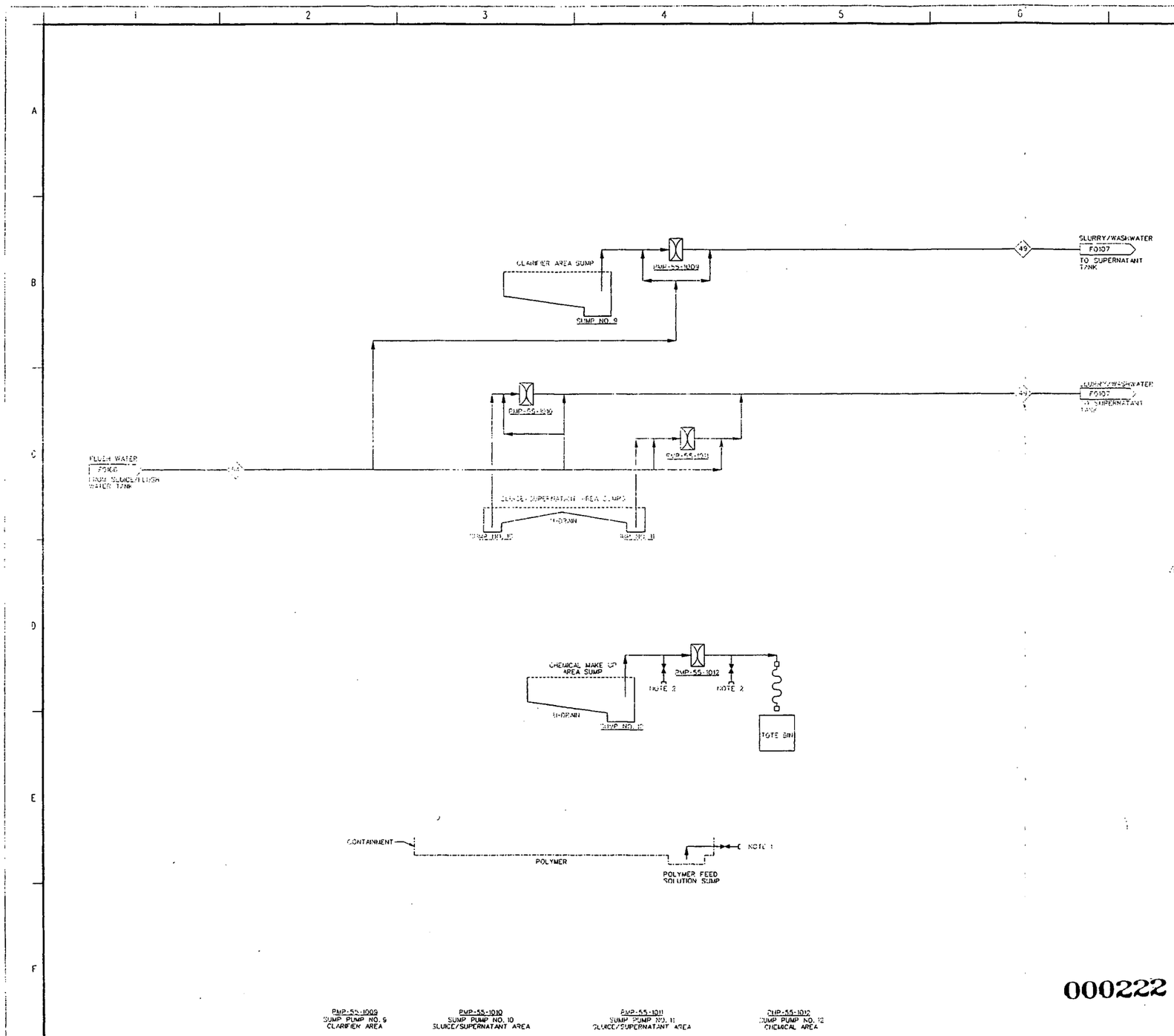
PLANT/BLDG. NO. | FLOOR | SCALE: NTS | CLASS

SUBMITTED FOR 30% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 60% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 90% ISSUE — TECH LEAD — DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01190	F0109	D

JEC PROJECT NO. 35H1950.3 | FILENAME 94XF190.DGN

DATE: 09DATE09999 TIME: 09TIME999 USER: PMUSER9 DESIGN FILE: 9FDGN



000222

NOTES:

1. PUMP-OUT CONNECTION FOR PORTABLE PUMP.
2. FLUSHING CONNECTIONS.

4654

REF DWG NO.	DRAWING TITLE
F0100	MATERIAL BALANCE TABLES
N0001	PIPING AND INSTRUMENT DIAGRAM PIPING, VALVES AND MISCELLANEOUS
N0002	PIPING AND INSTRUMENT DIAGRAM INSTRUMENTATION
N0003	PIPING AND INSTRUMENT DIAGRAM EQUIPMENT AND MISCELLANEOUS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
D	ISSUE FOR DESIGN	09/25/02	GCS	[illegible]
C	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/02/02	NPK	CCS
B	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
A	ISSUE FOR DESIGN	02/18/02	SJM	WET

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-9800
Fax: 865-220-6110

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
FLOW DIAGRAMS
PROCESS FLOW DIAGRAM
CLARIFIER/FLUSH/SUPERNATANT/CHEMICAL SUMPS

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
P. CROWE	02/19/02	NICHOLAS P. KOHUT	02/19/02	SUSAN J. MITCHELL	02/19/02

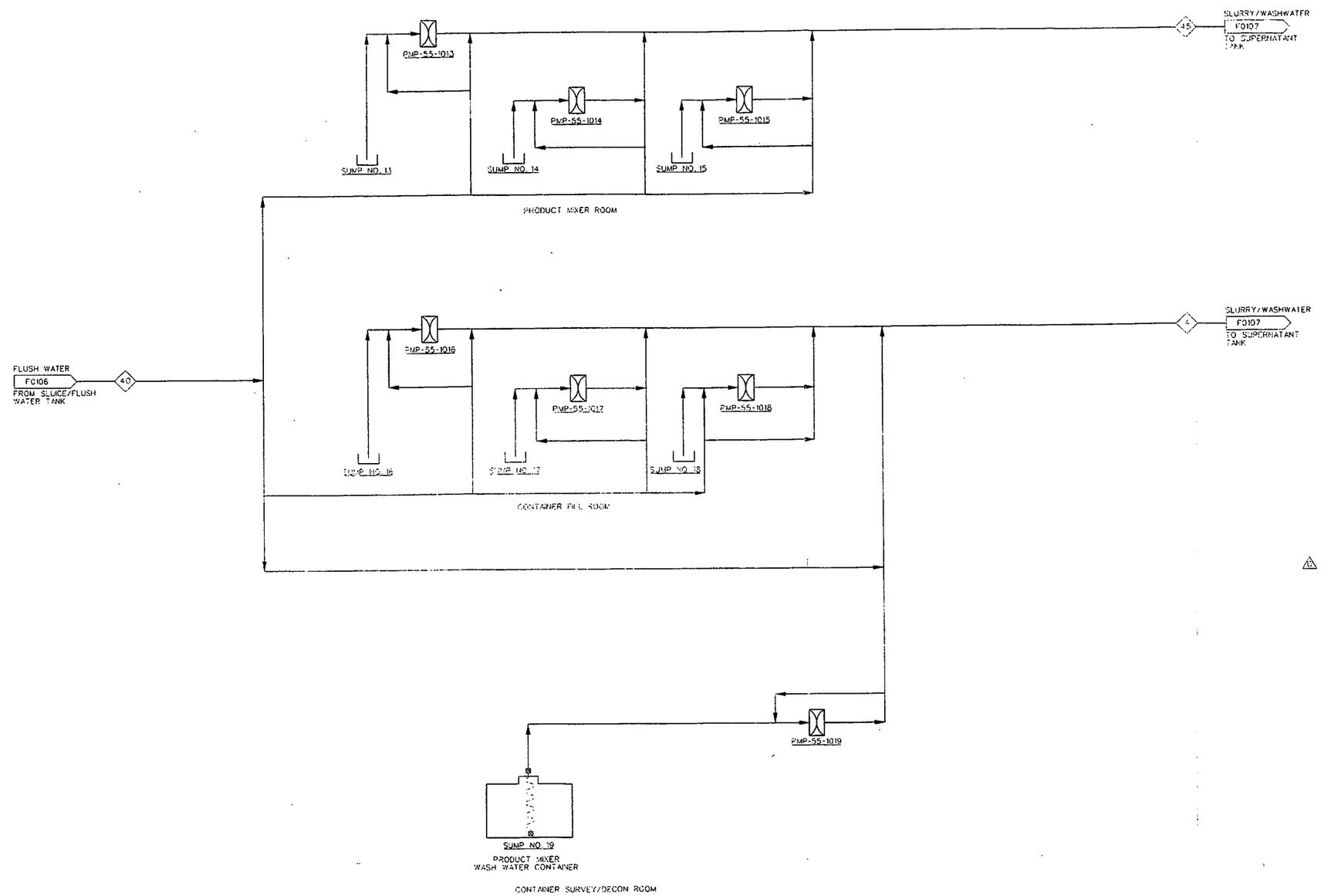
PLANT/BLDG. NO. | FLOOR | SCALE: NTS | CLASS: U

SUBMITTED FOR 30% ISSUE | SUBMITTED FOR 60% ISSUE | SUBMITTED FOR 90% ISSUE
TECH LEAD | TECH LEAD | TECH LEAD
DATE | DATE | DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01363	F0112	D

JE PROJECT NO. 35H960.3 | FILENAME 94XF1363.DGN

DATE: 09/24/2002 | USER: SHUSKIN
TIME: 08:58:00 | DESIGN FILE: 94XDGN$$$$$$$$$$$$$$$$$$$$$$$$



PMP-55-1013 SUMP PUMP NO. 13 PRODUCT MIXER

PMP-55-1014 SUMP PUMP NO. 14 PRODUCT MIXER

PMP-55-1015 SUMP PUMP NO. 15 PRODUCT MIXER

PMP-55-1016 SUMP PUMP NO. 16 CONTAINER FILL ROOM

PMP-55-1017 SUMP PUMP NO. 17 CONTAINER FILL ROOM

PMP-55-1018 SUMP PUMP NO. 18 CONTAINER FILL ROOM

PMP-55-1019 SUMP PUMP NO. 19 PRODUCT MIXER WASHWATER CONTAINER

000223

4654

REF DWG NO.	DRAWING TITLE
F0100	MATERIAL BALANCE TABLES
N0001	PIPING AND INSTRUMENT DIAGRAM PIPING, VALVES AND MISCELLANEOUS
N0002	PIPING AND INSTRUMENT DIAGRAM INSTRUMENTATION
N0003	PIPING AND INSTRUMENT DIAGRAM EQUIPMENT AND MISCELLANEOUS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APR.
D	ISSUE FOR DESIGN	09/25/02	GCS	W/T
C	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/02/02	NPK	GCS
B	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
A	ISSUE FOR DESIGN	02/19/02	SJM	WET

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JE JACOBS 125 Broadway Ave. Oak Ridge, Tennessee 37830 Tel: 865-220-4600 Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
FLOW DIAGRAMS
PROCESS FLOW DIAGRAM
MIXER/CONTAINER FILL AREA SUMPS

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
P. CROWE	02/19/02	NICHOLAS P. KOHUT	02/19/02	SUSAN J. MITCHELL	02/19/02

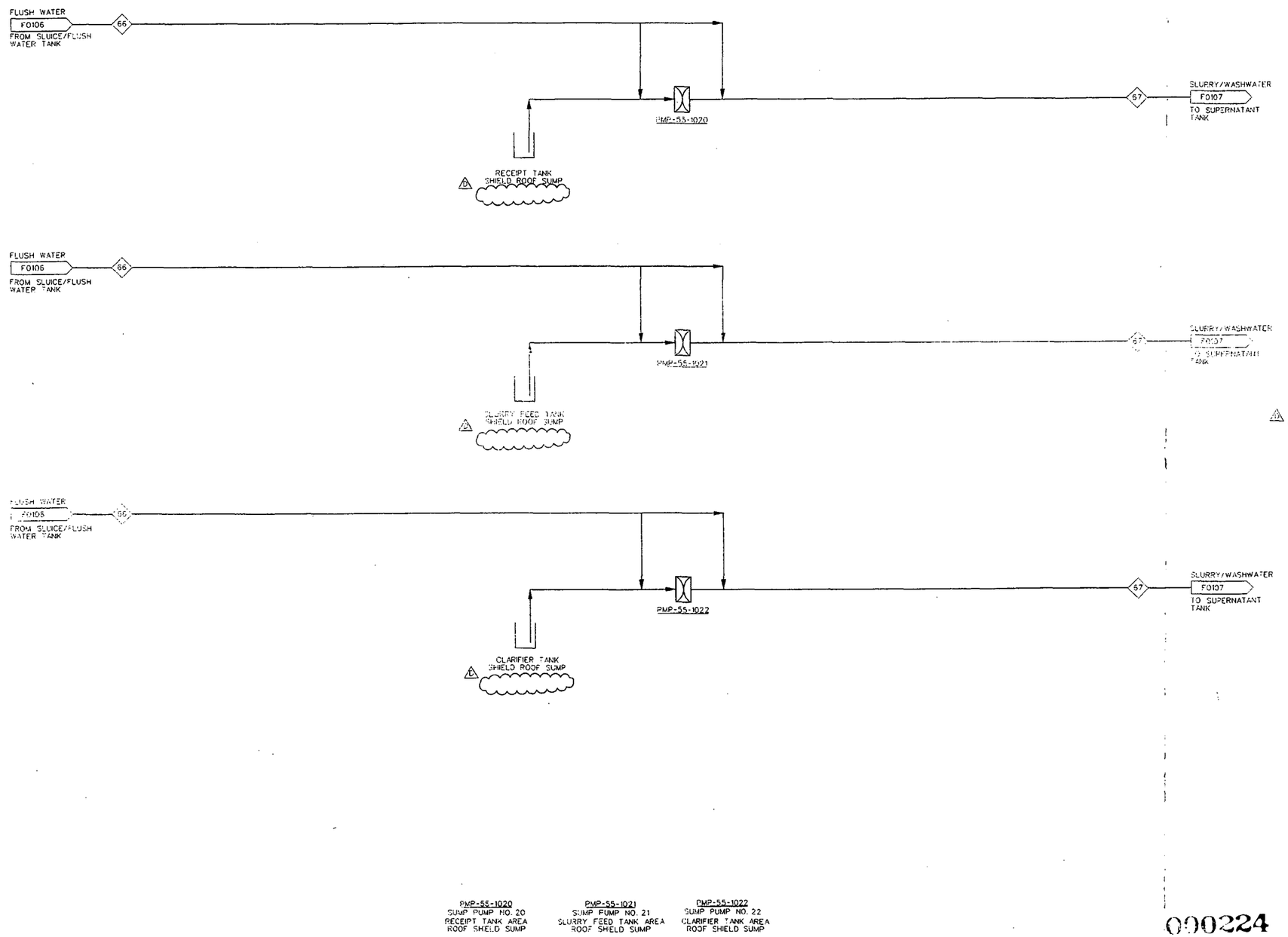
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NTS	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

I.D. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01364	F0113	D

JEG PROJECT NO.	FILENAME
35H19603	94XF01364.DGN

DATE: 09/25/02 TIME: 05:46:48 PM USER: KenyNA DESIGN FILE: I:\Proc\Drawings\94XF1364.DGN



000224

4654

REF DWG NO.	DRAWING TITLE
F0100	MATERIAL BALANCE TABLES
N0001	PIPING AND INSTRUMENT DIAGRAM PIPING,VALVES AND MISCELLANEOUS
N0002	PIPING AND INSTRUMENT DIAGRAM INSTRUMENTATION
N0003	PIPING AND INSTRUMENT DIAGRAM EQUIPMENT AND MISCELLANEOUS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
D	ISSUE FOR DESIGN	09/25/02	GCS	WT
C	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/02/02	NPK	GCS
B	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
A	ISSUE FOR DESIGN	02/19/02	SJM	WET

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JE JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
FLOW DIAGRAMS
PROCESS FLOW DIAGRAM
ROOF SHIELDS/REACTION TANK SUMPS

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
SUSAN M. SCHAEFER	02/19/02	NICHOLAS P. KOHUT	02/19/02	SUSAN J. MITCHELL	02/19/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NTS	U

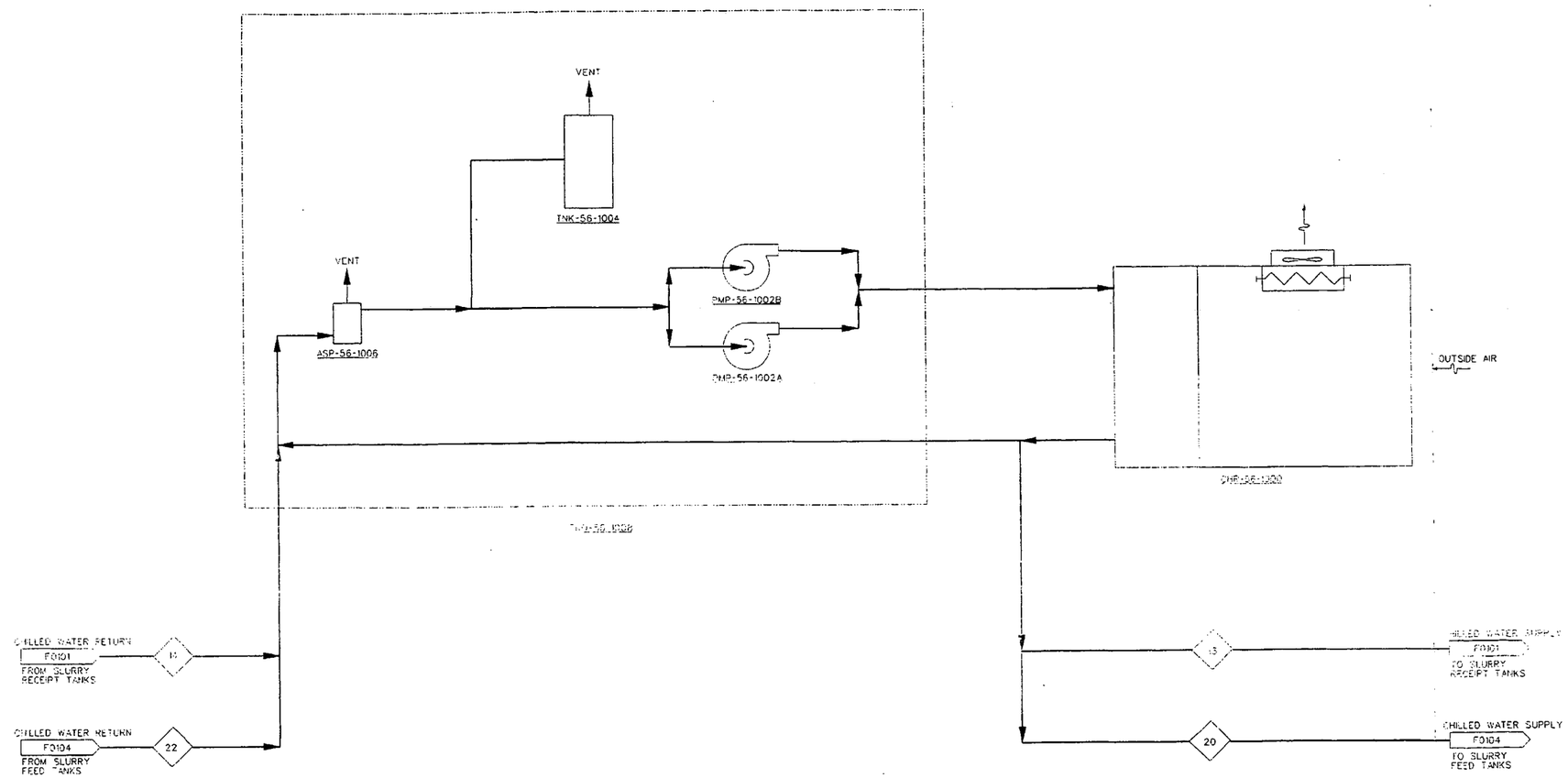
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01446	F0114	D

JEC PROJECT NO.	FILENAME
35H19603	94XF01446.DGN

DATE: 09/25/02
TIME: 05:16:28 PM
USER: KentMA
DESIGN FILE: I:\Proc\Drawings\94XF1446.dgn

4654



REF DWG NO.	DRAWING TITLE
F0100	MATERIAL BALANCE TABLES

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
A	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/02/02	NPK	CWS

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS
175 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
FLOW DIAGRAMS
PROCESS FLOW DIAGRAM
CHILLED WATER SYSTEM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
N. Dennis	8/02/02	Michael Mobley	8/02/02	Colin Schmitt	8-2-02

PLANT/BLDG. NO. — FLOOR — SCALE: NTS — CLASS: U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-02908	F0115	A

JEG PROJECT NO. 35H19503 — FILENAME 94XF2908.DGN

000225

PRELIMINARY
NOT FOR CONSTRUCTION

DATE: 08/02/02
TIME: 9:46:01 AM
USER: kentma
DESIGN FILE: h:\proc\drawings\94xf2908.dgn

- 4654

EQUIPMENT DESCRIPTION	EQUIPMENT DESIGNATOR (XXX)
AIR CONDITIONING UNIT	ACU
AIR HANDLING UNIT	AHU
CONDENSER	CND
DAMPER (BUTTERFLY)	DMP
DAMPER (NON-BUTTERFLY)	DPR
DUCT HEATER	DHT
ENCLOSURE	ENC
EXHAUST AIR REGISTER	EAR
EXPANSION JOINT	EXP
FAN	FAN
FILTER	FLT
FLEXIBLE CONNECTION	FLX
GRAVITY DAMPER	GDM
HEATER	HTR
HUMIDIFIER	HUM
JUNCTION BOX	JBX
LOUVER	LVR
MAIN CIRCUIT BREAKER	MCB
MOTOR	MTR
MOTOR CONTROL CENTER	MCC
MOTOR STARTER PANEL	MSP
PACKAGE UNIT	PKG
PANEL (CONTROL)	PNL
PANELBOARD	PBD
POWER DISTRIBUTION PANEL	PDP
POWER PANEL	PPN
POWER PANEL (NOTHUSHBUTTON)	PPN
RETURN AIR REGISTER	RAR
STACK	STK
SUPPLY AIR DIFFUSER	SAD
UNINTERRUPTABLE POWER SUPPLY	UPS
UPS DISTRIBUTION PANEL	UPN
VACUUM BREAKER	VBR

SYSTEM NUMBERING

YY (S-1 "EQUIPMENT NUMBER IDENTIFICATION," N0003)

FACILITIES
- 00 REMEDIATION BUILDING
- 01 PRODUCT HANDLING AND STORAGE FACILITY
- 02 WASTE RETRIEVAL FACILITIES
- 03 NOT USED
- 04 WAREHOUSE FACILITES
- 05 MISCELLANEOUS FACILITIES-SITE
- 06 NOT USED
- 07 NOT USED
- 08 NOT USED
- 09 NOT USED

RETRIEVAL
- 10 NOT USED
- 11 NOT USED
- 12 TRANSFER TANK SYSTEM
- 13 ETA WASTE RETRIEVAL SYSTEM
- 14 NOT USED

PROCESSING
- 15 FEED PREPARATION SYSTEM
- 16 PROCESSOR FEED SYSTEM
- 17 PROCESSOR SYSTEM
- 18 NOT USED
- 19 VESSEL VENT SYSTEM
- 20 RADON CONTROL SYSTEM
- 21 NOT USED
- 22 NOT USED

CONTAINER HANDLING
- 23 CONTAINER INSPECTION AND MAINTENANCE SYSTEM
- 24 CONTAINER FILLING SYSTEM
- 25 CONTAINER SHIPPING SYSTEM
- 26 NOT USED
- 27 NOT USED
- 28 NOT USED
- 29 NOT USED

ELECTRICAL
- 30 13.2 KV SYSTEM
- 31 480 VOLT DISTRIBUTION SYSTEM
- 32 STANDBY ELECTRICAL SYSTEM
- 33 UNINTERRUPTIBLE POWER SYSTEMS
- 34 LIGHTING SYSTEM
- 35 GROUNDING SYSTEM
- 36 NOT USED
- 37 NOT USED
- 38 NOT USED
- 39 MISCELLANEOUS ELECTRICAL

UTILITIES AND CHEMICALS
- 40 PLANT AND INSTRUMENT AIR SYSTEM
- 41 BREATHING AIR SYSTEM
- 42 NOT USED
- 43 NOT USED
- 44 PRODUCT ADDITIVE SYSTEM
- 45 NOT USED
- 46 NOT USED
- 47 NOT USED
- 48 NOT USED
- 49 NOT USED

WATER SYSTEMS
- 50 PROCESS WATER SYSTEM
- 51 POTABLE WATER SYSTEM
- 52 FIRE WATER SYSTEM
- 53 COOLING WATER SYSTEM
- 54 NOT USED
- 55 SUPERNATANT WATER SYSTEM
- 56 NOT USED
- 57 NOT USED
- 58 NOT USED
- 59 NOT USED

WASTE SYSTEMS
- 60 SANITARY SEWER SYSTEM
- 61 NOT USED
- 62 SLUICE/FLUSH WATER SYSTEM
- 63 LABORATORY WASTE SYSTEM
- 64 RADIOACTIVE SOLID WASTE SYSTEM
- 65 STORMWATER SYSTEM
- 66 NOT USED
- 67 NOT USED
- 68 NOT USED
- 69 NOT USED

HVAC SYSTEMS
- 70 REMEDIATION BUILDING SUPPLY AIR SYSTEM
- 71 REMEDIATION BUILDING EXHAUST AIR SYSTEM
- 72 NOT USED
- 73 NOT USED
- 74 NOT USED
- 75 NOT USED
- 76 WAREHOUSE FACILITIES HVAC SYSTEMS
- 77 MISCELLANEOUS FACILITIES HVAC SYSTEM
- 78 NOT USED
- 79 NOT USED

MECHANICAL AND ANALYTICAL SYSTEMS
- 80 MAINTENANCE EQUIPMENT
- 81 MECHANICAL HANDLING EQUIPMENT
- 82 REMOTE HANDLING EQUIPMENT
- 83 RADIATION SHIELDING EQUIPMENT
- 84 SAMPLING SYSTEM
- 85 INSPECTION SYSTEM
- 86 NOT USED
- 87 NOT USED
- 88 NOT USED
- 89 NOT USED

INFORMATION AND CONTROL SYSTEMS
- 90 DISTRIBUTED CONTROL SYSTEM
- 91 MANAGEMENT INFORMATION SYSTEM
- 92 FIRE DETECTION AND ALARM SYSTEM
- 93 HEALTH PROTECTION SYSTEM
- 94 ANALYTICAL LABORATORY SYSTEM
- 95 NOT USED
- 96 NOT USED
- 97 NOT USED
- 98 NOT USED
- 99 NOT USED

EQUIPMENT NUMBER IDENTIFICATION

XXX-YY-ZZZZ

- ZZZZ — EQUIPMENT SEQUENCE NUMBER
- YY — SYSTEM NUMBER
- XXX — EQUIPMENT CODE DESIGNATOR

GENERAL NOTES:

1. ALL NOTED DUCT DIMENSIONS ARE INSIDE DIMENSIONS UNLESS OTHERWISE NOTED.
2. ALL DUCTWORK SHALL BE GALVANIZED STEEL AS INDICATED IN SPECIFICATION SECTION: AIR-SUPPLY AND DISTRIBUTION SYSTEM UNLESS OTHERWISE NOTED.
3. ALL DUCTWORK ELEVATIONS ARE BOTTOM OF SHEET METAL, UNLESS OTHERWISE NOTED.
4. ROOM PRESSURES INDICATED ON DRAWINGS ARE DIFFERENTIAL PRESSURES (IN INCHES WG) WITH RESPECT TO ATMOSPHERIC PRESSURE.
5. AIR FLOWS SHOWN IN CUBIC FEET PER MINUTE (CFM) ARE ACTUAL FLOWS (ACFM) AT THE SITE ELEVATION ABOVE SEA LEVEL.
6. DIFFERENTIAL PRESSURE IN ALL CLEAN AREAS IS 0.05" WG THE THE ACTUAL PRESSURE COULD BE SLIGHTLY POSITIVE OR NEGATIVE WITH RESPECT TO ATMOSPHERE.
7. ALL EQUIPMENT SUPPORTS, FOUNDATIONS, PADS, WALL OPENINGS OR PENETRATIONS SHALL BE VERIFIED WITH THE ACTUAL EQUIPMENT FOR SIZE AND FIT. THE EQUIPMENT SIZES INDICATED ON THE DRAWINGS HAVE BEEN SELECTED FOR ENGINEERING DESIGN AND SPACE ALLOCATION PURPOSES. THE ACTUAL SIZES MAY VERY DEPENDING ON EQUIPMENT MANUFACTURER.
8. FOR EXPLANATION OF ADDITIONAL ABBREVIATIONS USED, SEE ASHRAE HANDBOOK OF FUNDAMENTALS.
9. ALL MOTORS ARE 3 PHASE, 60 HERTZ, 230/460 VOLTS UNLESS OTHERWISE NOTED.
10. FOR FIELD INSTRUMENTATION AND CONTROL, SEE INSTRUMENTATION AND CONTROL NOTES.

REF DWG NO.	DRAWING TITLE
H0002	HVAC, LEGEND, SYMBOLS & ABBREVIATIONS

REV. NO.	REVISIONS AND DATE	DATE	REV. BY	APPR
1	REVISED PER DCN 40750-JEG-005	04/16/02	RSSR	WJ
0	ISSUED FOR BID	02/15/02	RSSR	WJ

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY: JACOBS

PROJECT NAME: SILOS 1 AND 2

DRAWING TITLE: HVAC GENERAL NOTES SYSTEMS AND EQUIPMENT DESIGNATORS

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B. SLABBEKORN	02/19/02	PAUL D. STENECK	02/19/02	ROBERT STERLING SR	02/19/02

PLANT/BLDG NO.	FLOOR	SCALE	CLASS
N/A	N/A	NONE	1

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.D. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-H-01448	H0001	1

JEG PROJECT NO 35H19503 | FILENAME 94xhh48.dgn

000226

4654

EQUIPMENT DESCRIPTION	EQUIPMENT DESIGNATOR (XXX)
AIR CONDITIONING UNIT	ACU
AIR HANDLING UNIT	AHU
AIR FLOW MEASURING STATION	AMS
BACKDRAFT DAMPER	BKD
CONDENSER	CND
CONTINUOUS EMISSION MONITORING	CEM
DAMPER	DPR
DUCT HEATER	DHT
EXHAUST AIR GRILLE	EAG
ENCLOSURE	ENC
EXHAUST AIR REGISTER	EAR
EXPANSION JOINT	EXP
FAN	FAN
FILTER	FLT
FLEXIBLE CONNECTION	FLX
GLOVE BOX	GLB
GRAVITY DAMPER	GDM
HEATER	HTR
HUMIDIFIER	HUM
JUNCTION BOX	JBX
LOUVER	LVR
MAIN CIRCUIT BREAKER	MCB
MOTOR	MTR
MOTOR CONTROL CENTER	MCC
MOTOR STARTER PANEL	MSP
PACKAGE UNIT	PKU
PANEL (CONTROL)	PNL
PANELBOARD	PNB
PITOT TUBE STATION	PTS
POWER DISTRIBUTION PANEL	PDP
POWER PANEL	PPN
POWER PANEL (INSTRUMENTATION)	PWP
RETURN AIR GRILLE	RAG
RETURN AIR REGISTER	RAR
STACK	STK
SUPPLY AIR DIFFUSER	SAD
SUPPLY AIR GRILLE	SAG
SUPPLY AIR REGISTER	SAR
VACUUM BREAKER	VBR

SYSTEM NUMBERING

YY

FACILITIES
- 00 REMEDIATION BUILDING
- 01 PRODUCT HANDLING AND STORAGE FACILITY
- 02 WASTE RETRIEVAL FACILITIES
- 03 NOT USED
- 04 WAREHOUSE FACILITIES
- 05 MISCELLANEOUS FACILITIES-SITE
- 06 NOT USED
- 07 NOT USED
- 08 NOT USED
- 09 NOT USED

RETRIEVAL
- 10 NOT USED
- 11 NOT USED
- 12 TRANSFER TANK SYSTEM
- 13 TTA WASTE RETRIEVAL SYSTEM
- 14 NOT USED

PROCESSING
- 15 FEED PREPARATION SYSTEM
- 16 PROCESSOR FEED SYSTEM
- 17 PROCESSOR SYSTEM
- 18 NOT USED
- 19 VESSEL VENT SYSTEM
- 20 RADON CONTROL SYSTEM
- 21 NOT USED
- 22 NOT USED

CONTAINER HANDLING
- 23 CONTAINER RECEIPT AND PREPARATION SYSTEM
- 24 CONTAINER FILLING SYSTEM
- 25 CONTAINER SHIPPING SYSTEM
- 26 NOT USED
- 27 NOT USED
- 28 NOT USED
- 29 NOT USED

ELECTRICAL
- 30 13.2 KV SYSTEM
- 31 480 VOLT DISTRIBUTION SYSTEM
- 32 STANDBY ELECTRICAL SYSTEM
- 33 UNINTERRUPTIBLE POWER SYSTEM
- 34 LIGHTING SYSTEM
- 35 GROUNDING SYSTEM
- 36 NOT USED
- 37 NOT USED
- 38 NOT USED
- 39 MISCELLANEOUS ELECTRICAL

UTILITIES AND CHEMICALS
- 40 PLANT AND INSTRUMENT AIR SYSTEM
- 41 BREATHING AIR SYSTEM
- 42 NOT USED
- 43 NOT USED
- 44 NOT USED
- 45 NOT USED
- 46 NOT USED
- 47 NOT USED
- 48 NOT USED
- 49 NOT USED

WATER SYSTEMS
- 50 PROCESS WATER SYSTEM
- 51 POTABLE WATER SYSTEM
- 52 FIRE WATER SYSTEM
- 53 COOLING WATER SYSTEM
- 54 NOT USED
- 55 DEMINERALIZED WATER SYSTEM
- 56 NOT USED
- 57 NOT USED
- 58 NOT USED
- 59 NOT USED

WASTE SYSTEMS
- 60 SANITARY SEWER SYSTEM
- 61 NOT USED
- 62 SLUICE/FLUSH WATER SYSTEM
- 63 LABORATORY WASTE SYSTEM
- 64 RADIOACTIVE SOLID WASTE SYSTEM
- 65 STORMWATER SYSTEM
- 66 NOT USED
- 67 NOT USED
- 68 NOT USED
- 69 NOT USED

HVAC SYSTEMS
- 70 REMEDIATION BUILDING SUPPLY AIR SYSTEM
- 71 REMEDIATION BUILDING EXHAUST AIR SYSTEM
- 72 HVAC CHILLED WATER SYSTEM
- 73 NOT USED
- 74 NOT USED
- 75 NOT USED
- 76 WAREHOUSE FACILITIES HVAC SYSTEMS
- 77 MISCELLANEOUS FACILITIES HVAC SYSTEM
- 78 NOT USED
- 79 NOT USED

MECHANICAL AND ANALYTICAL SYSTEMS
- 80 MAINTENANCE EQUIPMENT
- 81 MECHANICAL HANDLING EQUIPMENT
- 82 REMOTE HANDLING EQUIPMENT
- 83 RADIATION SHIELDING EQUIPMENT
- 84 SAMPLING SYSTEM
- 85 INSPECTION SYSTEM
- 86 NOT USED
- 87 NOT USED
- 88 NOT USED
- 89 NOT USED

INFORMATION AND CONTROL SYSTEMS
- 90 DISTRIBUTED CONTROL SYSTEM
- 91 MANAGEMENT INFORMATION SYSTEM
- 92 FIRE DETECTION AND ALARM SYSTEM
- 93 HEALTH PROTECTION SYSTEM
- 94 ANALYTICAL LABORATORY SYSTEM
- 95 NOT USED
- 96 NOT USED
- 97 NOT USED
- 98 NOT USED
- 99 NOT USED

EQUIPMENT NUMBER IDENTIFICATION

XXX-YY ZZZZ

- ZZZZ — EQUIPMENT SEQUENCE NUMBER
- YY — SYSTEM NUMBER
- XXX — EQUIPMENT CODE DESIGNATOR

GENERAL NOTES:

1. ALL NOTED DUCT DIMENSIONS ARE INSIDE DIMENSIONS UNLESS OTHERWISE NOTED.
2. ALL DUCTWORK SHALL BE GALVANIZED STEEL AS INDICATED IN SPECIFICATION SECTION 15810 IN AIR SUPPLY AND DISTRIBUTION SYSTEM UNLESS OTHERWISE NOTED.
3. ALL DUCTWORK ELEVATIONS ARE BOTTOM OF SHEET METAL, UNLESS OTHERWISE NOTED.
4. ROOM PRESSURES INDICATED ON DRAWINGS ARE DIFFERENTIAL PRESSURES (IN INCHES WC) WITH RESPECT TO ATMOSPHERIC PRESSURE.
5. AIRFLOW RATES SHOWN IN CUBIC FEET PER MINUTE (CFM) ARE ACTUAL FLOWS (ACFM) AT THE SITE ELEVATION ABOVE SEA LEVEL.
6. ALL EQUIPMENT SUPPORTS, FOUNDATIONS, PADS, WALL OPENINGS AND PENETRATIONS SHALL BE VERIFIED WITH THE ACTUAL EQUIPMENT FOR SIZE AND FIT THE EQUIPMENT SIZES INDICATED ON THE DRAWINGS HAVE BEEN SELECTED FOR ENGINEERING DESIGN AND SPACE ALLOCATION PURPOSES. THE ACTUAL SIZES MAY VARY DEPENDING ON EQUIPMENT MANUFACTURER.
7. ALL MOTORS ARE 3 PHASE, 60 HERTZ, 230/460 VOLTS UNLESS OTHERWISE NOTED.
8. FOR PIPING INSTRUMENTATION AND LEGEND SEE N0001, H0002 AND K0003.

REF DWG NO.	DRAWING TITLE
H0001	HVAC LEGEND, SYMBOLS AND ABBREVIATIONS

REV NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV BY	APPR
C	REMEDIAL DESIGN- ISSUED FOR REVIEW	08/09/02	BOC	[illegible]
B	PRELIMINARY DESIGN ISSUE	04/12/02	BOC	WE
A	CONCEPTUAL DESIGN-ISSUE FOR REVIEW	07/26/01	BAL	JVF

INITIALS AND DATE

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JACOBS — 125 Broadway Ave., Oak Ridge, Tennessee 37830, Tel: 865-220-4000, Fax: 865-220-6110

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
HVAC
REMEDIATION FACILITY
GENERAL NOTES, SYSTEMS AND EQUIPMENT DESIGNATORS

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B.SLABEKORN	07/26/02	B. O. CINGILLI	07/26/01	B.A.LANGLEY	07/26/01

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
NA	NA	NONE	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-H-01143	H0010	C

JCG PROJECT NO.	FILENAME
35H195603	94xh0143.DGN

000227

PRELIMINARY
NOT FOR CONSTRUCTION

DATE: 08/09/02 TIME: 10:58:04 AM USER: BSchbek DESIGN FILE: I:\hvac\drawings\airflow DNGS\94XH0143.dgn

4654

HEATING, VENTILATION AND AIR CONDITIONING LEGEND, SYMBOLS AND ABBREVIATIONS

DOUBLE LINE

- SUPPLY AIR DUCT SECTION
- SUPPLY AIR DUCT END ELEVATION
- RETURN OR EXHAUST AIR SECTION
- RETURN OR EXHAUST AIR DUCT END ELEVATION
- OUTSIDE AIR DUCT SECTION
- OUTSIDE AIR DUCT END ELEVATION
- ROUND DUCT SECTION
- ROUND DUCT END ELEVATION
- BRANCH TAKEOFF WITH ADJUSTABLE EXTRACTOR
- PROPORTIONAL THROAT (T) WITH TURNING VANES AND VOLUME CONTROL DAMPERS
- PROPORTIONAL THROAT (T) WITH SPLITTER DAMPER
- TRANSITION RECTANGULAR TO ROUND
- ELBOW WITH TURNING VANES
- MITERS ELBOW
- FIRE DAMPER
- DUCT SIZE (FIRST FIGURE IS SIZE SHOWN, SECOND FIGURE IS SIZE NOT SHOWN)
- DUCT RISE WITH RESPECT TO AIR FLOW
- DUCT DROP WITH RESPECT TO AIR FLOW
- FLEXIBLE CONNECTION
- ACCESS DOOR (AD) OR ACCESS PANEL (AP) — AD, AP
- 24X12 SR 600 CFM — SUPPLY GRILLE OR REGISTER WALL OR SIDE OUTLET (FIRST FIGURE IS SIDE SHOWN, SECOND FIGURE IS SIDE NOT SHOWN)
- 20X12 TR 300 CFM, WALL — TRANSFER GRILLE OR REGISTER WALL OR SIDE OUTLET (FIRST FIGURE IS SIDE SHOWN SECOND FIGURE IS SIDE NOT SHOWN)
- 24X12 SR 500 CFM — RETURN GRILLE OR REGISTER (LARGER SIDE FIGURE SHOWN FIRST, SMALLER SIDE FIGURE SHOWN SECOND)
- 18X12 CD 1,600 CFM — RECTANGULAR SUPPLY CEILING DIFFUSER (SIZE, TYPE AND NUMBER OF DIRECTIONS SHOWN)
- BACKDRAFT DAMPER
- AUTOMATIC CONTROL DAMPER ELECTRIC MOTOR OPERATOR SHOWN
- FE — FLOW ELEMENT
- MANUAL VOLUME DAMPER (PARALLEL OR OPPOSED BLADE & BUTTERFLY)
- 24X24 CD 14" ø NK — SQUARE SUPPLY CEILING DIFFUSER WITH (FACE SIZE, NECK SIZE AND NUMBER OF DIRECTIONS SHOWN)

SINGLE LINE

- FILTER (35% ASHRAE EFFICIENCY RATING)
- FILTER (90-95% ASHRAE EFFICIENCY RATING)
- HIGH EFFICIENCY PARTICULATE AIR (HEPA) FILTER
- ULTRA-LOW PENETRATING AIR (ULPA) FILTER
- OUTSIDE AIR LOUVER
- BACKDRAFT DAMPER
- MANUAL VOLUME DAMPER
- MOTORIZED DAMPER
- FIRE DAMPER STATION
- ELECTRIC HEAT (FOR IN DUCT HEATER)
- ELECTRIC MOTOR
- A/C COOLING COIL HOT/COLD WATER COIL
- ELECTRIC RADIANT HEATER
- DUCT TRANSITION
- SUPPLY AIR FLOW DIRECTION
- EXHAUST, INFILTRATION, OR EXFILTRATION AIRFLOW DIRECTION
- LEFT OFF PAGE CONNECTOR
- RIGHT OFF PAGE CONNECTOR

ABBREVIATIONS

ABBREV.	WORD OR TERM	ABBREV.	WORD OR TERM
ABV	ABOVE	OA	OUTSIDE AIR
ACFM	ACTUAL CUBIC FEET PER MINUTE	OBD	OPPOSED BLADE DAMPER
AC	AIR CONDITIONING	OC	ON CENTER
ACU	AIR CONDITIONING UNIT	OD	OUTSIDE DIAMETER
APPROX	APPROXIMATELY	OHD	OVERHEAD
ATM	ATMOSPHERE	OP	OUTPUT
AUTO	AUTOMATIC	OPER	OPERATING/OPERATOR
BEL	BELOW	OPNG	OPENING
BHP	BRAKE HORSEPOWER		
BOG	BOTTOM OF GRILLE	PD	PRESSURE DROP
BOD	BOTTOM OF DUCT	PENET	PENETRATION
BOL	BOTTOM OF LOUVER	PF	PREFILTER
BOP	BOTTOM OF PIPE	PH	PHASE
BOU	BOTTOM OF UNIT	PL	PLATE
BTUH	BRITISH THERMAL UNITS PER HOUR	PLCS	PLACES
BYP	BYPASS	PNL	PANEL
		PNEU	PNEUMATIC
CNTRFGL	CENTRIFUGAL	POC	POINT OF CONNECTION
C	COMMON	POS	POSITIVE
CAP	CAPACITY	PRESS	PRESSURE
CCW	COUNTERCLOCKWISE	PDAH	PRESSURE DIFFERENTIAL ALARM HIGH
CD	CEILING DIFFUSER	PDAL	PRESSURE DIFFERENTIAL ALARM LOW
CFH	CUBIC FEET PER HOUR	PDI	PRESSURE DIFFERENTIAL INDICATOR
CFM	CUBIC FEET PER MINUTE	PDIC	PRESSURE DIFFERENTIAL INDICATING CONTROLLER
CG	CEILING GRILLE	PDIT	PRESSURE DIFFERENTIAL INDICATING TRANSMITTER
CL	CENTERLINE	ΔP	PRESSURE DIFFERENTIAL
CLG	COOLING	PSIG	POUNDS PER SQUARE INCH (GAUGE)
CONC	CONCRETE		
COND	CONDENSATE	QTY	QUANTITY
CONN	CONNECTION		
CR	CEILING REGISTER	R	ROWS
CS	CARBON STEEL	RA	RETURN AIR
CTR	CENTER	RD	REFRIGERANT DISCHARGE
CW	CLOCKWISE	REF	REFERENCE
		REG	REGISTER
DEG	DEGREE	REQD	REQUIRED
DIA	DIAMETER	RG	RETURN GRILLE
DISCH	DISCHARGE	REGT	REFRIGERANT
DN	DOWN	RH	RELATIVE HUMIDITY
DP	DIFFERENTIAL PRESSURE	RL	REFRIGERANT LIQUID
DRN	DRAIN	RPM	REVOLUTIONS PER MINUTE
DT	DESIGN TEMPERATURE	RR	RETURN REGISTER
DWG	DRAWING	RS	REFRIGERANT SUCTION
EA	EXHAUST AIR	SA	SUPPLY AIR
EF	EXHAUST FAN	SCFM	STANDARD CUBIC FEET PER MINUTE
EFF	EFFICIENCY	SCH	SCHEDULE
EG	EXHAUST GRILLE	SD	SHUTDOWN
EL	ELEVATION	SF	SQUARE FOOT
ENT	ENTERING	SG	SUPPLY GRILLE
EQUIP	EQUIPMENT	SIS	SAFETY INSTRUMENTED SYSTEM
ES	EXPLOSION PROOF	SL	SOUND LEVEL
ER	EXHAUST REGISTER	SPD	SPEED
EO	EMERGENCY SHUTDOWN	SP	STATIC PRESSURE
EVAC	EVACUATION	SR	SUPPLY REGISTER
EXFIL	EXFILTRATION	SS	STAINLESS STEEL
EXH	EXHAUST	STD	STANDARD
		SV	SHUTOFF VALVE
FA	FURNISHED	TA	TEMPERED AIR
F	DEGREES FAHRENHEIT	TEFC	TOTALLY ENCLOSED FAN COOLED
F DB	DEGREES FAHRENHEIT DRY BULB	TEMP	TEMPERATURE
F WB	DEGREES FAHRENHEIT WET BULB	TG	TRANSFER GRILLE
FLEX	FLEXIBLE	TC	TOP OF CONCRETE
FLTR	FILTER	TOS	TOP OF STEEL
FLR	FLOOR	TOW	TOP OF WALL
FLTR	FILTER	TS	TRANSFER SECTION
FP	FIRE PROTECTION	TR	TRANSFER
FPI	FINS PER INCH	TSP	TOTAL STATIC PRESSURE
FPM	FEET PER MINUTE	TYP	TYPICAL
FT	FOOT		
FTG	FOOTING	UC	UNDERCUT DOOR
FT²	SQUARE FEET	UG	UNDERGROUND
FT³	CUBIC FEET		
FC	FULL CLOSED	VAV	VARIABLE AIR VOLUME
FO	FULL OPEN	VEL	VELOCITY
FL	FULL LOCKED	VENT	VENT
FWD CRV	FORWARD CURVED		
		W	WIDE
GAL	GALLON	W/	WITH
GALV	GALVANIZED	WC	WATER COLUMN
GPM	GALLONS PER MINUTE	WG	WATER GAUGE
GR	GRADE	W/O	WITHOUT
		WT	WEIGHT
H	HIGH	WTR	WATER
HTG	HEATING		
HEPA	HIGH EFFICIENCY PARTICULATE AIR FILTER		
HVAC	HEATING VENTILATION AND AIR CONDITIONING		
HD	HEAD		
HDR	HEADER		
HP	HORSEPOWER		
HGT	HEIGHT		
H/O/A	HAND/OFF/AUTOMATIC		
HPT	HIGH POINT		
HR	HOUR		
HZ	HERTZ		
IAS	INSTRUMENT AIR SUPPLY		
INSUL	INSULATION		
I.E.	THAT IS		
IN	INCH		
INFIL	INFILTRATION		
INSTR	INSTRUMENT		
IN WC	INCHES WATER COLUMN		
IN WG	INCHES WATER GAUGE		
KW	KILOWATT		
L	LONG		
LG	LEVEL GAUGE		
LGTH	LENGTH		
LP	LOW PRESSURE		
LPT	LOW POINT		
MBH	THOUSAND BRITISH THERMAL UNITS PER HOUR		
MAX	MAXIMUM		
MCC	MOTOR CONTROL CENTER		
MW	MANWAY		
MIN	MINIMUM		
MOV	MOTOR OPERATED VALVE		
MTD	MOUNTED		
MTG	MOUNTING		
MTL	MATERIAL		
MFR	MANUFACTURER		
NC	NORMALLY CLOSED		
NEG	NEGATIVE		
NIC	NOT IN CONTRACT		
NK	NECK		
NO	NORMALLY OPEN		
NTS	NOT TO SCALE		

000228

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO	DRAWING TITLE
H0010	HVAC GENERAL NOTES, SYSTEMS AND EQUIPMENT DESIGNATORS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR
A	REMEDIAL DESIGN-ISSUED FOR REVIEW	08/09/02		

ACTUAL DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
HVAC
REMEDIATION FACILITY
LEGEND, SYMBOLS AND ABBREVIATIONS

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
					8/19/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
NA	NA	NONE	

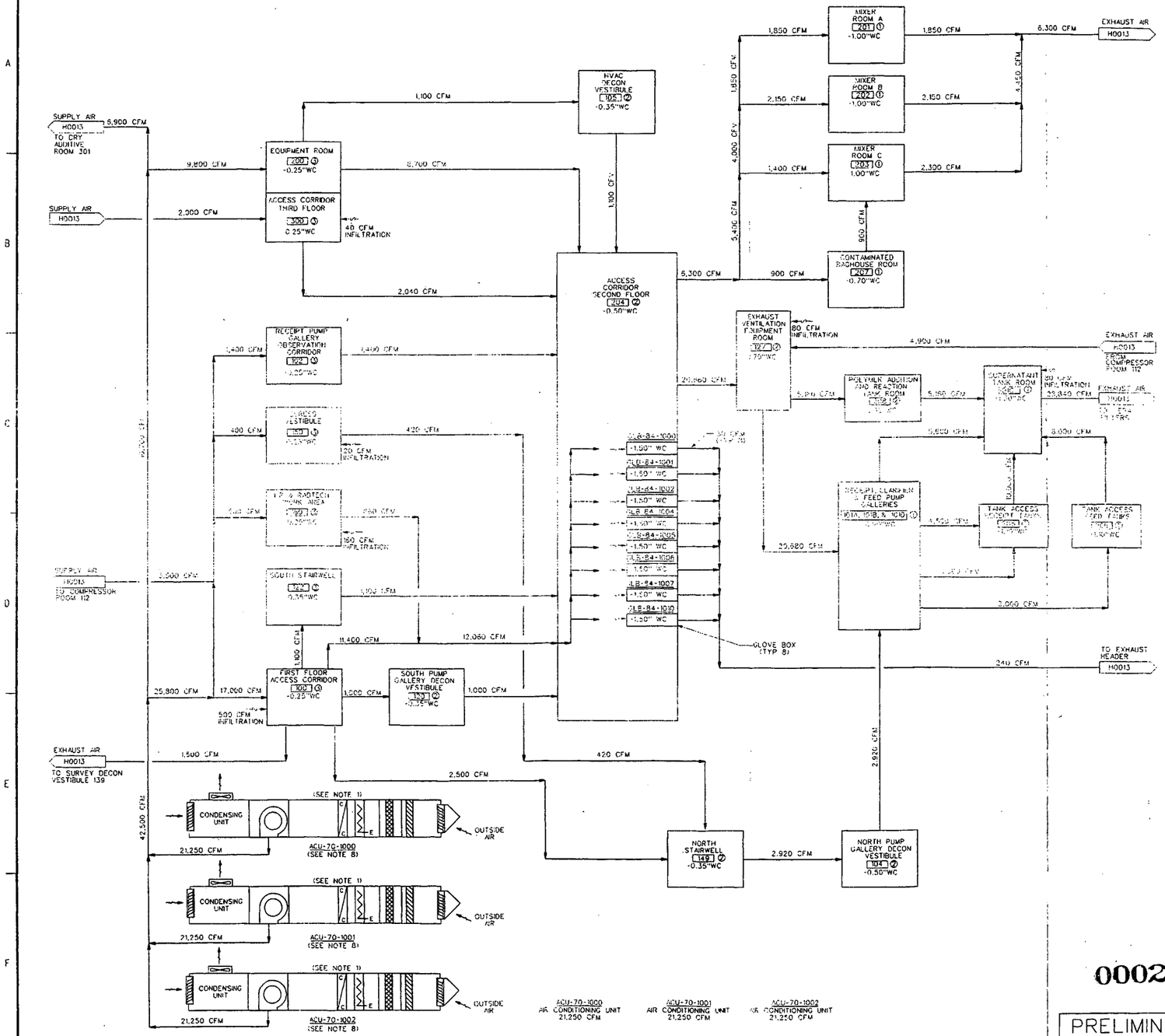
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-H-01426	H0011	A

J.E. PROJECT NO.	FILENAME
35H19603	94X3426.DGN

DATE: 08/09/02
TIME: 10:53:34 AM
USER: BSOBDAA
DESIGN FILE: N:\hvac\groups\airflow DRGS\94X0426.dgn

4654



000229

PRELIMINARY
NOT FOR CONSTRUCTION

NOTES:

1. ANY TWO (2) SUPPLY AIR CONDITIONING UNITS WILL BE OPERATING AND ONE STANDING-BY AT ANY GIVEN TIME.
2. THE ROOM EXHAUST AIRFLOW RATES SHALL BE ADJUSTED DURING THE AIR SYSTEM BALANCING IN ORDER TO OFFSET THE ACTUAL INFILTRATION RATES TO OBTAIN THE DESIGN ROOM NEGATIVE PRESSURES. THE EXHAUST AIR FILTRATION UNITS ARE SIZED TO HANDLE THE BUILDING INFILTRATION QUANTITIES.
3. THE INDICATED ROOM DIFFERENTIAL PRESSURES AS SHOWN ARE THE MINIMUM DIFFERENTIALS WITH RESPECT TO OUTDOORS (TYPICAL FOR EACH ROOM).
4. SUPPLY DUCT SIZES SHALL BE BASED ON 1,200-1,500 FPM VELOCITY. EXHAUST DUCT SIZES SHALL BE SIZED BASED ON 1,800-2,500 FPM.
5. NUMBERS IN CIRCLES, SHOWN THUS (2), REPRESENT VENTILATION ZONES. A TOTAL NUMBER OF FOUR ZONES HAVE BEEN DEFINED: ZONE 1 HAS THE HIGHEST POTENTIAL TO BE CONTAMINATED; ZONE 2 COULD BE CONTAMINATED DUE TO UNPLANNED LOW-LEVEL RADIOACTIVE RELEASES FROM OPERATIONS OR MAINTENANCE; ZONE 3 IS GENERALLY OCCUPIED, CLEAN AREAS, NORMALLY FREE OF RADIOACTIVE CONTAMINATION; AND ZONE 4 IS ALWAYS FREE OF RADIOACTIVE CONTAMINATION, OCCUPIED, OR NON-OCCUPIED.
6. VENTILATION ZONE DRAWING SHEET NUMBERS ARE H0080 AND H0091.
7. MANUAL VOLUME DAMPERS ARE NOT SHOWN ON THIS DRAWING. REFER TO PLAN DRAWINGS FOR DAMPER LOCATIONS AND SIZES. MANUAL VOLUME DAMPERS ARE INSTALLED IN ALL SUPPLY, TRANSFER AND EXHAUST DUCT BRANCHES FOR BALANCING AIRFLOW RATES.
8. THE AIR-CONDITIONING UNITS SHALL BE CONNECTED TO THE STAND-BY POWER SYSTEM.

TYP. DWG. NO.	DRAWING TITLE
H0010	HVAC GENERAL NOTES, SYSTEMS AND EQUIPMENT DESIGNATORS
H0011	HVAC LEGEND, SYMBOLS AND ABBREVIATIONS
H0012	HVAC AIRFLOW DIAGRAM
H0014	HVAC AIRFLOW DIAGRAM

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
C	REMEDIAL DESIGN-ISSUED FOR REVIEW	08/09/02	BOC	[illegible]
B	PRELIMINARY DESIGN ISSUE	04/12/02	BOC	WT
A	CONCEPTUAL DESIGN-ISSUE FOR REVIEW	07/26/01	BAL	JVF

DETAILS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4600
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
HVAC
REMEDIATION FACILITY
PROCESS AREA AIRFLOW DIAGRAM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B. SLABEKORN	07/2001	B. O. CINGILLI	07/26/01	B.A. LANGLEY	07/26/01

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
NA	NA	NONE	U

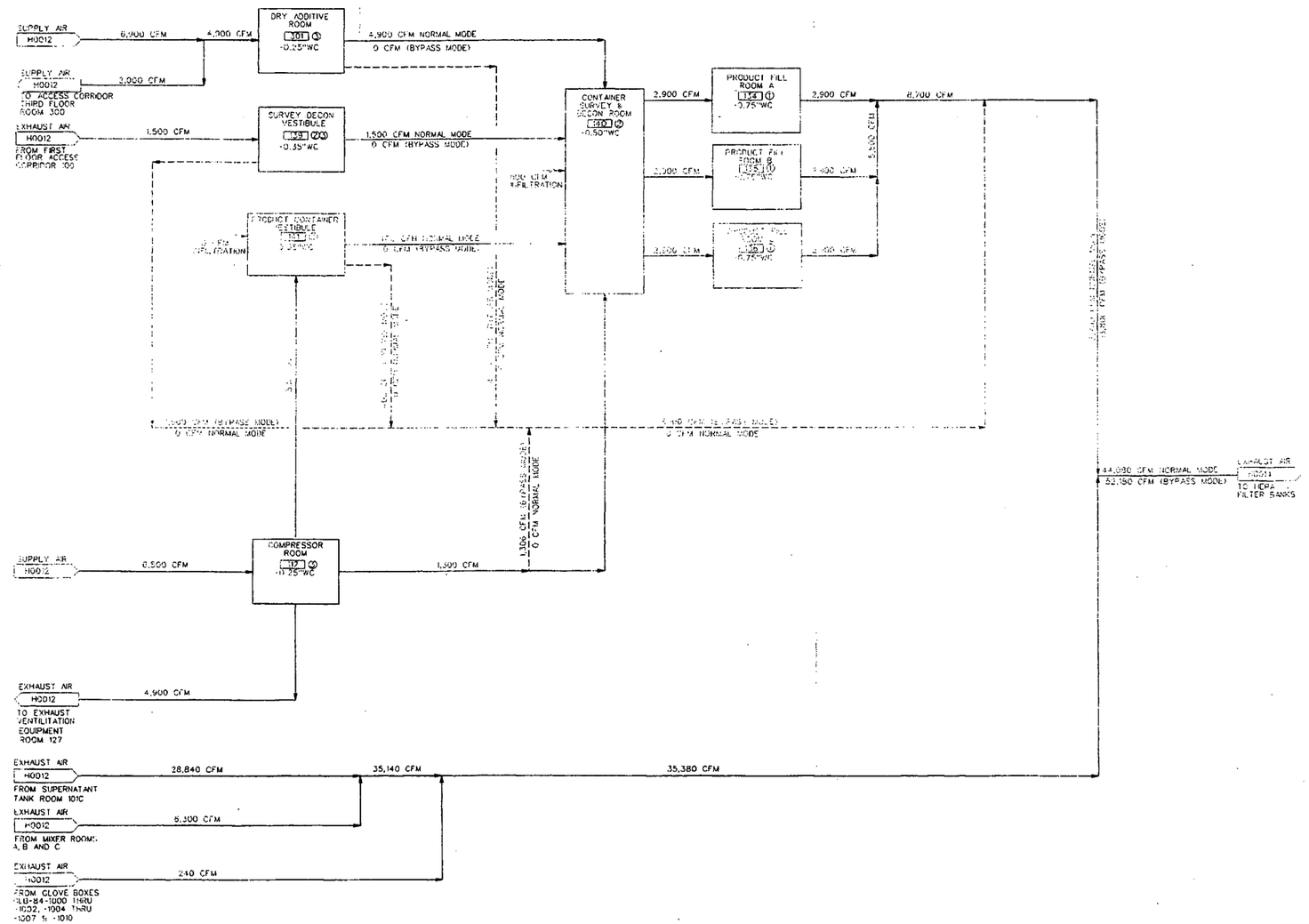
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-H-01140	H0012	C

A.E. PROJECT NO. 35H19603 FILENAME 94xh1140.DGN

DATE: 08/09/02 TIME: 12:04:36 PM USER: BSlabekorn DESIGN FILE: h:\hvac\drawings\AIRFLOW DRGS\94XH1140.dgn

4654



NOTES:

1. FOR NOTES THIS SHEET SEE H0012.
2. AIRFLOW RATES WITH DASHED LINES REPRESENT AIRFLOW BYPASSING ROOM 140 WHENEVER A PRODUCT VERTICAL LIFT DOOR IS OPENED INTO THE CONTAINER RAIL CAR LOADING AREA.

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
B	REMEDIAL DESIGN-ISSUED FOR REVIEW	08/09/02	BOC	[illegible]
A	PRELIMINARY DESIGN ISSUE	04/12/02	BOC	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
HVAC
REMEDIATION FACILITY
PROCESS AREA AIRFLOW DIAGRAM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B. SLABBEKORN	04/12/02	PAUL D. STENECK	04/12/02	B.O. CINGILLI	04/12/02
PLANT/BLDG. NO. NA		FLOOR NA		SCALE NONE	CLASS U
SUBMITTED FOR 30% ISSUE		SUBMITTED FOR 60% ISSUE		SUBMITTED FOR 90% ISSUE	
TECH LEAD		TECH LEAD		TECH LEAD	
DATE		DATE		DATE	

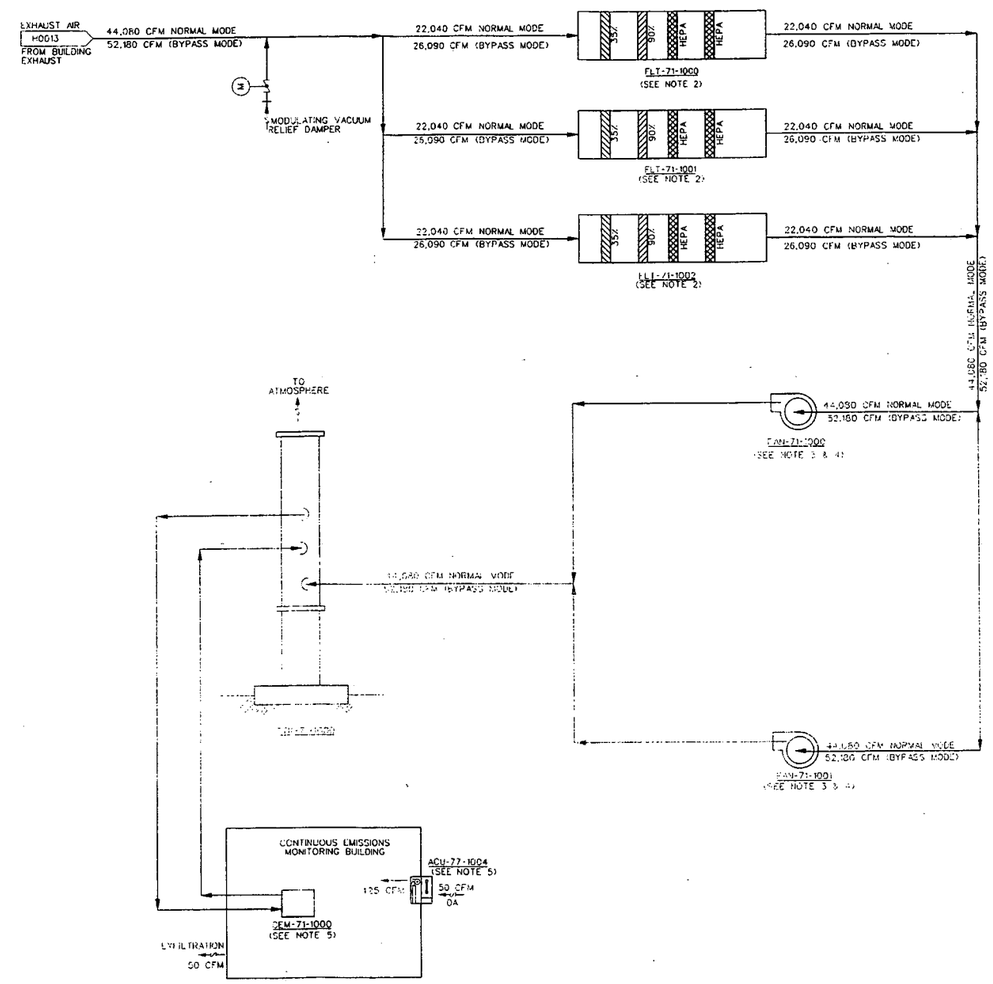
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-H-01141	H0013	B
JEG PROJECT NO. 35H19603	FILENAME 94xh1141.DGN			

PRELIMINARY
NOT FOR CONSTRUCTION

DATE: 08/09/02
TIME: 10:49:33 AM
USER: BSlabbek
DESIGN FILE: h:\hvac\drawings\AIRFLOW DWGS\94XH1141.dgn

000230

-4654



NOTES:

1. FOR NOTES THIS SHEET SEE H0012.
2. ANY TWO (2) HEPA FILTER UNITS WILL BE OPERATING AND ONE (1) STANDING-BY AT ANY GIVEN TIME.
3. ONE (1) EXHAUST FAN WILL BE OPERATING AND ONE (1) STANDING-BY AT ANY GIVEN TIME.
4. THE EXHAUST FANS SHALL BE CONNECTED TO THE STAND-BY POWER SYSTEM.
5. THE CONTINUOUS EMISSIONS MONITORING BUILDING AIR CONDITIONING UNIT, AND THE CONTINUOUS EMISSION MONITORING SYSTEM SHALL BE CONNECTED TO THE STAND-BY POWER SYSTEM.

REF. DWG. NO.	DRAWING TITLE
H0010	HVAC GENERAL NOTES, SYMBOLS AND EQUIPMENT DESIGNATORS
H0011	HVAC, LEGEND, SYMBOLS AND ABBREVIATIONS
H0012	HVAC, AIRFLOW DIAGRAM
H0013	HVAC, AIRFLOW DIAGRAM

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
B	REMEDIAL DESIGN-ISSUED FOR REVIEW	08/09/02	BOC	WT
A	PRELIMINARY DESIGN ISSUE	04/12/02	BOC	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS 123 Broadway Ave., Oak Ridge, Tennessee 37830 Tel: 865-220-8000 Fax: 865-220-6110

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
HVAC
REMEDIATION FACILITY
PROCESS AREA AIRFLOW DIAGRAM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B.SLABBEKORN	04/12/02	PAUL D. STENECK	04/12/02	B.O.CINGILLI	04/12/02

PLANT/BLDG NO.	FLOOR	SCALE	CLASS
NA	NA	NONE	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-H-01142	H0014	B

JEC PROJECT NO.	FILENAME
35H1960.3	94xh1142.DGN

PRELIMINARY
NOT FOR CONSTRUCTION

000231

FLT-71-1000
HEPA FILTER HOUSING
30,000 CFM (NOMINAL)

FLT-71-1001
HEPA FILTER HOUSING
30,000 CFM (NOMINAL)

FLT-71-1002
HEPA FILTER HOUSING
30,000 CFM (NOMINAL)

FAN-71-1000
EXHAUST FAN
54,000 CFM
(NOMINAL)

FAN-71-1001
EXHAUST FAN
54,000 CFM
(NOMINAL)

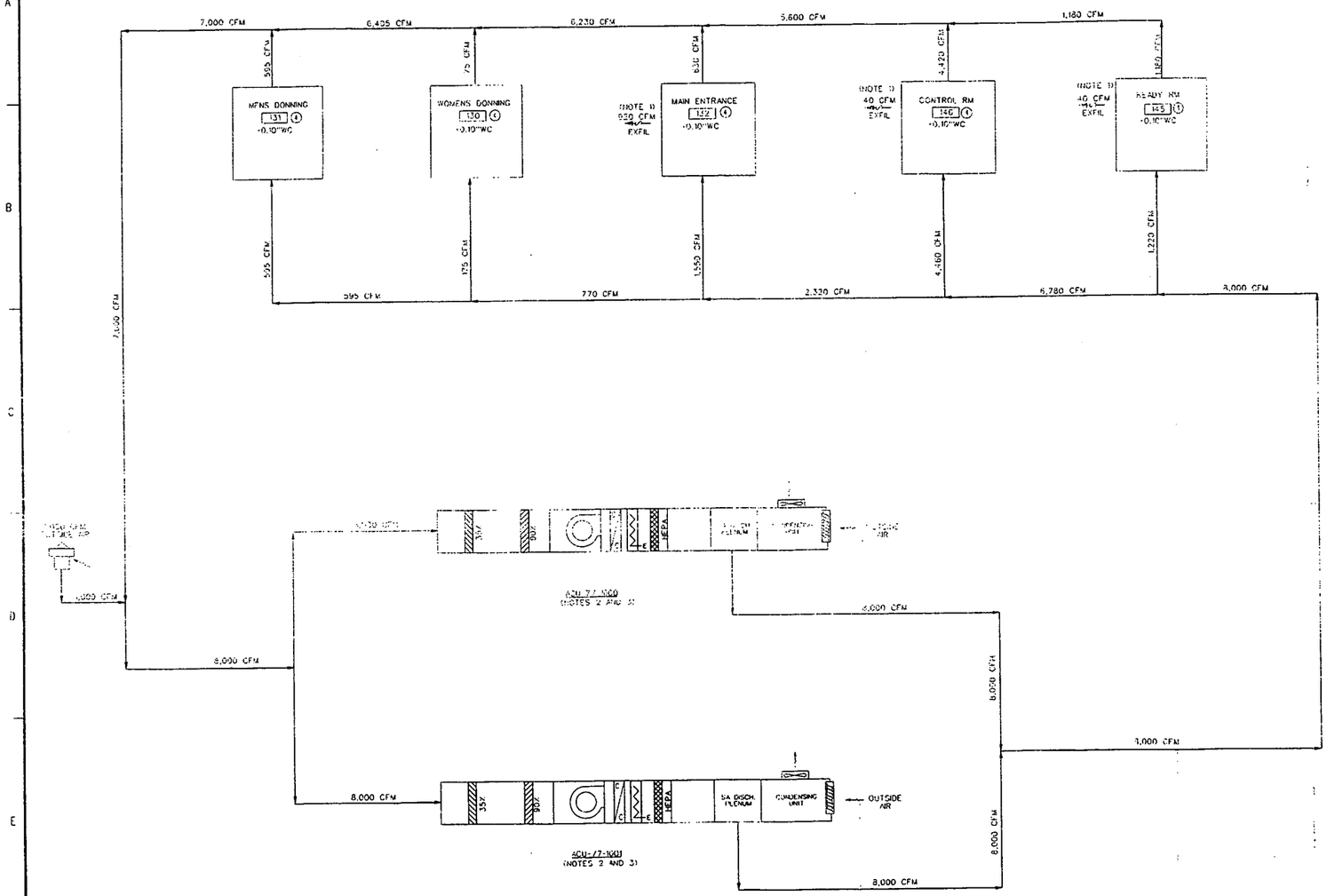
STK-71-1000
EXHAUST STACK

CEM-71-1000
CONTINUOUS EMISSIONS MONITORING

ACU-77-1004
AIR CONDITIONING UNIT
FAN 425 CFM

DATE: 08/09/02
TIME: 10:50:45 AM
USER: B.Slabbekorn
DESIGN FILE: h:\hvac\drawings\AIRFLOW DNGS\94xh1142.dgn

4654



NOTES:

1. THE ROOM EXFILTRATION AIR FLOW RATES ARE APPROXIMATE. ADJUST THE ROOM RETURN AIR FLOW QUANTITIES, DURING AIR SYSTEM BALANCING, IN ORDER TO OFFSET THE ACTUAL ROOM EXFILTRATION FLOW RATES AND OBTAIN THE REQUIRED ROOM PRESSURIZATION.
2. ONE SUPPLY AIR CONDITIONING UNIT WILL BE OPERATING AND ONE STANDING-BY AT ANY GIVEN TIME.
3. THE SUPPLY AIR CONDITIONING UNITS SHALL BE CONNECTED TO THE STAND-BY POWER SYSTEM.
4. NUMBERS IN CIRCLES, SHOWN THUS (1), REPRESENT VENTILATION ZONES. ZONE 4 IS ALWAYS FREE OF RADIOACTIVE CONTAMINATION, OCCUPIED, OR NON-OCCUPIED.
5. VENTILATION ZONE DRAWING SHEET NUMBERS ARE H0090 and H0091.

REF DWG NO.	DRAWING TITLE
H0010	HVAC GENERAL NOTES, SYSTEM AND EQUIPMENT DESIGNATORS
H0011	HVAC LEGEND, SYMBOLS & ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	DRN. BY	CHK. BY
B	REMEDIAL DESIGN-ISSUED FOR REVIEW	08/09/02	BOC	
A	PREMILINARY DESIGN ISSUE	04/12/02	BOC	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS
123 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4900
Fax: 865-220-4119

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
HVAC
REMEDIATION FACILITY
CONTROL ROOM AIRFLOW DIAGRAM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B.S.JABBEKORN	04/12/02	PAUL D. STENECK	04/12/02	B.O.CINGILI	04/12/02

PLANT/BLDG NO.	LOCATION	SCALE	CLASS
NA	NA	NONE	13

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

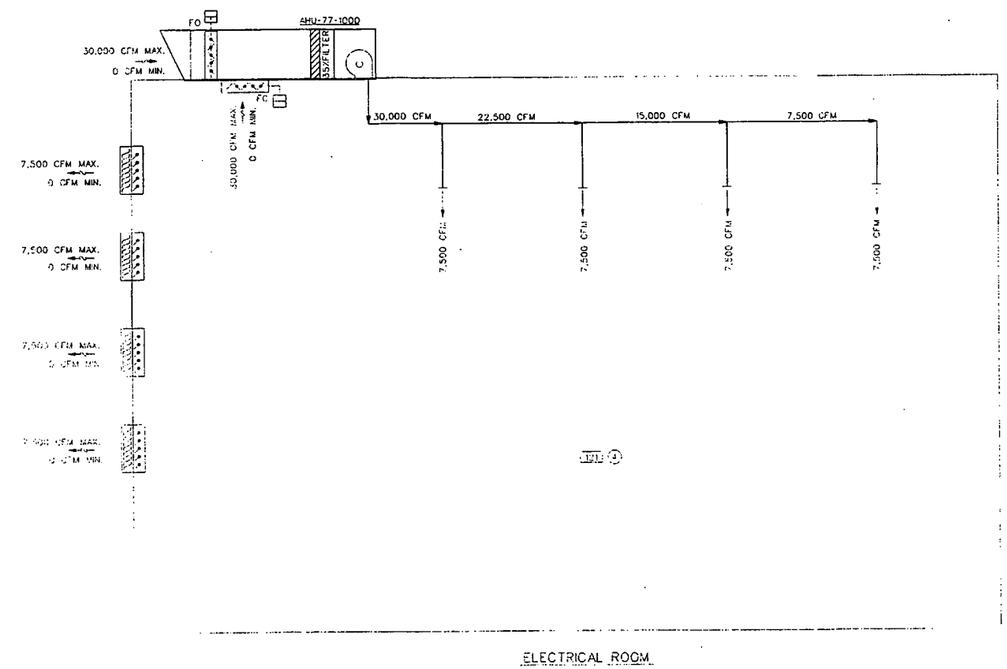
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-H-01144	H0015	B
JOB PROJECT NO. 35H19503	FILENAME 94xh1144.DGN			

PRELIMINARY
NOT FOR CONSTRUCTION

000232

DATE: 08/09/02
TIME: 9:54:35 AM
USER: BSJABBEKORN
DESIGN FILE: N:\hvac\drawings\ARTLOP DGNS\94XH044.DGN

4654



NOTES:

1. NUMBERS IN CIRCLES, SHOWN THUS (4), REPRESENT VENTILATION ZONES. ZONE 4 IS ALWAYS FREE OF RADIOACTIVE CONTAMINATION, OCCUPIED, OR NON-OCCUPIED.
2. VENTILATION ZONE DRAWING SHEET NUMBERS ARE H0090 AND H0091.

REF DWG NO.	DRAWING TITLE
H0010	HVAC, GENERAL NOTES, SYSTEMS AND EQUIPMENT DESIGNATORS
H0011	HVAC, LEGEND, SYMBOLS & ABBREVIATIONS

REV NO	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	INITIALS AND DATE
B	REMEDIAL DESIGN-ISSUED FOR REVIEW	08/09/02		
A	PRELIMINARY DESIGN ISSUE	04/12/02	BOC	WI

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JE JACOBS

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
HVAC
REMEDIATION FACILITY
ELECTRICAL ROOM AIRFLOW DIAGRAM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B.SLABBEKORN	04/12/02	PAUL D. STENECK	04/12/02	B.D. CINCILLI	04/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
NA	NA	NONE	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-H-01473	H0016	B

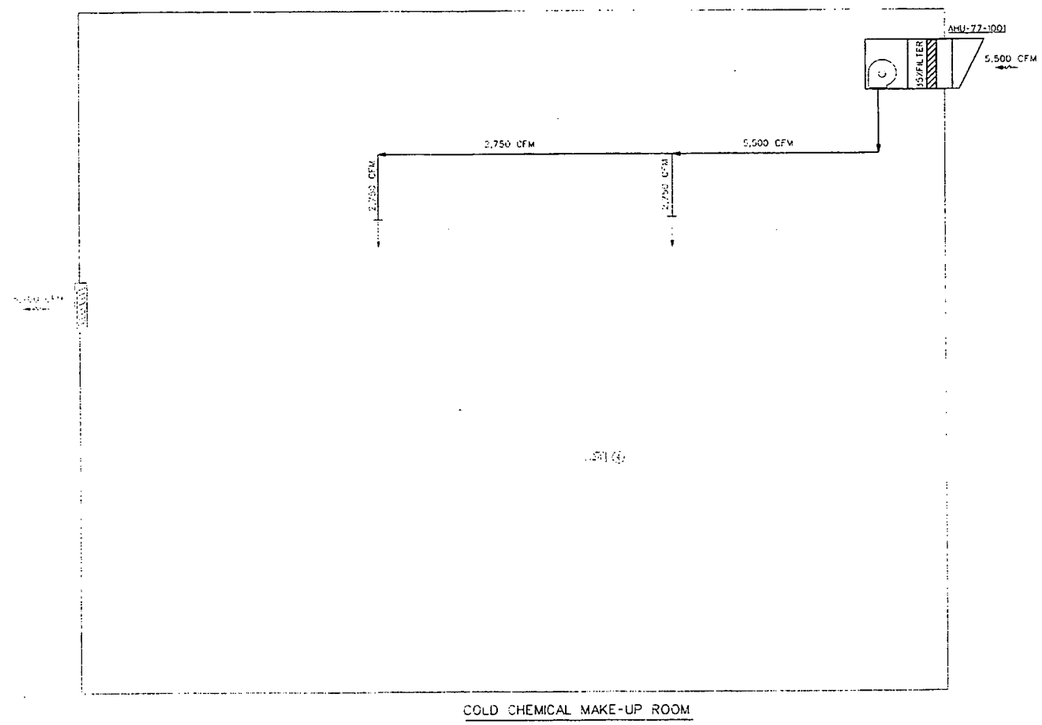
JEG PROJECT NO.	FILENAME
35H19603	94xh1473.DGN

000233

PRELIMINARY
NOT FOR CONSTRUCTION

DATE: 08/09/02
TIME: 10:54:38 AM
USER: BSlabbekorn
DESIGN FILE: I:\hvac\drawings\AIRFLOW DWGS\94xh1473.dgn

4654



NOTES:

1. NUMBERS IN CIRCLES, SHOWN THUS (4), REPRESENT VENTILATION ZONES. ZONE 4 IS ALWAYS FREE OF RADIOACTIVE CONTAMINATION, OCCUPIED, OR NON-OCCUPIED.
2. VENTILATION ZONE DRAWING SHEET NUMBERS ARE H0090 AND H0091.

REF DWG NO.	DRAWING TITLE
H0010	HVAC, GENERAL NOTES, SYSTEM AND EQUIPMENT DESIGNATORS
H0011	HVAC, LEGEND, SYMBOLS AND ABBREVIATIONS

REV NO	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	CHK
0	REMEDIAL DESIGN-ISSUED FOR REVIEW	08/09/02	[illegible]	[illegible]
A	PRELIMINARY DESIGN ISSUE	04/12/02	BOC	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JE JACOBS
175 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
HVAC
REMEDIATION FACILITY
COLD CHEMICAL MAKE-UP ROOM AIRFLOW DIAGRAM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B. SLABBEKORN	04/12/02	PAUL D. STENECK	04/12/02	B.O. CINGILLI	04/12/02
PLANT/BLDG. NO. NA		FLOOR NA		SCALE NONE	CLASS U
SUBMITTED FOR 30% ISSUE		SUBMITTED FOR 60% ISSUE		SUBMITTED FOR 90% ISSUE	
TECH LEAD		TECH LEAD		TECH LEAD	
DATE		DATE		DATE	

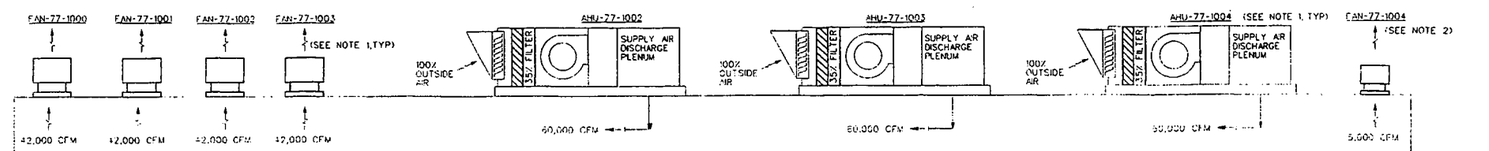
T.D NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-H-01474	H0017	B
JEG PROJECT NO. 35H19603	FILENAME 94xh1474.DGN			

PRELIMINARY
NOT FOR CONSTRUCTION

000234

DATE: 08/09/02 TIME: 1H5:25 AM USER: BSlabbek DESIGN FILE: h:\hvac\drawings\AIRFLOW DWGS\94X0474.dgn

4654



CONTAINER RAILCAR LOADING AREA

000235

FAN-77-1000	EXHAUST FAN 42,000 CFM		
FAN-77-1001	EXHAUST FAN 42,000 CFM		
FAN-77-1002	EXHAUST FAN 42,000 CFM		
FAN-77-1003	EXHAUST FAN 42,000 CFM		
AHU-77-1002	AIR HANDLING UNIT SUPPLY FAN 40,000 CFM		
AHU-77-1003	AIR HANDLING UNIT SUPPLY FAN 60,000 CFM		
AHU-77-1004	AIR HANDLING UNIT SUPPLY FAN 60,000 CFM		
FAN-77-1004	EXHAUST FAN 5,000 CFM		

PRELIMINARY
NOT FOR CONSTRUCTION

NOTES:

1. THREE AIR HANDLING UNITS AND FOUR EXHAUST FANS SHALL RUN FOR 100% SYSTEM CAPACITY. HOWEVER, ANY NUMBER OF AIR HANDLING UNITS AND EXHAUST FANS CAN BE OPERATED MANUALLY.
2. EXHAUST FAN, FAN-77-1004, SHALL RUN CONTINUOUSLY, AND BE CONNECTED TO THE STAND-BY POWER SYSTEM.
3. NUMBERS IN CIRCLES, SHOWN THUS (4), REPRESENT VENTILATION ZONES. ZONE 4 IS ALWAYS FREE OF RADIOACTIVE CONTAMINATION, OCCUPIED, OR NON-OCCUPIED.
4. VENTILATION ZONE DRAWING SHEET NUMBERS ARE H0090 AND H0091.

REF DWG NO.	DRAWING TITLE
H0018	HVAC GENERAL NOTES, SYMBOLS AND EQUIPMENT DESIGNATORS
H0011	HVAC LEGEND SYMBOLS AND ABBREVIATIONS

REV NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR
B	REMEDIAL DESIGN-ISSUED FOR REVIEW	08/09/02	BOC	[illegible]
A	PRELIMINARY DESIGN ISSUE	04/12/02	BOC	WS

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
175 Broadway Ave., Bay Village, Ohio 44140
Tel: 440-835-9000
Fax: 440-835-6170

PROJECT NAME
SILOS 1 AND 2

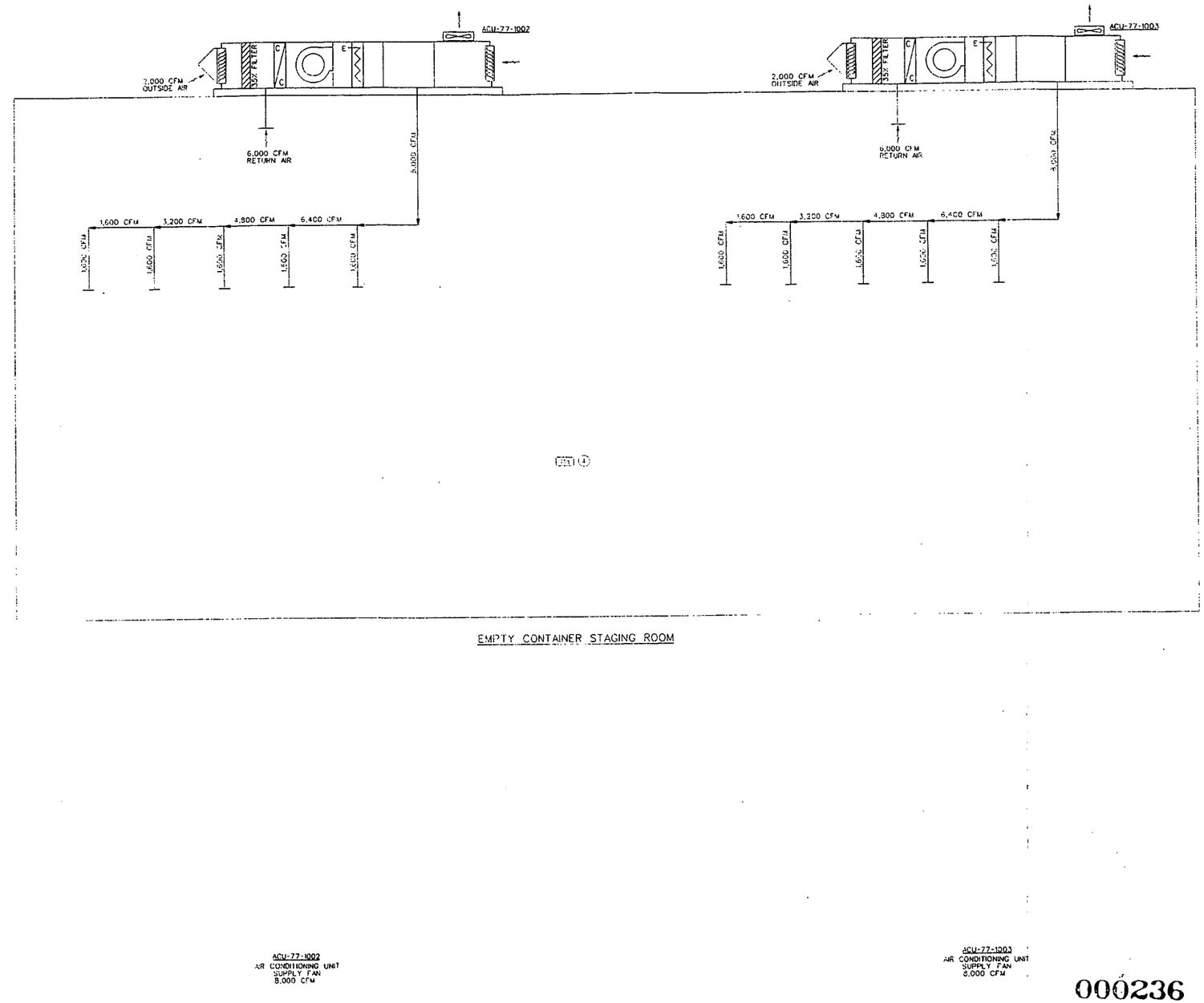
DRAWING TITLE
HVAC
REMEDIATION FACILITY
CONTAINER RAILCAR LOADING AREA AIRFLOW DIAGRAM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B.SLABBEKORN	04/12/02	PAUL D. STENECK	04/12/02	B.O.CINGILLI	04/12/02
PLANT/BLDG NO. NA		FLOOR NA		SCALE NONE	CLASS U
SUBMITTED FOR 30% ISSUE		SUBMITTED FOR 60% ISSUE		SUBMITTED FOR 90% ISSUE	
TECH LEAD		TECH LEAD		TECH LEAD	
DATE		DATE		DATE	

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO
N/A	40750	94X-3900-H-01632	H0018	B
JEC PROJECT NO. 35H19603	FILENAME 94xh1632.DGN			

DATE: 08/09/02
TIME: 09:16 AM
USER: BSlabbekorn
DESIGN FILE: [illegible] DWG:94X-H-1632.dgn

4654



000236

PRELIMINARY
NOT FOR CONSTRUCTION

NOTES:

1. NUMBERS IN CIRCLES, SHOWN THUS (4), REPRESENT VENTILATION ZONES. ZONE 4 IS ALWAYS FREE OF RADIOACTIVE CONTAMINATION, OCCUPIED, OR NON-OCCUPIED.
2. VENTILATION ZONE DRAWING SHEET NUMBERS ARE H0090 AND H0091

REF DWG NO.	DRAWING TITLE
H0010	HVAC GENERAL NOTES, SYSTEMS AND EQUIPMENT DESIGNATORS
H0011	HVAC, LEGEND SYMBOLS AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV BY	APPR
B	REMEDIAL DESIGN-ISSUED FOR REVIEW	08/09/02	BOC	
A	PRELIMINARY DESIGN ISSUE	04/12/02	BOC	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-8000
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
HVAC
REMEDIATION FACILITY
EMPTY CONTAINER STAGING AREA AIRFLOW DIAGRAM

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B.SLABBEKORN	04/12/02	PAUL D. STENECK	04/12/02	B.O.CINGILLI	04/12/02

PLANT/BLDG NO.	FLOOR	SCALE	CLASS
NA	NA	NONE	U

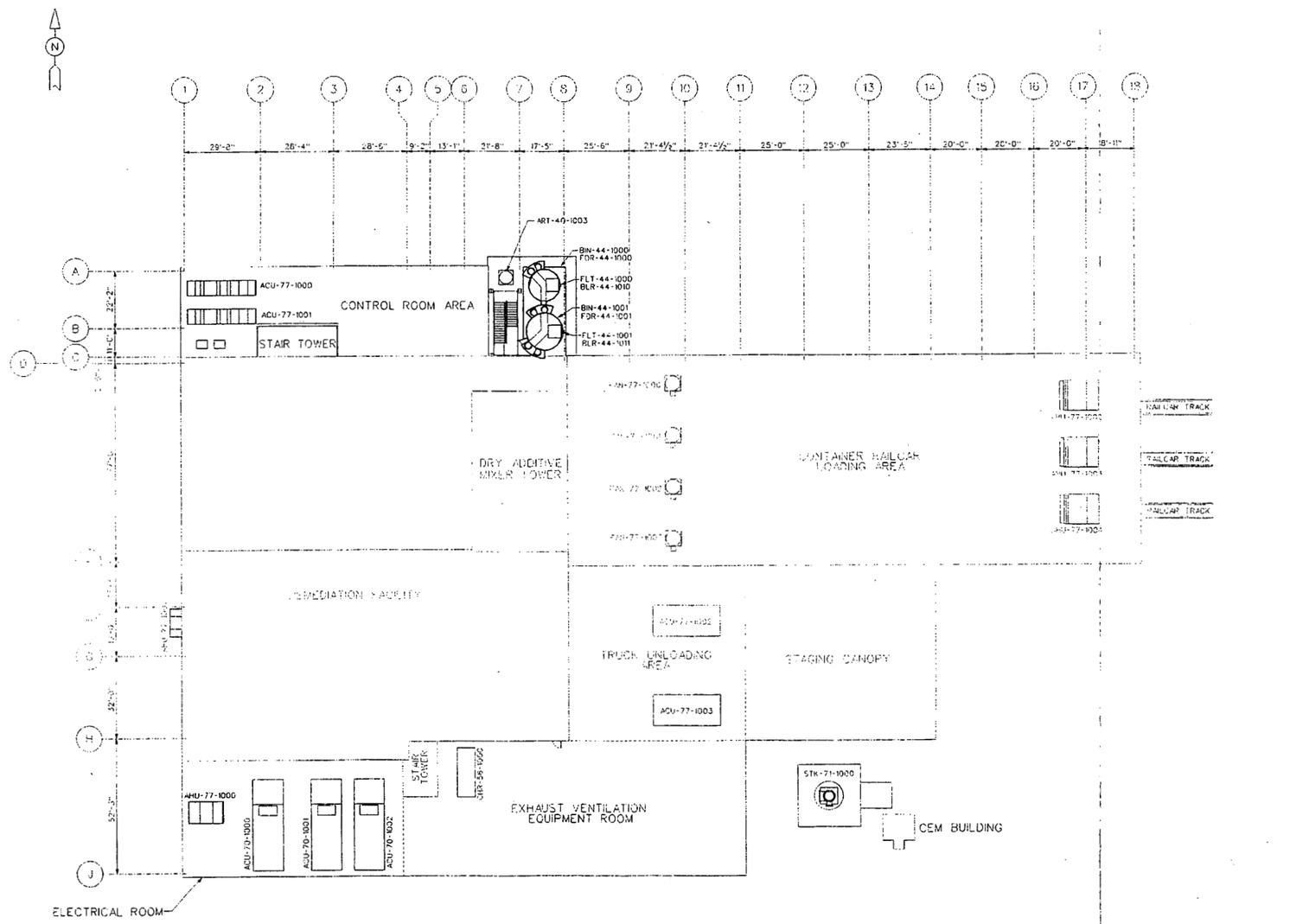
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-H-01633	H0019	B

JEG PROJECT NO.	FILENAME
35H19603	94xh1633.DGN

DATE: 08/09/02 TIME: 10:58:45 AM USER: BSlabbek DESIGN FILE: N:\Hvac\drawings\AIRFLOW DWGS\94XH1633.dgn

4654



PLOT PLAN

000237

0 16 32 48 FT
SCALE: 1/16" = 1'-0"

NOTES:

1. ONLY MAIN PRIMARY COLUMNS ARE SHOWN FOR CLARITY. FOR COMPLETE COLUMN LAYOUT SEE STRUCTURAL DRAWING 94X-3900-S-01453

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
10001	PIPING, VALVES AND MISCELLANEOUS
10002	INSTRUMENTATION
10003	EQUIPMENT AND MISCELLANEOUS
20010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	REVIEW
0	REMEDIAL DESIGN - ISSUE FOR REVIEW	07/27/02	NPK	GCS
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	GS

INITIALS AND DATE

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS 123 Broadway Ave. Suite 1100 Knoxville, Tennessee 37930 Tel: 865-220-6170 Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
PLOT PLAN

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	N/A	1/16" = 1'-0"	U

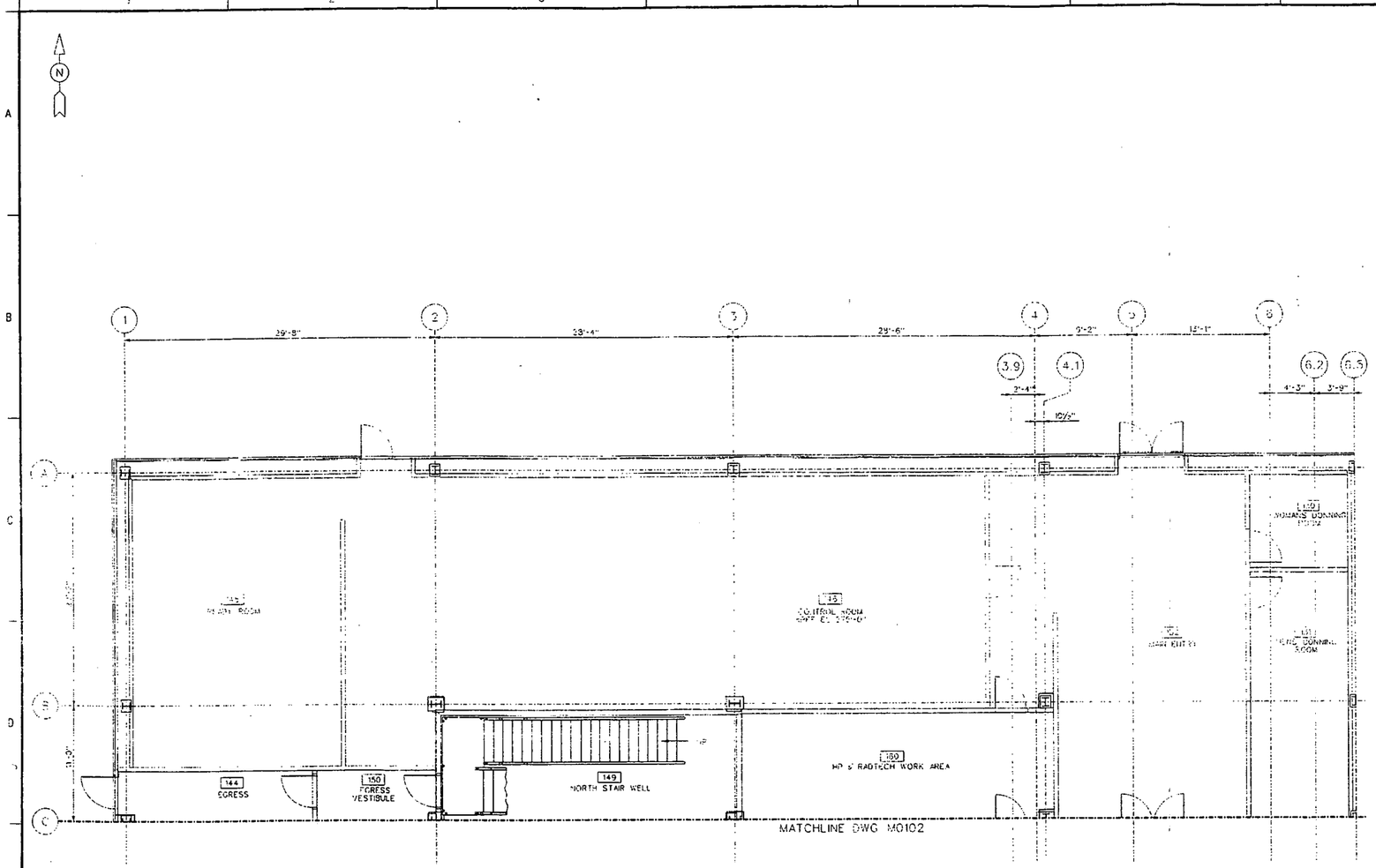
SUBMITTED FOR 30% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 90% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 90% ISSUE — TECH LEAD — DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01590	M0010	B

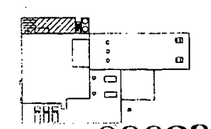
J.E. PROJECT NO. 35H106003 — FILENAME 94XM1590.DGN

DATE: 08/02/02
TIME: 10:07:49 AM
USER: DDavis
DESIGN FILE: J:\mag\dwg\94xm1590.dgn

4654



PLAN
1ST FLOOR



SCALE: ¼" = 1'-0"

PRELIMINARY
NOT FOR CONSTRUCTION

SLF DWG NO	DRAWING TITLE
M0001	PIPING, VALVES AND MISCELLANEOUS
M0002	INSTRUMENTATION
M0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APP.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	[illegible]
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-6110

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
1ST FLOOR COLUMNS 1-6.5 & A-C

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	1ST	¼" = 1'-0"	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

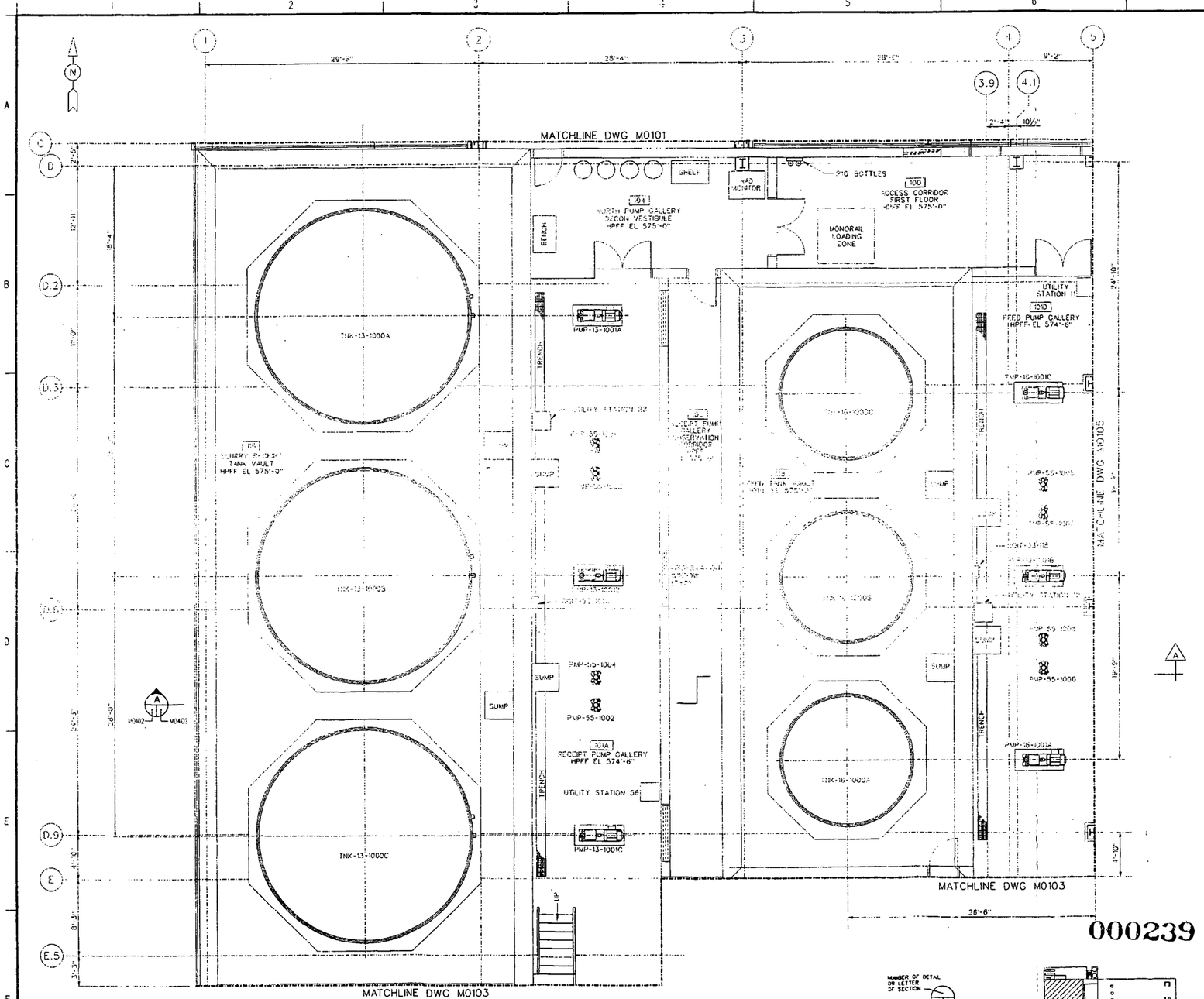
T.D. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01592	M0101	B

JEG PROJECT NO.	FILENAME
35H19603	94XM1592.DGN

000238

DATE: 08/12/02
TIME: 10:07:49 AM
USER: DDavis
DESIGN FILE: j:\eap\dwg\94xm592.dgn

4654



000239

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
M0001	PIPING, VALVES AND MISCELLANEOUS
M0002	INSTRUMENTATION
M0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV NO	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GCS
A	PRELIMINARY DESIGN ISSUE	01/12/02	NPK	WT

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
175 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4000
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
1ST FLOOR COLUMNS 1-5 & E.5

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	1ST	1/4" = 1'-0"	U

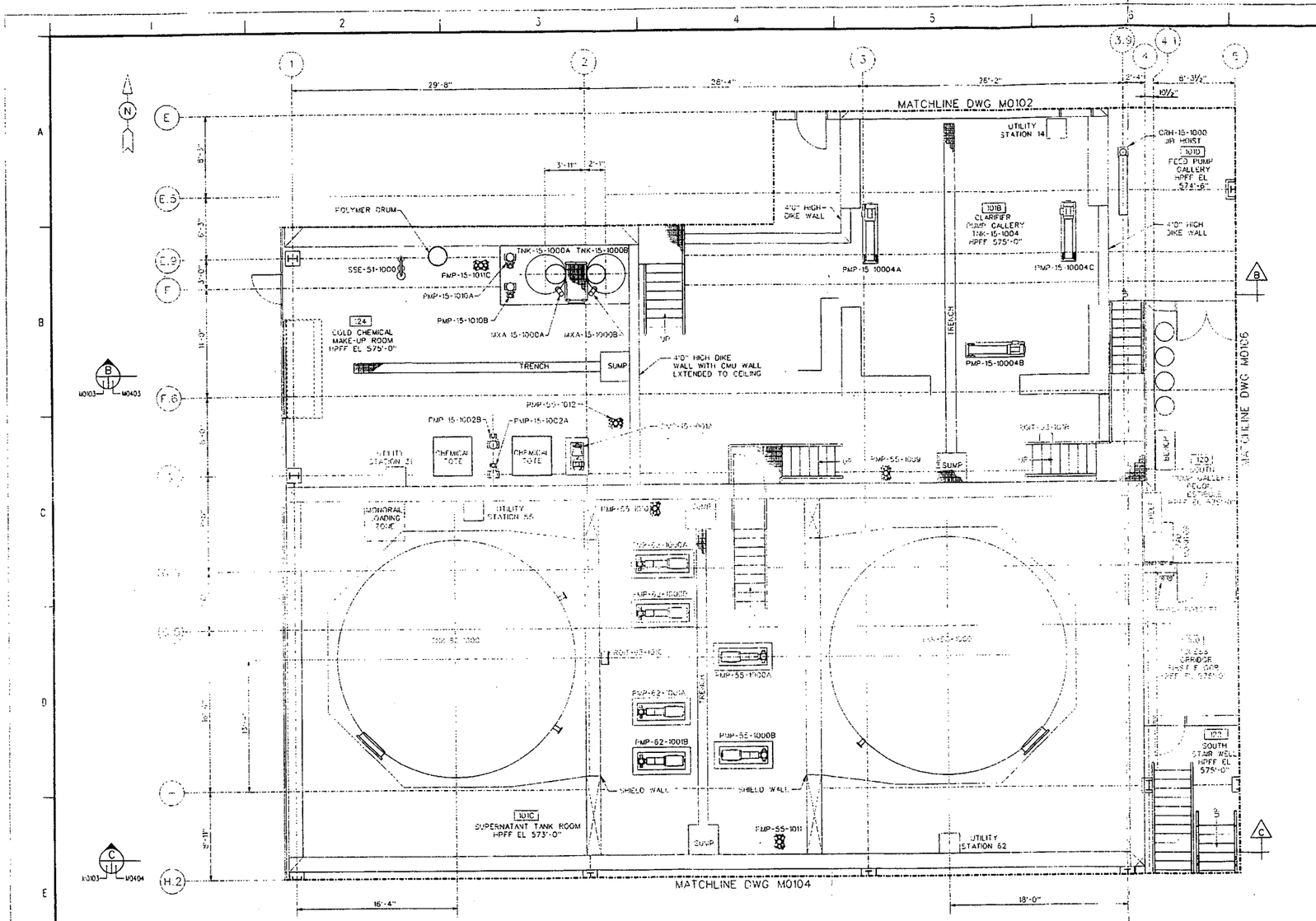
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO
N/A	40750	94X-3900-M-01593	M0102	B

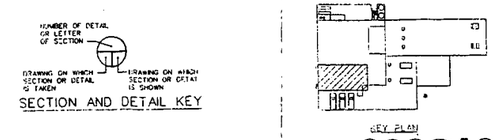
JEG PROJECT NO.	FILENAME
35H19603	94XM1593.DGN

DATE: 08/12/02 TIME: 10:08:02 AM USER: DDavis DESIGN FILE: J:\eap\dwg\94xm593.dgn

4654



PLAN
1ST FLOOR



SECTION AND DETAIL KEY

KEY PLAN

000240

SCALE: 1/4" = 1'-0"

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO	DRAWING TITLE
M0001	PIPING, VALVES AND MISCELLANEOUS
M0002	INSTRUMENTATION
M0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APR
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GGS
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

NOTES AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4000
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
1ST FLOOR COLUMNS 1-5 & E-H.2

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	1ST	1/4" = 1'-0"	U

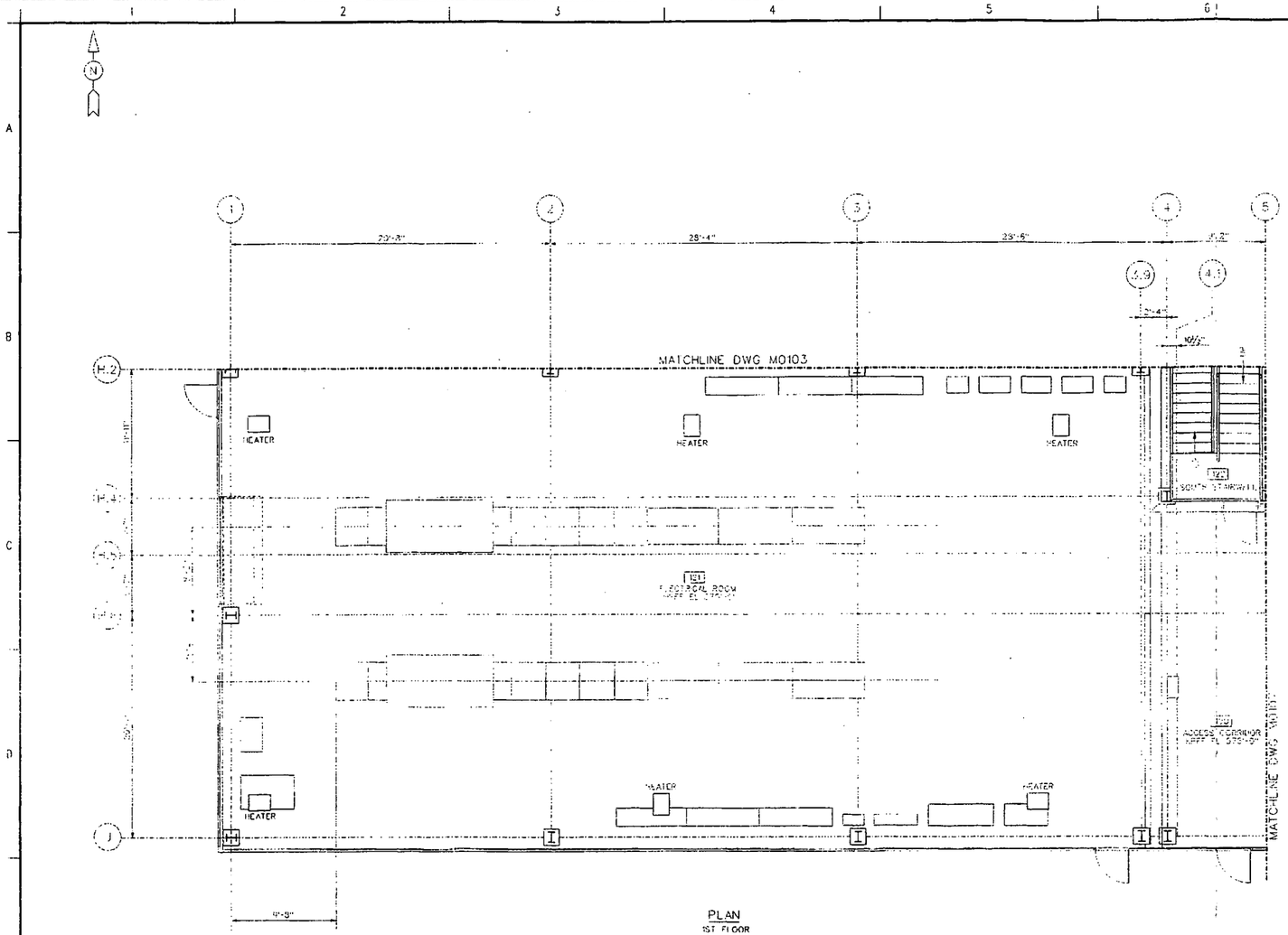
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV NO.
N/A	40750	94X-3900-M-01594	M0103	B

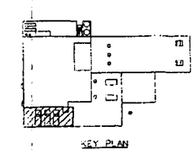
JEG PROJECT NO.	FILENAME
35H19603	94XM1594.DGN

DATE: 08/12/02
TIME: 10:08:22 AM
USER: 00avis
DESIGN FILE: j:\eap\dwg\94xm594.dgn

4654



PLAN
1ST FLOOR



KEY PLAN

SCALE: 1/4" = 1'-0"

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
N0001	PIPING, VALVES AND MISCELLANEOUS
N0002	INSTRUMENTATION
N0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GCS
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4600
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
1ST FLOOR COLUMNS 1-5 & K-J

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	1ST	1/4" = 1'-0"	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

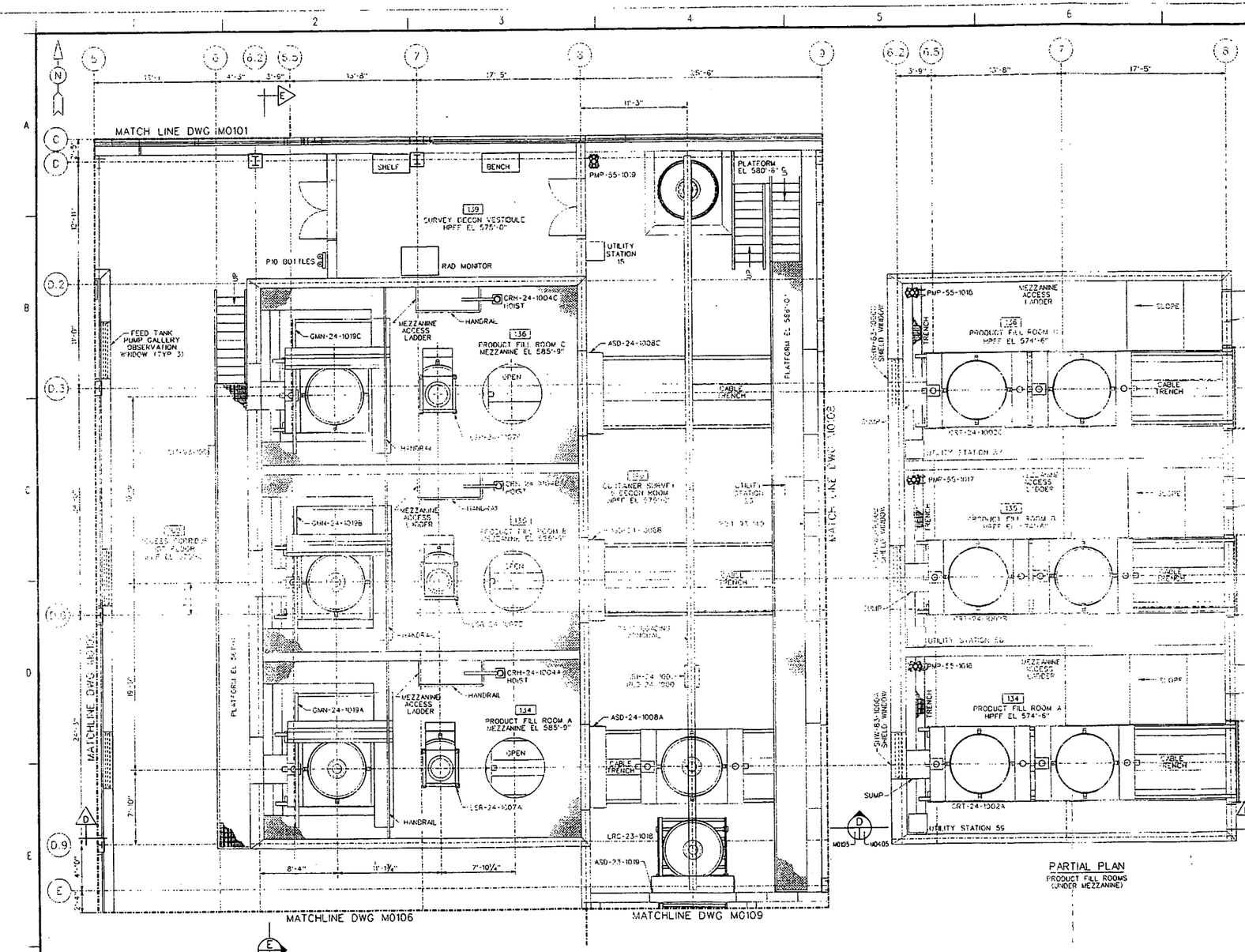
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01595	M0104	B

JEG PROJECT NO.	FILENAME
35H19603	94XM1595.DGN

000241

DATE: 08/12/02
TIME: 10:08:39 AM
USER: DDavis
DESIGN FILE: h:\eap\dwg\94xm1595.dgn

4654



PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
M0001	PIPING, VALVES AND MISCELLANEOUS
M0002	INSTRUMENTATION
M0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GCS
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRAGEMENT
1ST FLOOR COLUMNS 5-9 & C-E

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLENN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	1ST	1/4" = 1'-0"	U

SUBMITTED FOR 30X ISSUE	SUBMITTED FOR 60X ISSUE	SUBMITTED FOR 90X ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

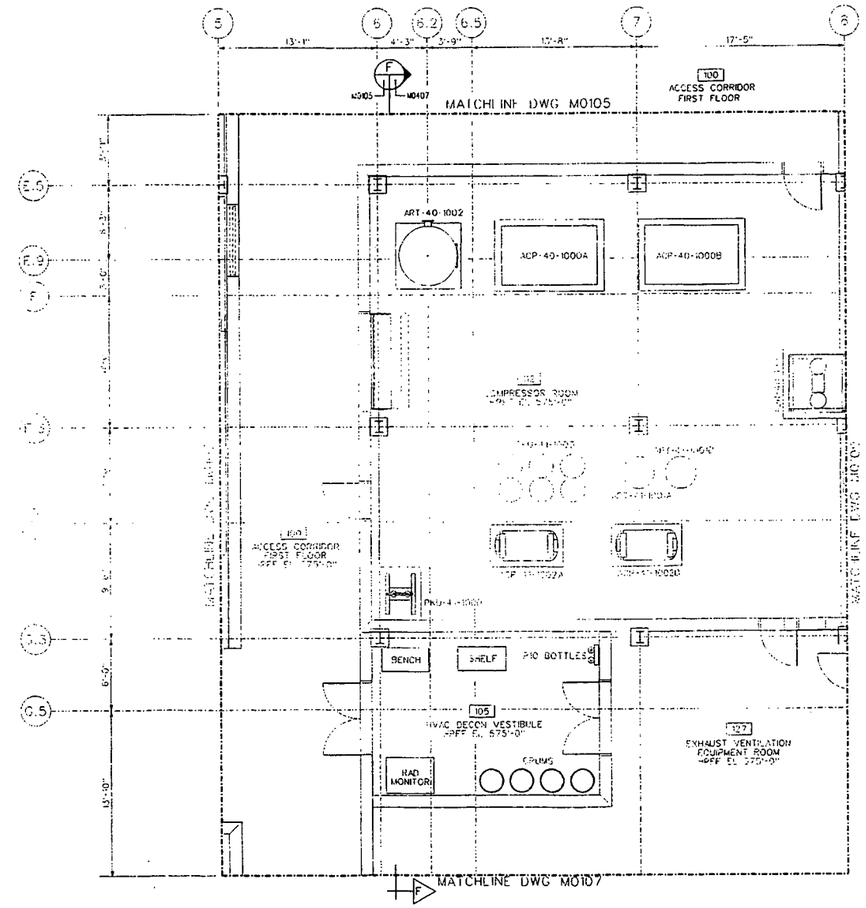
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01596	M0105	B

JEG PROJECT NO.	FILENAME
35H19603	94XM1596.DGN

DATE: 08/12/02 TIME: 10:08:45 AM USER: DDavis DESIGN FILE: J:\ea01\dwg\94xm1596.dgn

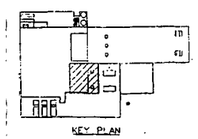
000242

4654



PLAN
1ST FLOOR

SCALE: 1/4" = 1'-0"



KEY PLAN

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
M0001	PIPING, VALVES AND MISCELLANEOUS
M0002	INSTRUMENTATION
M0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV BY	APPD
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	G.K.S
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
1ST FLOOR COLUMNS 5-8 & E.5-G.5

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/17/02	NICHOLAS KOHLIT	4/12/02

PLANT/BLDG. NO. — FLOOR: 1ST — SCALE: 1/4" = 1'-0" — CLASS: U

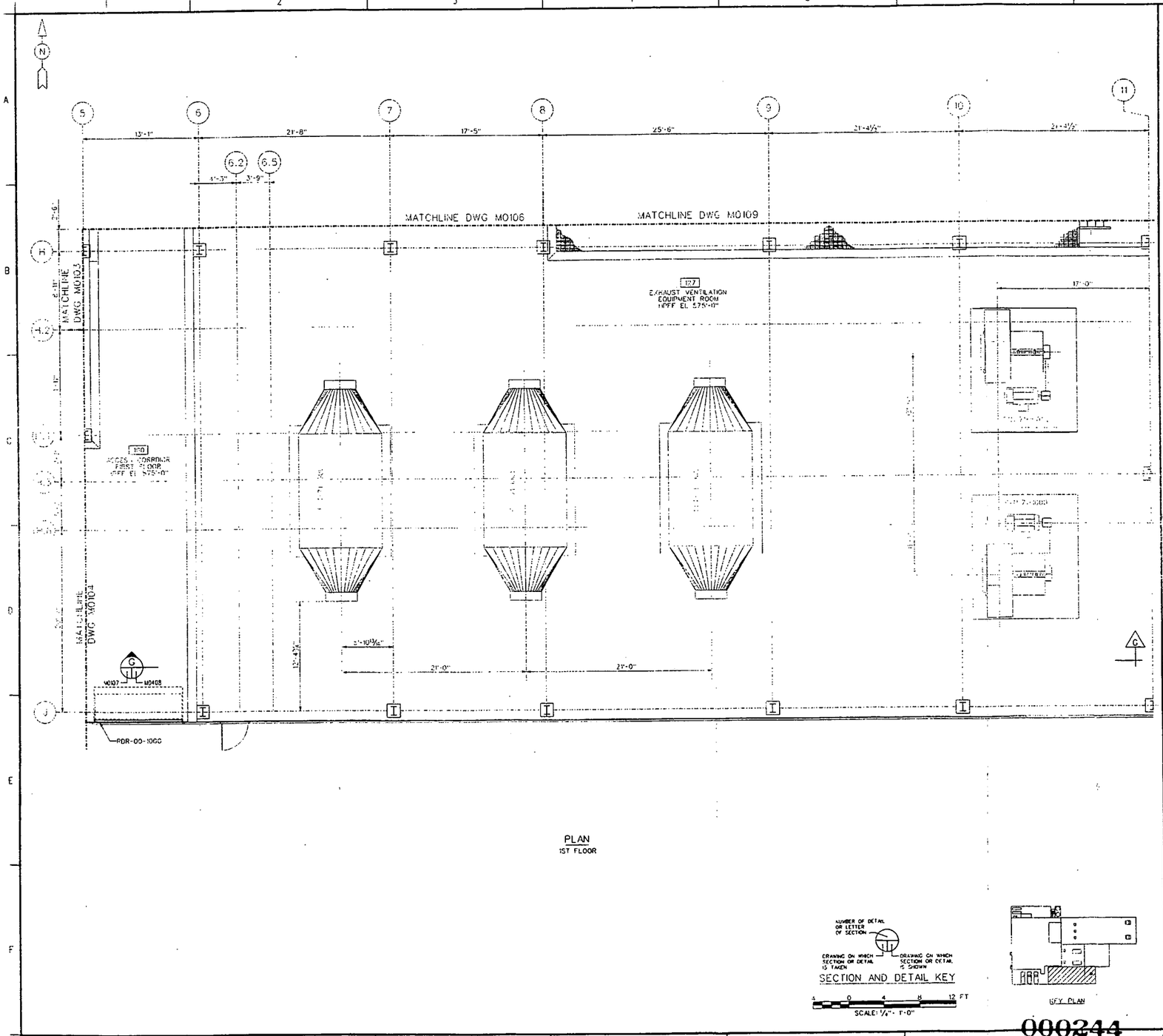
SUBMITTED FOR 30% ISSUE — SUBMITTED FOR 60% ISSUE — SUBMITTED FOR 90% ISSUE
TECH LEAD — TECH LEAD — TECH LEAD
DATE — DATE — DATE

T.O. NUMBER: N/A — PROJECT NO.: 40750 — DRAWING INDEX CODE NO.: 94X-3900-M-01597 — SHEET NO.: M0106 — REV NO.: B
JEC PROJECT NO.: 35H19603 — FILENAME: 94XM1597

000243

DATE: 08/12/02 TIME: 10:08:55 AM USER: DDavis DESIGN FILE: J:\acad\dwg\94xm1597.dgn

4654



PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
00001	PROJECT REFERENCE AND ABBREVIATIONS
00002	INSTRUMENTATION
00003	EQUIPMENT AND MISCELLANEOUS
00010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APP.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GCS
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

REVISIONS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4600
Fax: 865-220-4610

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
1ST FLOOR COLUMNS 5-11 & H-J

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	1ST	1/4"=1'-0"	U

SUBMITTED FOR 30% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 60% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 90% ISSUE — TECH LEAD — DATE

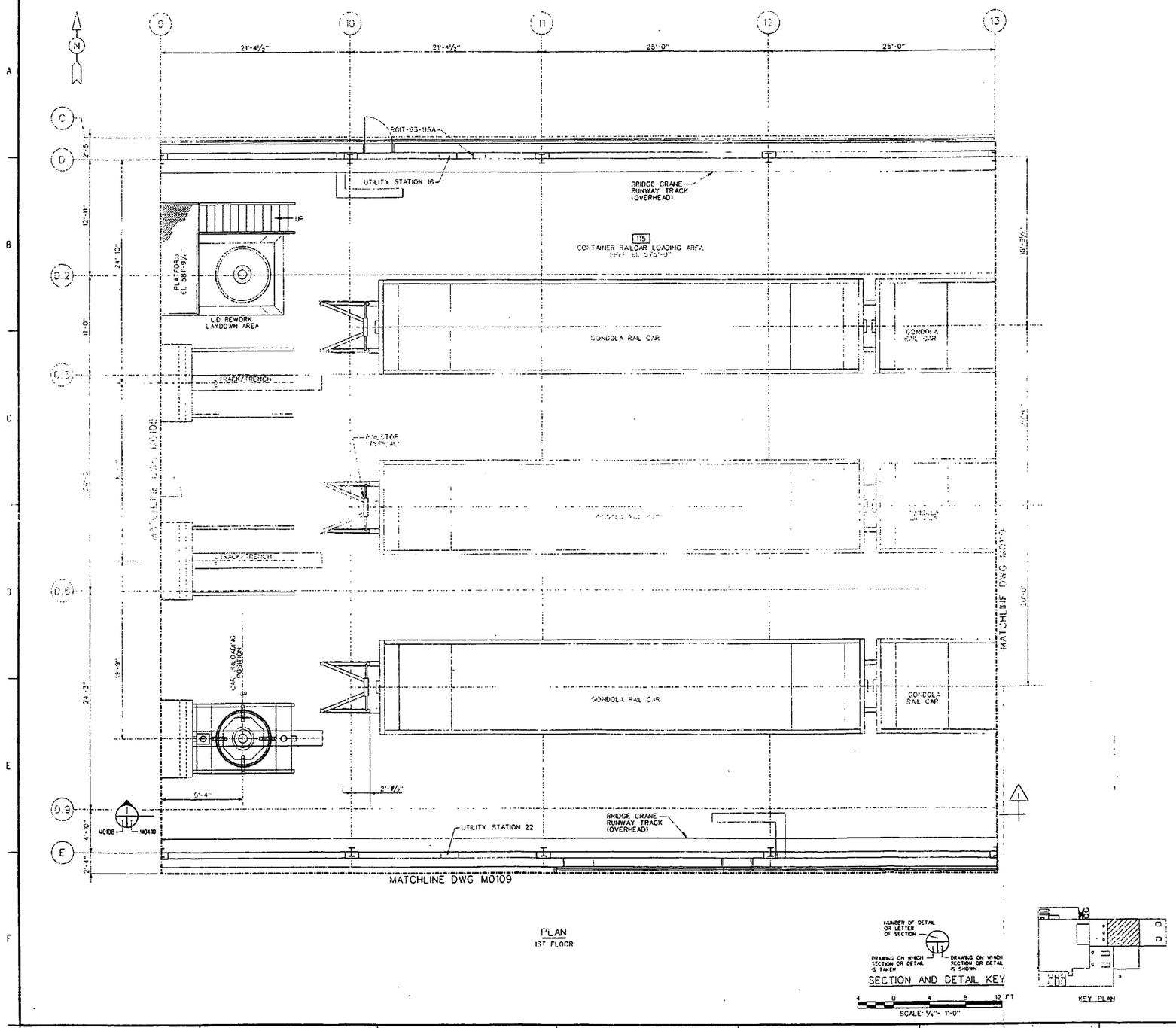
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO	SHEET NO	REV. NO
N/A	40750	94X-3900-M-01598	M0107	B

E.O. PROJECT NO.	FILENAME
35H19603	94XM0107

DATE: 08/12/02
TIME: 10:09:03 AM
USER: DDW46
DESIGN FILE: [illegible]

000244

4654



PLAN
1ST FLOOR

SECTION AND DETAIL KEY

SCALE: ¼" = 1'-0"

KEY PLAN

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
M0001	PIPING, VALVES AND MISCELLANEOUS
M0002	INSTRUMENTATION
M0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GAS
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
1ST FLOOR COLUMNS 9-13 & C-E

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	1ST	¼" = 1'-0"	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

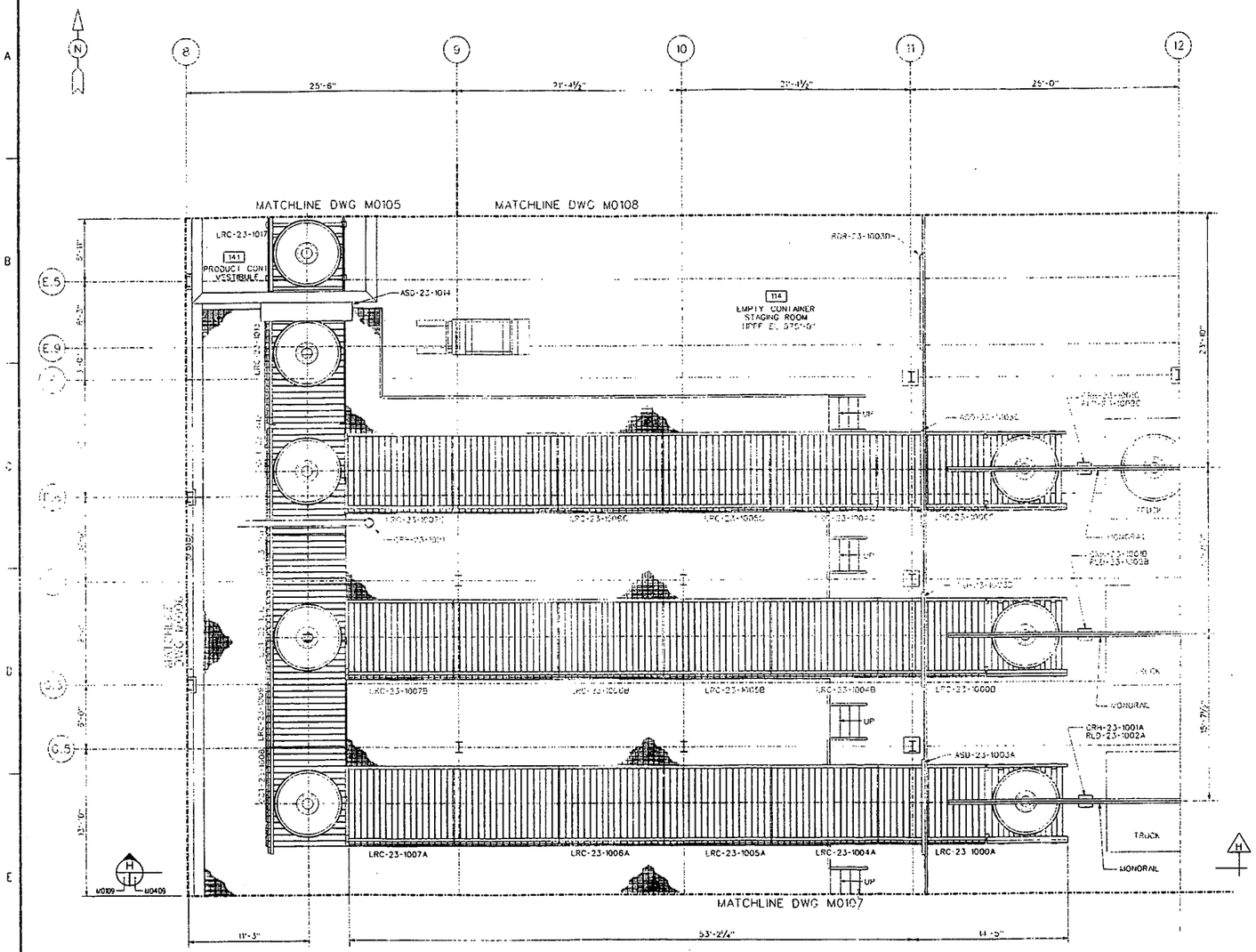
T.D. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01599	M0108	B

JEC PROJECT NO.	FILENAME
35H19603	94XM1599.DGN

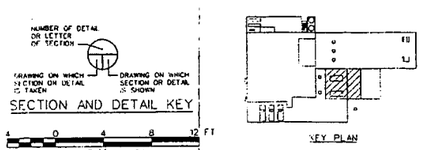
DATE: 08/12/02
TIME: M04:09 AM
USER: DDavis
DESIGN FILE: J:\Eqp\Dwg\94xm1599.dgn

000245

4654



PLAN
1ST FLOOR



SECTION AND DETAIL KEY

SCALE: ¼" = 1'-0"

KEY PLAN

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
M0001	PIPING, VALVES AND MISCELLANEOUS
M0002	INSTRUMENTATION
M0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GCS
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4600
Fax: 865-220-6130

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
1ST FLOOR COLUMNS B-12 & E.5 - G.5

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	1ST	¼" = 1'-0"	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

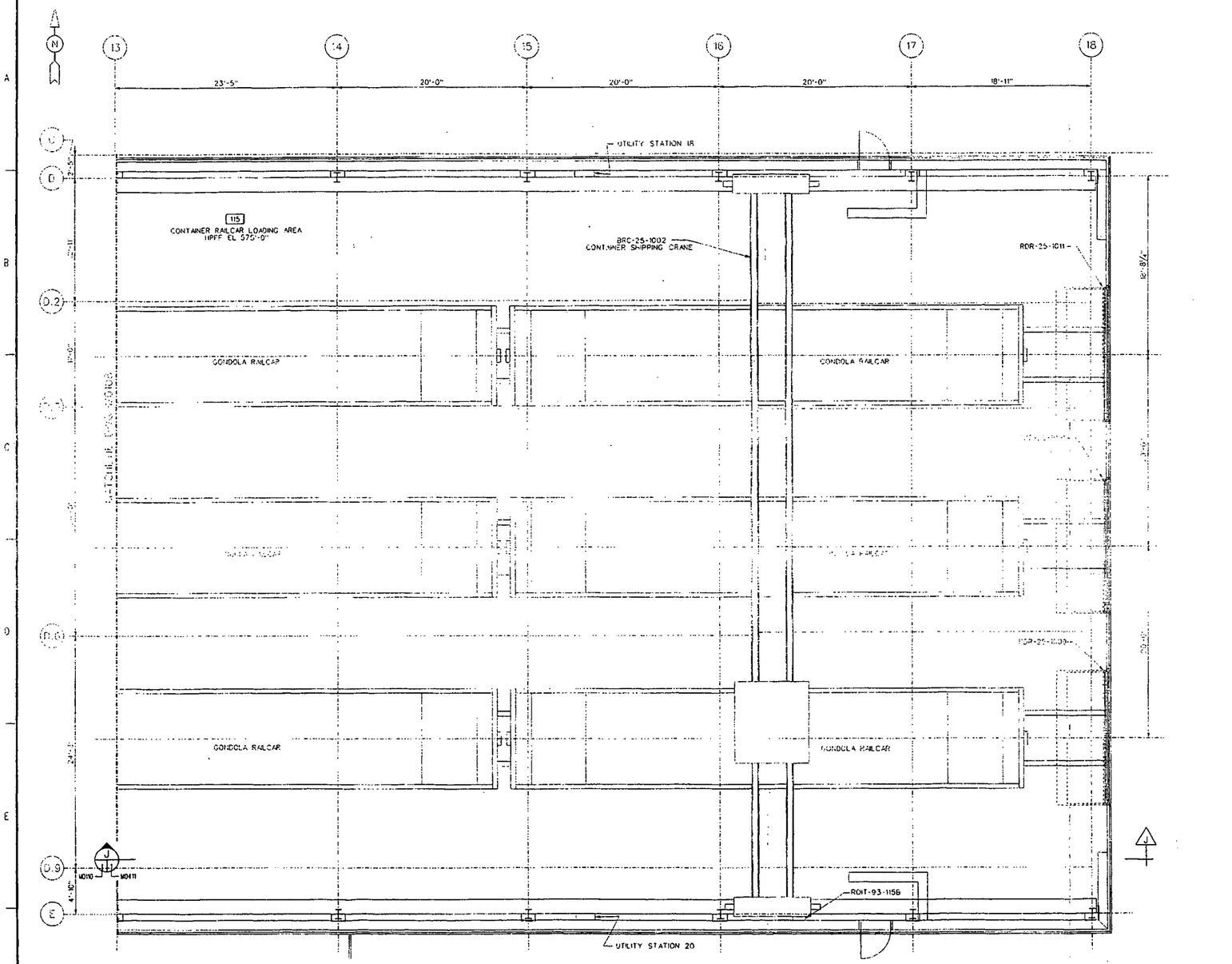
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01600	M0109	B

JEG PROJECT NO.	FILENAME
35H19603	94XM1600.DGN

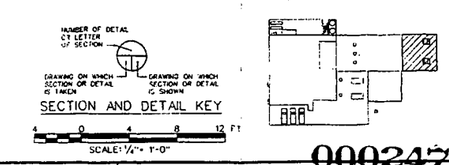
DATE: 06/12/02
TIME: 10:09:20 AM
USER: DDavis
DESIGN FILE: [illegible]

000246

4654



PLAN
1ST FLOOR
HPFF EL 576'-0"



SECTION AND DETAIL KEY

SCALE: 1/4" = 1'-0"

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
K0001	PIPING, VALVES AND MISCELLANEOUS
K0002	INSTRUMENTATION
K0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV NO	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GCS
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-6110

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
1ST FLOOR COLUMNS 13-18 & C-E

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	1ST	1/4" = 1'-0"	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

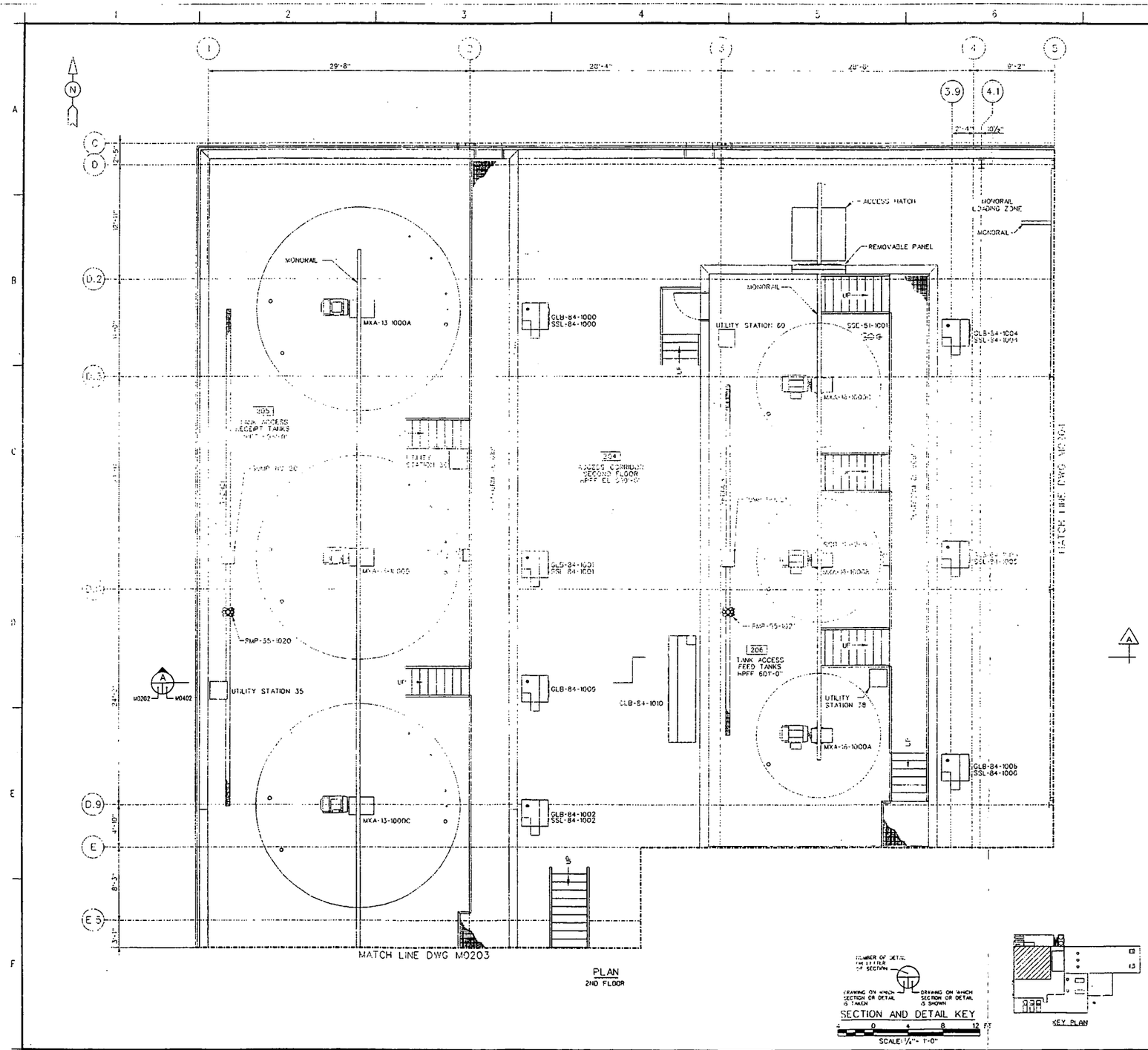
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01601	M0110	B

JEG PROJECT NO.	FILENAME
35H19503	94XM1601.DGN

000247

DATE: 08/12/02
TIME: 10:09:21 AM
USER: DDavis
DESIGN FILE: J:\eap\dwg\94xm601.dgn

4654



PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO	DRAWING TITLE
M0001	PIPING, VALVES AND MISCELLANEOUS
M0002	INSTRUMENTATION
M0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV NO	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GLS
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4000
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
2ND FLOOR COLUMNS 1-5 & C-E.5

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO. | FLOOR | SCALE 1/4" = 1'-0" | CLASS

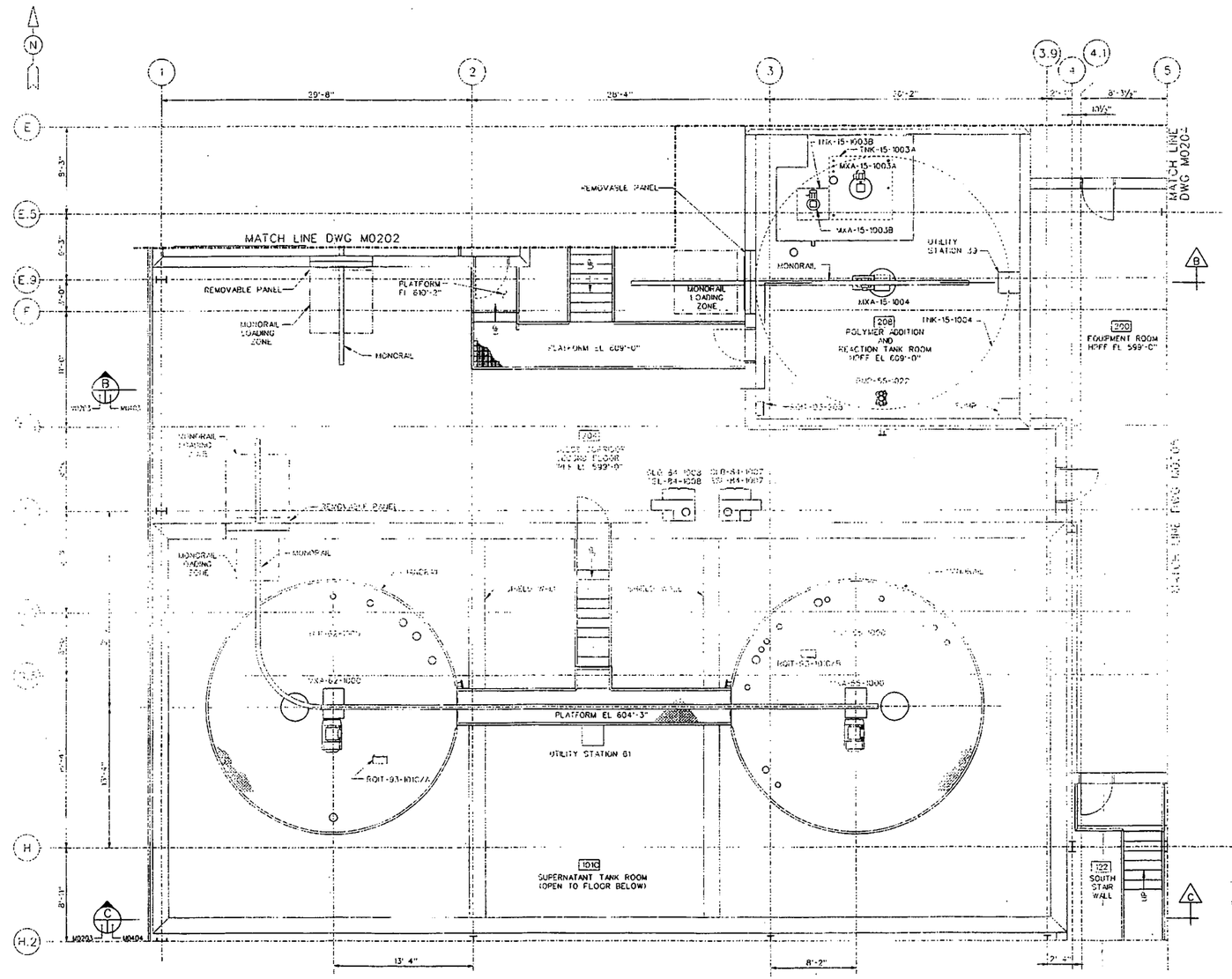
SUBMITTED FOR 30% ISSUE | SUBMITTED FOR 60% ISSUE | SUBMITTED FOR 90% ISSUE
TECH LEAD | TECH LEAD | TECH LEAD
DATE | DATE | DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV NO
N/A	40750			
JEG PROJECT NO. 35H19603	FILENAME 94XM1602.DGN	94X-3900-M-01602	M0202	B

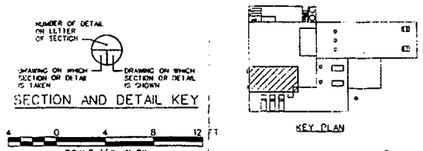
DATE: 08/12/02 TIME: 10:09:39 AM USER: DDavis DESIGN FILE: j:\acp\dwg\94xm1602.dgn

000248

4654



PLAN
2ND FLOOR



SECTION AND DETAIL KEY

SCALE: 1/4" = 1'-0"

KEY PLAN

PRELIMINARY
NOT FOR CONSTRUCTION

FPE DWG NO	DRAWING TITLE
M0001	PIPING, VALVES AND MISCELLANEOUS
M0002	INSTRUMENTATION
M0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APP.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GCS
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

DETAILS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
San Diego, Tennessee 37801
Tel: 865-220-4800
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
2ND FLOOR COLUMNS 1-5 & E-H.2

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	2ND	1/4" = 1'-0"	

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

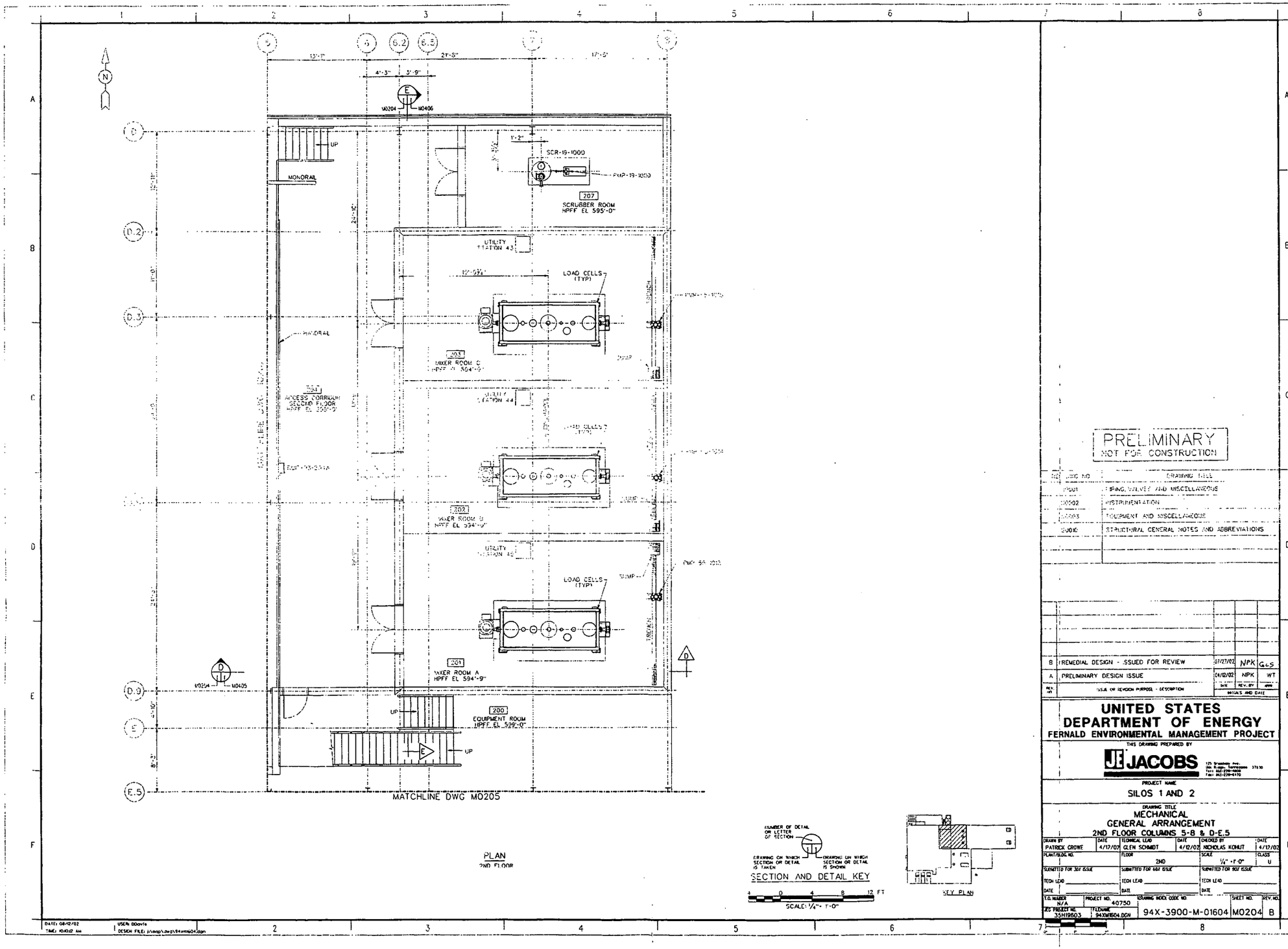
F.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO	REV NO
N/A	40750	94X-3900-M-01603	M0203	B

JEG PROJECT NO.	FILENAME
35H19603	94XM1603.DGN

DATE: 08/12/02
TIME: 10:01:01 AM
USER: DDavis
DESIGN FILE: h:\dcp\dwg\94xm1603.dgn

000249

4654



PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	DWG NO.	DRAWING TITLE
	M0001	PIPING, VALVES AND MISCELLANEOUS
	M0002	INSTRUMENTATION
	M0003	EQUIPMENT AND MISCELLANEOUS
	S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GLS
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4000
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
2ND FLOOR COLUMNS 5-8 & D-E.5

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	2ND	1/4" = 1'-0"	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

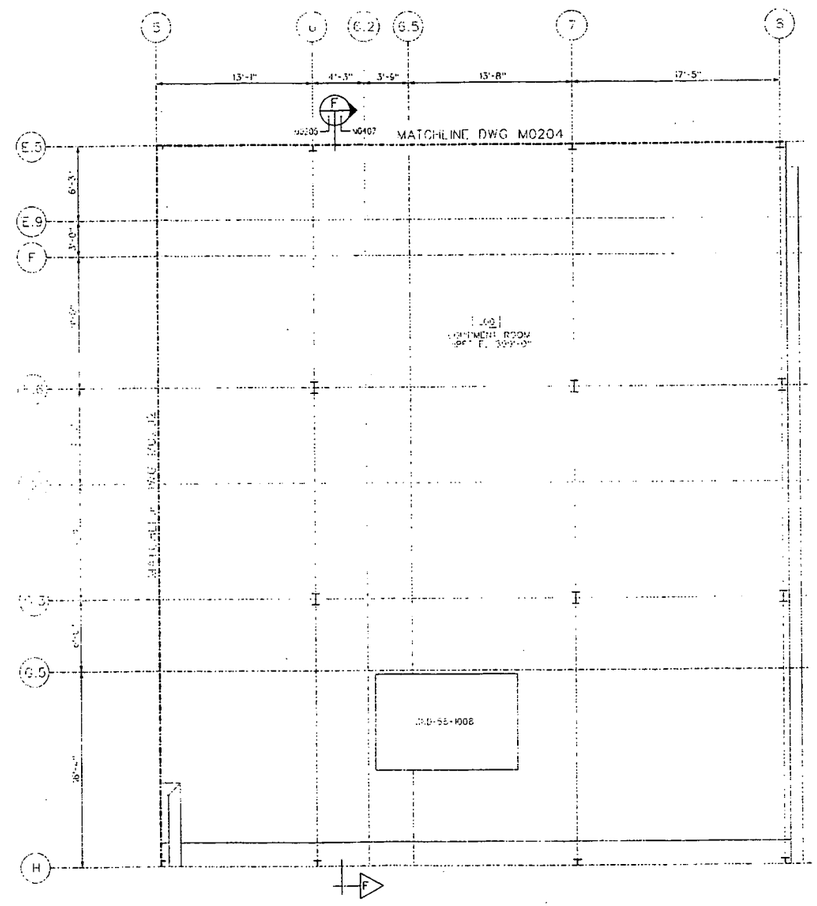
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01604	M0204	B

JEG PROJECT NO.	FILENAME
35H19603	94XM1604.DGN

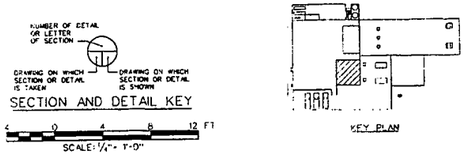
DATE: 08/12/02
TIME: 10:10:12 AM
USER: DDavis
DESIGN FILE: j:\dwg\94xm1604.dgn

000250

4654



PLAN
2ND FLOOR



SECTION AND DETAIL KEY

SCALE: 1/4" = 1'-0"

KEY PLAN

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO	DRAWING TITLE
M0001	PIPING, VALVES AND MISCELLANEOUS
M0002	INSTRUMENTATION
M0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
A	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NFK	GCS

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
2ND FLOOR COLUMNS 5-8 & E.5-H

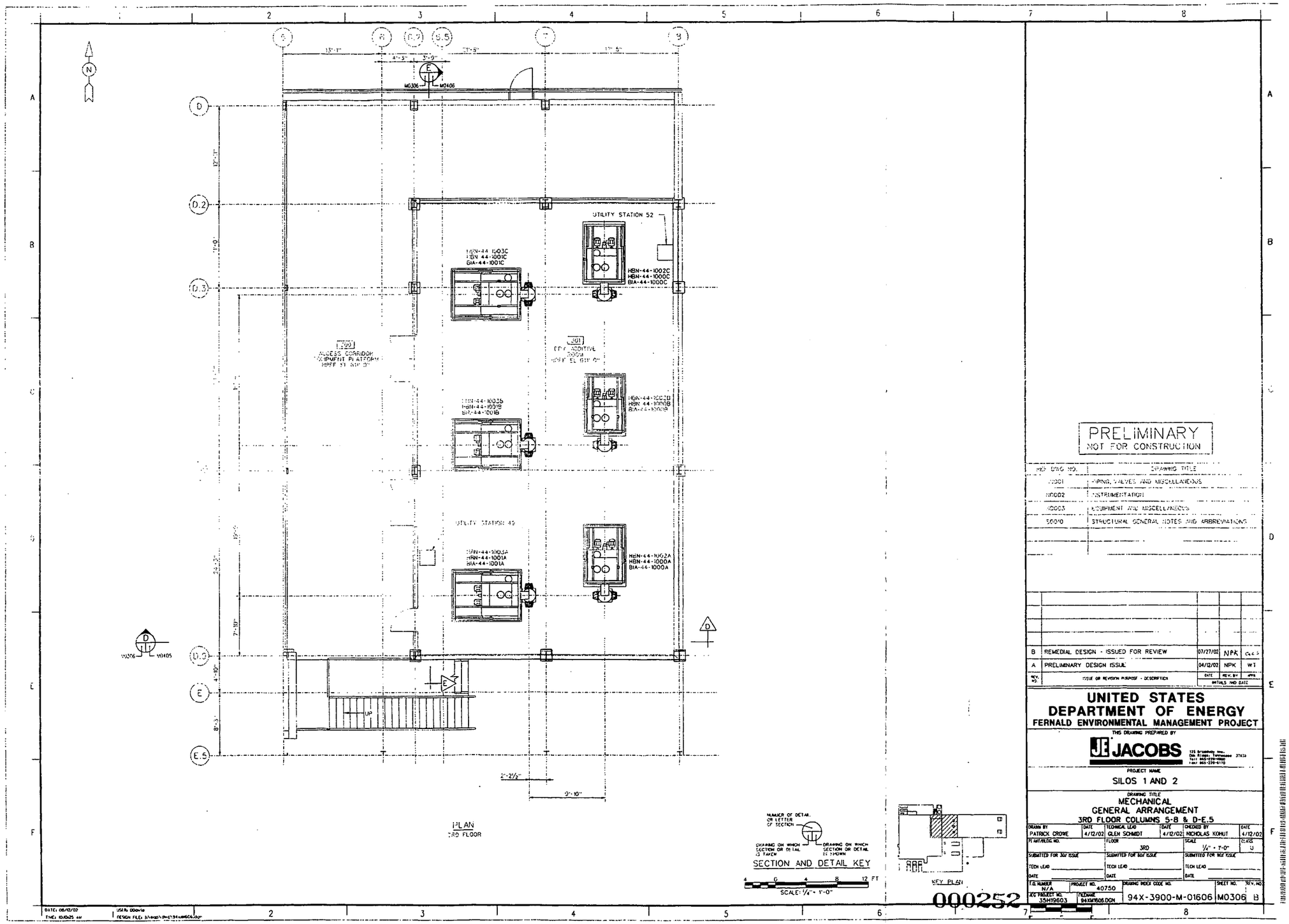
DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PLANT/BLDG. NO.		FLOOR		SCALE 1/4" = 1'-0"	CLASS
SUBMITTED FOR 30% ISSUE		SUBMITTED FOR 60% ISSUE		SUBMITTED FOR 90% ISSUE	
TECH LEAD		TECH LEAD		TECH LEAD	
DATE		DATE		DATE	

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01605	M0205	A
JEG PROJECT NO. 35H19603	FILENAME 94XM1605			

DATE: 08/12/02 TIME: 10:10:19 AM
USER: DDavis
DESIGN FILE: b:\eco\dwg\94xm1605.dgn

000251

4654



PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
10001	PIPING, VALVES AND MISCELLANEOUS
10002	INSTRUMENTATION
10003	EQUIPMENT AND MISCELLANEOUS
50010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	[illegible]
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4000
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
3RD FLOOR COLUMNS 5-8 & D-E.5

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	3RD	1/4" = 1'-0"	U

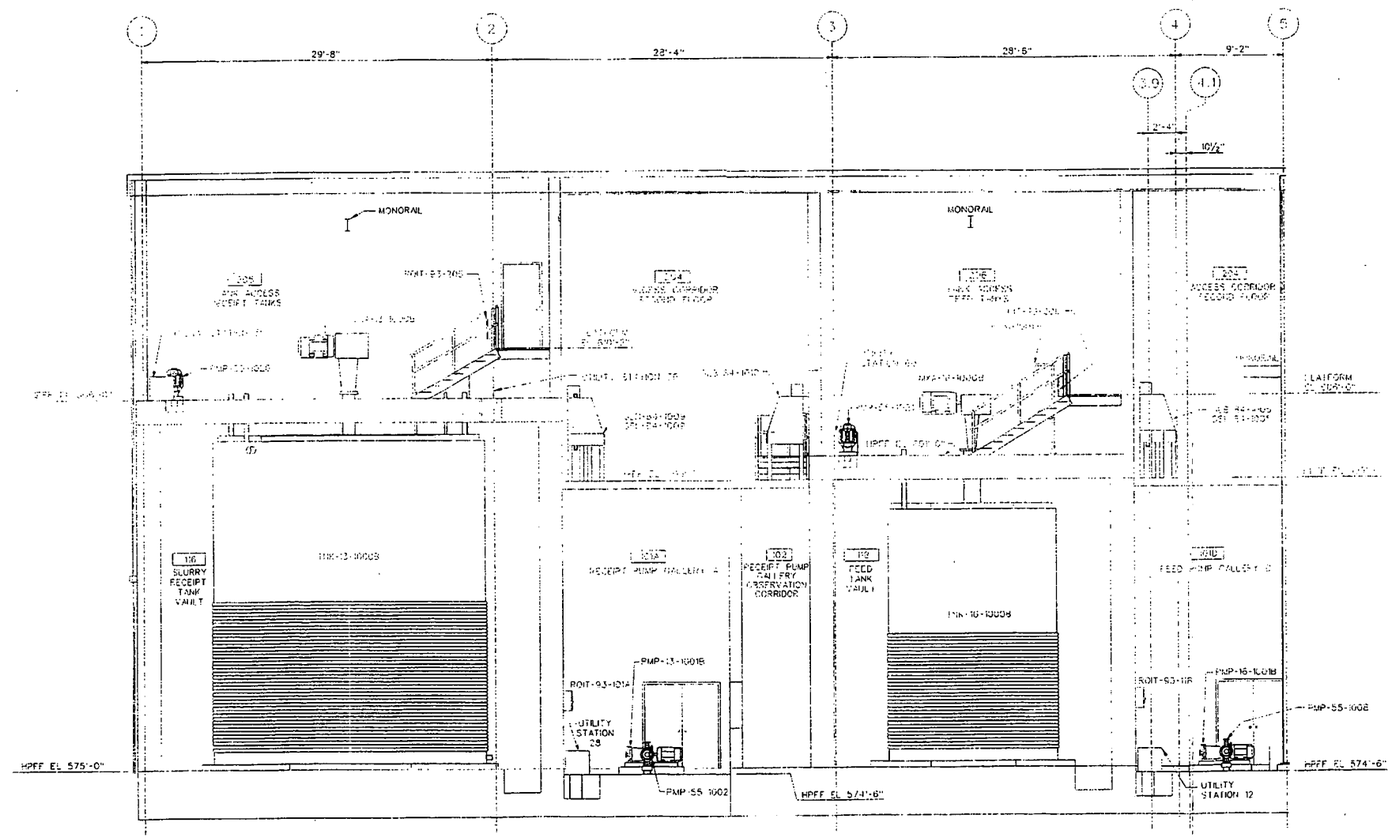
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01606	M0306	B

JEG PROJECT NO. 35H19603 | FILENAME 94XM1606.DGN

000252

4654



SECTION
LOOKING NORTH
M0102 M0202 M0402

NUMBER OF DETAIL OR LETTER OF SECTION
DRAWING ON WHICH SECTION OR DETAIL IS TAKEN
DRAWING ON WHICH SECTION OR DETAIL IS SHOWN

SECTION AND DETAIL KEY

4 0 4 8 12 FT
SCALE: 1/4" = 1'-0"

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
M0001	PIPING, VALVES AND MISCELLANEOUS
M0002	INSTRUMENTATION
M0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APP.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GLS
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
SECTION A COLUMNS 1-5

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	NA	1/4" = 1'-0"	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

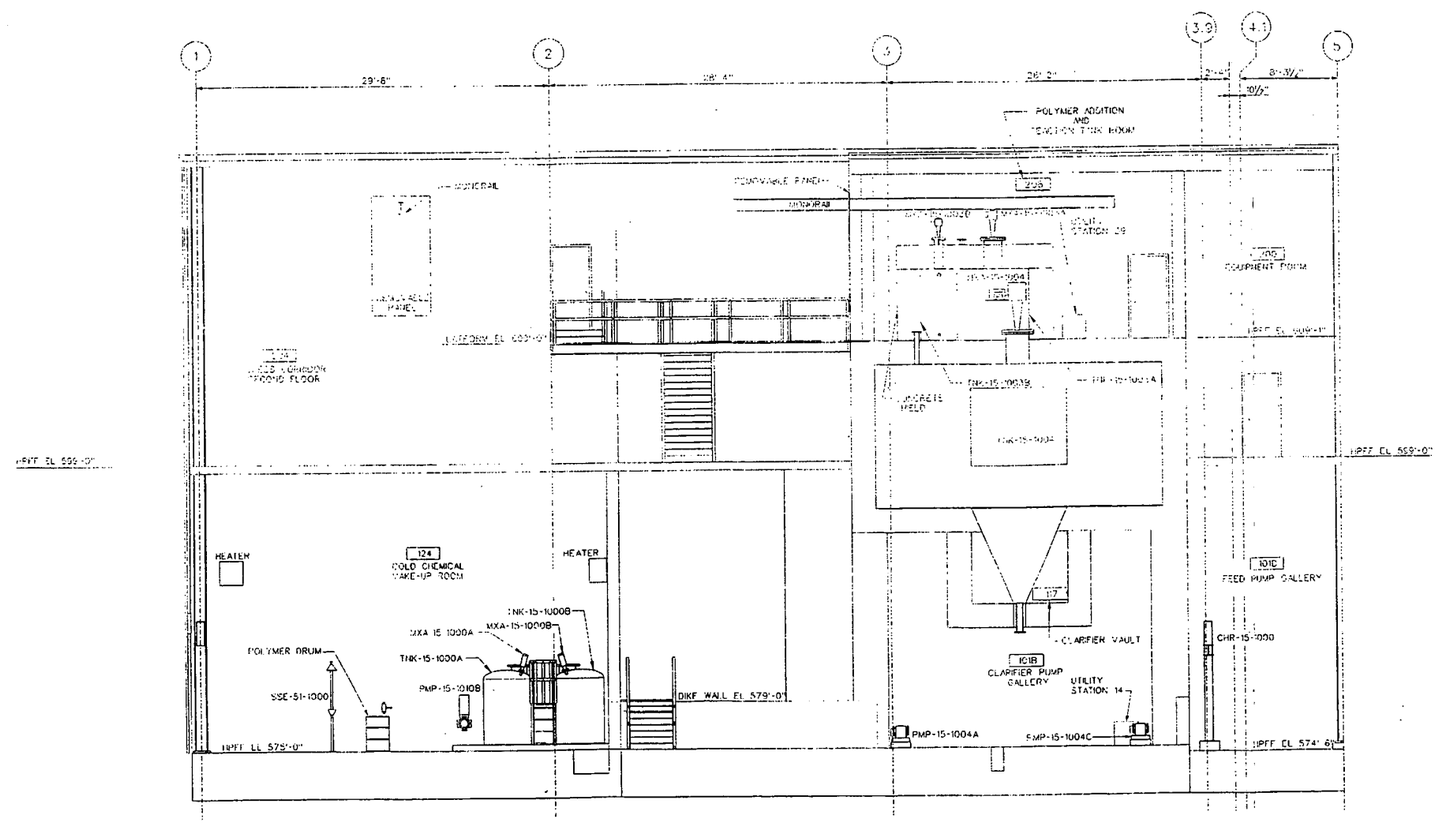
T.O. NUMBER	PROJECT NO	DRAWING INDEX CODE NO.	SHEET NO.	REV NO
N/A	40750	94X-3900-M-01607	M0402	B

JEG PROJECT NO.	FILENAME
35H19603	94XM1607

DATE: 08/12/02 TIME: 10:01:37 AM USER: DDavis DESIGN FILE: h:\eng\dwg\94xm1607.dgn

000253

4654



SECTION
LOOKING NORTH
B
U0103
U0203
U0403

NUMBER OF DETAIL OR LETTER OF SECTION
DRAWING ON WHICH SECTION OR DETAIL IS TAKEN
DRAWING ON WHICH SECTION OR DETAIL IS SHOWN
SECTION AND DETAIL KEY

4 0 4 8 12 FT
SCALE: 1/4" = 1'-0"

PRELIMINARY
NOT FOR CONSTRUCTION

REF. DWG. NO	DRAWING TITLE
U0001	PIPING, VALVES AND MISCELLANEOUS
U0002	INSTRUMENTATION
U0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	REMARKS	DATE	REV. BY	APR.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	G.C.S.
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

SCALE OR REVISION PURPOSE - DESCRIPTION

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
175 Broadway Ave., Oak Ridge, Tennessee 37830
Tel: 865-220-4000
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
SECTION B COLUMNS 1-5

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	N/A	1/4" = 1'-0"	U

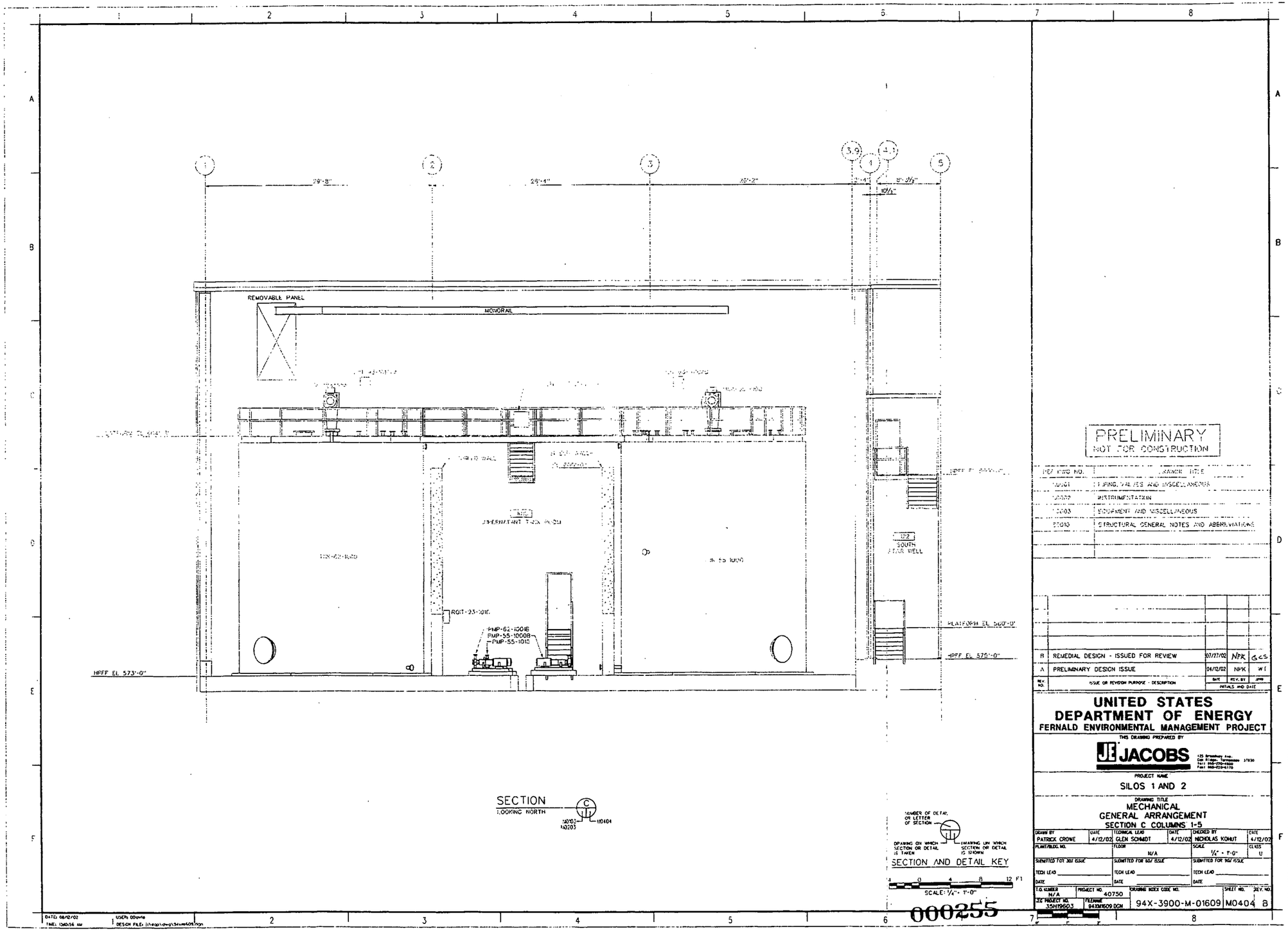
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO	SHEET NO.	REV. NO
N/A	40750			
JES PROJECT NO. 35N19603	FILENAME 94X0608.DGN	94X-3900-M-01608	M0403	B

DATE: 08/12/02
TIME: 08:48 AM
USER: DDavis
MESH FILE: J:\ead\dwg\94x0608.dgn

000254

4654



PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
M0001	PIPING, VALVES AND MISCELLANEOUS
M0002	INSTRUMENTATION
M0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GCS
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS

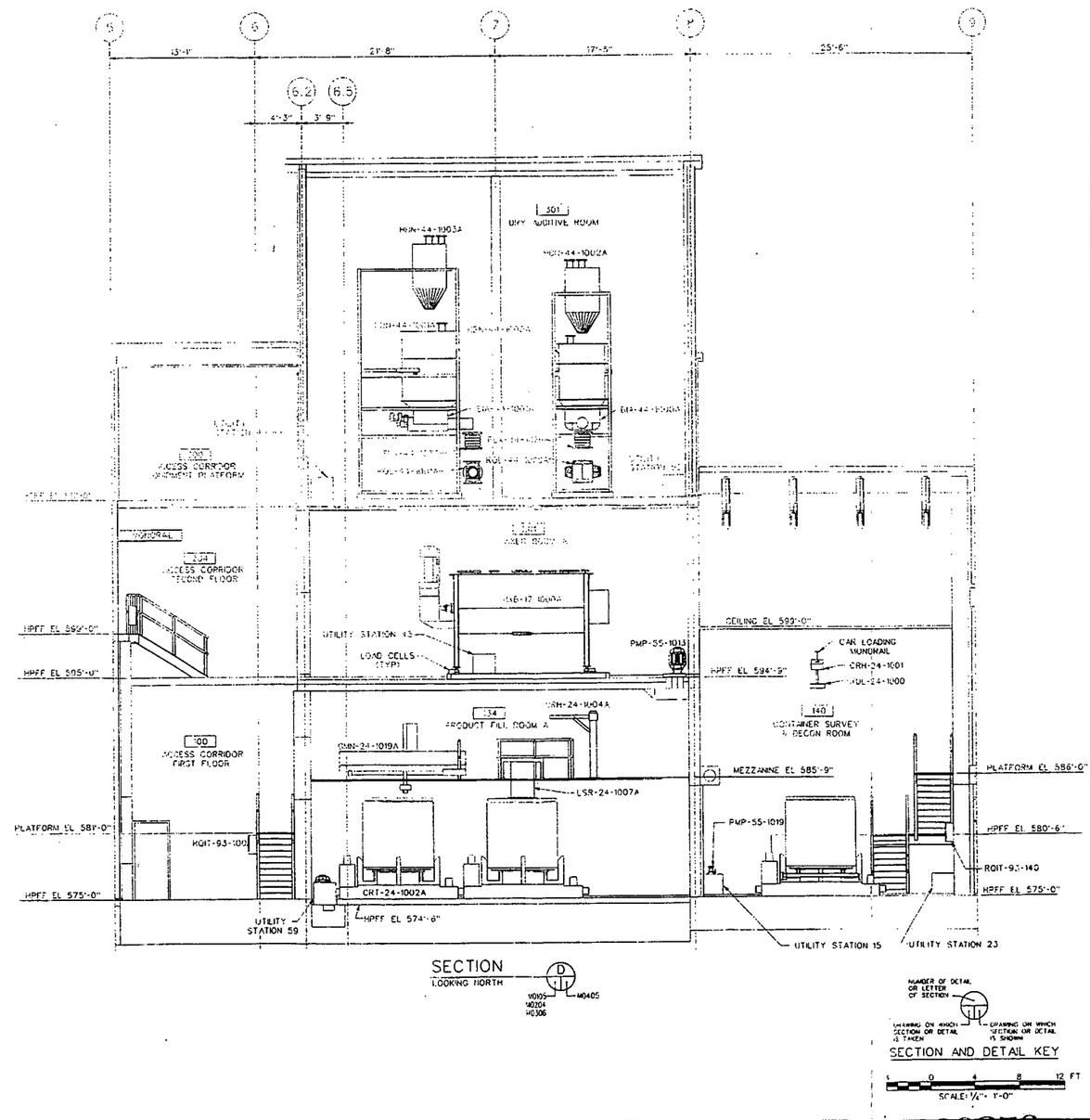
PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
SECTION C COLUMNS 1-5

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02
PLANT/BLDG. NO.		FLOOR N/A		SCALE 1/4" = 1'-0"	CLASS U
SUBMITTED FOR 30% ISSUE		SUBMITTED FOR 60% ISSUE		SUBMITTED FOR 90% ISSUE	
TECH LEAD		TECH LEAD		TECH LEAD	
DATE		DATE		DATE	

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01609	M0404	B
JEG PROJECT NO. 35H19603	FILENAME 94XM1609.DGN			

000255



SECTION
LOOKING NORTH
D
M0105
M0204
M0306
M0405

NUMBER OF DETAIL OR LETTER OF SECTION
DRAWING ON WHICH SECTION OR DETAIL IS TAKEN
DRAWING ON WHICH SECTION OR DETAIL IS SHOWN

SECTION AND DETAIL KEY

1 0 4 8 12 FT
SCALE: 1/4" = 1'-0"

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
M0001	PIPING, VALVES, AND MISC EQUIPMENT
M0002	INSTRUMENTATION
M0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV NO	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APVD.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	[illegible]
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	NT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS 125 Broadway Ave., Oak Ridge, Tennessee 37831 Tel: 865-220-4000 Fax: 865-220-6178

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
SECTION D COLUMNS 5-9

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

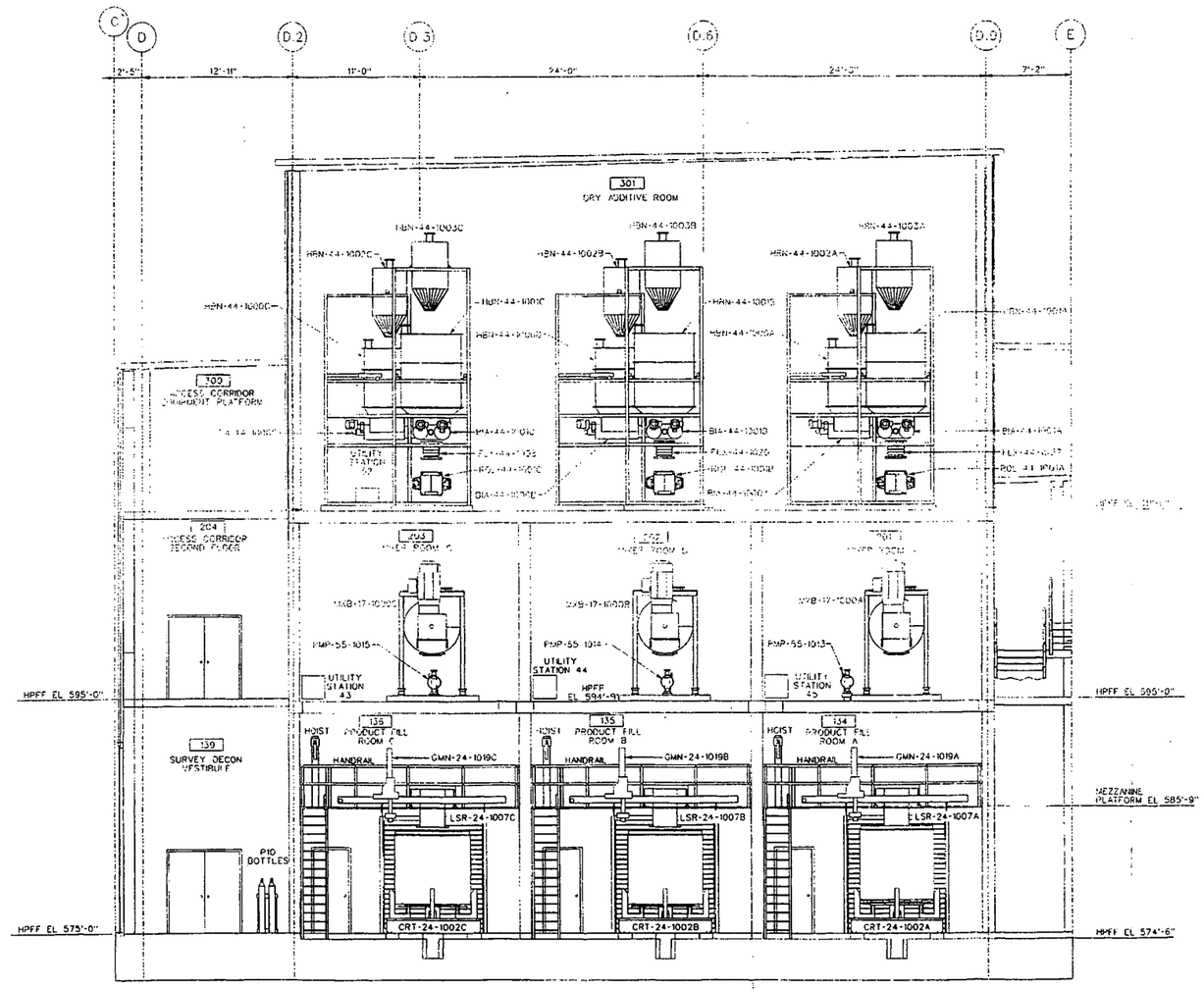
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	N/A	1/4" = 1'-0"	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

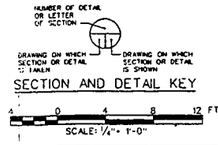
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV NO
N/A	40750	94X-3900-M-01610	M0405	B

JE PROJECT NO.	FILENAME
35H19603	94XM1610.DGN

DATE: 08/12/02
TIME: 10:06:04 AM
USER: DDavis
DESIGN FILE: [illegible]



SECTION
LOOKING EAST
E
M0305
M0304
M0306
M0406



SECTION AND DETAIL KEY

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
M0001	PIPING, VALVES AND MISCELLANEOUS
M0002	INSTRUMENTATION
M0003	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GCS
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WI

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS 125 Broadway Ave. Oak Ridge, Tennessee 37831 Tel: 865-220-4000 Fax: 865-220-4170

PROJECT NAME
SILOS 1 AND 2

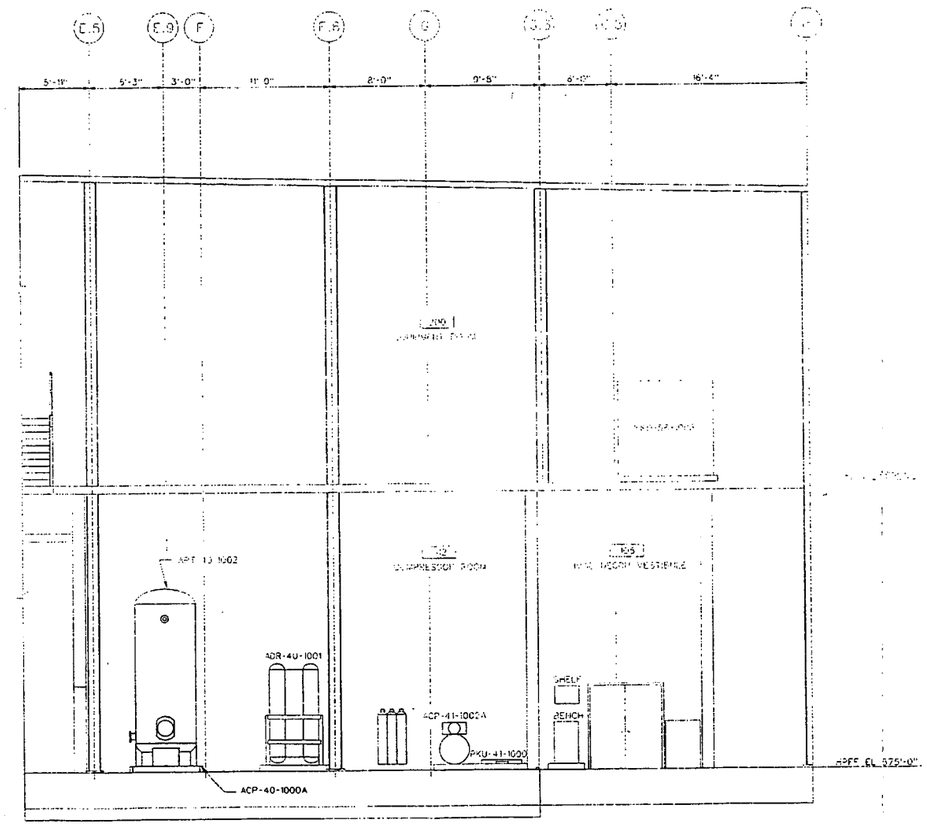
DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
SECTION E COLUMNS C-E.1

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02
PLANT/BLDG. NO.		FLOOR		SCALE	CLASS
		N/A		1/4" = 1'-0"	U
SUBMITTED FOR 30% ISSUE		SUBMITTED FOR 90% ISSUE		SUBMITTED FOR 100% ISSUE	
TECH LEAD		TECH LEAD		TECH LEAD	
DATE		DATE		DATE	

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750			
JCS PROJECT NO. 35H19603	FEDSHARE 94XM0611.DGN	94X-3900-M-01611	M0406	B

DATE: 08/12/02 TIME: 10:00 AM
USER: CDAVIS
DESIGN FILE: J:\MOD\CAD\34M0611.DGN

4654



SECTION
LOOKING EAST
F
M0100
100205
M0407

NUMBER OF DETAIL OR LETTER OF SECTION
DRAWING ON WHICH SECTION OR DETAIL IS TAKEN
DRAWING ON WHICH SECTION OR DETAIL IS SHOWN
SECTION AND DETAIL KEY

4 0 4 8 12 FT
SCALE: 1/4" = 1'-0"

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
00001	PIPING, VALVES AND MISCELLANEOUS
00002	INSTRUMENTATION
00003	EQUIPMENT AND MISCELLANEOUS
00010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APP.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GCF
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

DETAILS AND DATA

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS
125 Broadway Ave., Lake Bluff, Tennessee 37830
Tel: 865-220-4000
Fax: 865-229-6110

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
SECTION F COLUMNS E.1-H

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLENN SCHMIDT	4/12/02	NICHOLAS KOMUT	4/12/02
PLANT/BLDG. NO.		FLOOR		SCALE	CLASS
		N/A		1/4" = 1'-0"	U

SUBMITTED FOR JGF ISSUE — TECH LEAD ____ DATE ____
SUBMITTED FOR DOE ISSUE — TECH LEAD ____ DATE ____
SUBMITTED FOR NOF ISSUE — TECH LEAD ____ DATE ____

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01612	M0407	B

JGF PROJECT NO. 35H19803 — FILENAME 94XM1612.DGN

DATE: 08/12/02
TIME: 10:04:47 AM
USER: DDennis
DESIGN FILE: I:\Eaud\Dn-g\94xm1612.dgn

000258

4654

STREAM NUMBER	1	2A	2B	3	4	5	6	7	8
STREAM DESCRIPTION	TTA SLURRY FROM TRANSFER TANK AREA (TTA) TIE-IN	RECEIPT TANK SLURRY TO REACTION TANK	TREATED SLURRY TO CLARIFIER	FLUSH WATER TO SLURRY RECEIPT TANKS AND SLURRY RECEIPT TANK SUMP PUMPS	MIXER WASHWATER HEADER TO SUPERNATANT TANK		FEED TANK SLURRY TO SLURRY RECEIPT TANKS	SLURRY RECEIPT TANK VENTS	SLUICE/FLUSH WATER TANK AND RECEIPT TANKS VENT TOTALS
WATER (LB/DAY)	442,444	444,277	459,177	1,833	25,025			TBD	TBD
K-65 SOLIDS (LB/DAY)	78,078	78,078	78,078						
POLYMER (LB/DAY)			30.0						
CEMENT (LB/DAY)									
FLY ASH (LB/DAY)									
RADON (pCi/L)								1.12E-05	1.16E-05
TOTAL (LB/DAY)	520,523	522,355	537,285	1,833	25,025				
AIR FLOW (SCFM)								10	40
FLOW (GPM-LIQ)/(CFM-SOL)	350	40	40	200	40		100		
TEMPERATURE (DEG F)	70	75	76	AMBIENT	AMBIENT		70	70	70-76
PRESSURE (PSIG)	150	60		60	40		75		
VACUUM (IN WC)			-2.0					-2.0	-2.0
WEIGHT % SOLIDS	15.00	14.95	14.53				30		
DENSITY (LB/FT3)	69.06	69.03	69.03	62.4	62.4			TBD	TBD
COMMENTS:	2.7 HRS/DAY	24 HRS/DAY	24 HRS/DAY	INTERMITTENT	INTERMITTENT		INTERMITTENT	NOTE 2a	

STREAM NUMBER	9	10	11	12	13	14	15	16	17	18
STREAM DESCRIPTION	VENT GASES FROM SLUICE/FLUSH WATER TANK	VENT GASES TO RCS VENT HEADER	VENT GASES TO RCS	PROCESS WATER TO POLYMER PACKAGE	SLURRY RECEIPT TANKS CHILLED WATER SUPPLY	SLURRY RECEIPT TANKS CHILLED WATER RETURN	SAMPLE RECYCLE	CHEMICAL SOLUTION FROM TOTES TO FEED PUMPS	CHEMICAL SOLUTION TO REACTION TANK	NEAT POLYMER TOTES
WATER (LB/DAY)	TBD	TBD	TBD	14,900	2,161,728	2,161,728	0.75			70
K-65 SOLIDS (LB/DAY)							0.25			
POLYMER (LB/DAY)										30
CEMENT (LB/DAY)										
FLY ASH (LB/DAY)										
RADON (pCi/L)	3.64E-03	7.11E-05	8.27E-05							
TOTAL (LB/DAY)				14,900	2,161,728	2,161,728	1			100
AIR FLOW (SCFM)	10	150	190							
FLOW (GPM-LIQ)/(CFM-SOL)				30	160	180		0-20	0-1	
TEMPERATURE (DEG F)	76	77-98	70-98	AMBIENT	60	70	AMBIENT	AMBIENT	AMBIENT	AMBIENT
PRESSURE (PSIG)				60	45	TBD			40	
VACUUM (IN WC)	-2.0	-2.0	-2.0							
WEIGHT % SOLIDS							15-30			
DENSITY (LB/FT3)	TBD	TBD	TBD	62.4	62.4	62.4	69-78			
COMMENTS:				INTERMITTENT			INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT

STREAM NUMBER	19	20	21	22	23	24	25	26	27
STREAM DESCRIPTION	POLYMER SOLUTION TO POLYMER ADDITION TANK	SLURRY FEED TANKS CHILLED WATER SUPPLY	CHEMICAL SOLUTION TO RECEIPT/ FEED TANKS AND PRODUCT MIXERS	SLURRY FEED TANKS CHILLED WATER RETURN	FLUSH WATER TO CLARIFIER AND CLARIFIER UNDERFLOW PUMPS	SUPERNATANT TO SUPERNATANT TANK	THICKENED SLURRY TO SLURRY FEED TANKS	VENT GASES FROM SUPERNATANT TANK	REACTION TANK VENT
WATER (LB/DAY)	14,900	720,576		720,576	768	275,226	182,951	TBD	TBD
K-65 SOLIDS (LB/DAY)							78,078		
POLYMER (LB/DAY)	30						30		
CEMENT (LB/DAY)									
FLY ASH (LB/DAY)									
RADON (pCi/L)								7.30E-03	2.58E-05
TOTAL (LB/DAY)	14,930	720,576		720,576	768	276,226	261,059		
AIR FLOW (SCFM)								10	10
FLOW (GPM-LIQ)/(CFM-SOL)	0.4	60	5-20	60	200	22.9	17.1		
TEMPERATURE (DEG F)	AMBIENT	60	AMBIENT	70	AMBIENT	77	77	77	76
PRESSURE (PSIG)	35	45	60	TBD	80		150		
VACUUM (IN WC)						-2.0		-2.0	-2.0
WEIGHT % SOLIDS							30.00		
DENSITY (LB/FT3)	67.32	62.40	TBD	62.4	62.4	62.4	77.51	TBD	TBD
COMMENTS:			INTERMITTENT		INTERMITTENT				NOTE 3

STREAM NUMBER	28	29	30	31	32	33	34	35	36	37
STREAM DESCRIPTION	SLURRY WASHWATER FROM SLURRY FEED TANK SUMPS	CLARIFIER VENT		VENT GASES SUPERNATANT TANK VENT HEADER	VENT GASES FROM PRODUCT MIXER VENT SYSTEM	CLARIFIER, SUPERNATANT TANK AND SLURRY FEED TANK VENT HEADER TOTALS	SLURRY FEED TANK VENTS	FLUSH WATER TO SLURRY FEED TANKS AND SLURRY FEED SUMP PUMPS	SCRUBBER BLOWDOWN	SLURRY WASHWATER FROM SLURRY RECEIPT TANK SUMPS
WATER (LB/DAY)		TBD		TBD	TBD	TBD	TBD	14,426	125	
K-65 SOLIDS (LB/DAY)										
POLYMER (LB/DAY)										
CEMENT (LB/DAY)					0.01				1.25	
FLY ASH (LB/DAY)					0.05				5.04	
RADON (pCi/L)		2.58E-05		5.23E-05	3.80E-03	7.07E-05	1.84E-05			
TOTAL (LB/DAY)								14,426	131	
AIR FLOW (SCFM)		10		30	105	45	5			
FLOW (GPM-LIQ)/(CFM-SOL)	40							200	5	40
TEMPERATURE (DEG F)	AMBIENT	77		77	71-96	70-77	70	AMBIENT	AMBIENT	AMBIENT
PRESSURE (PSIG)	40							50	50	40
VACUUM (IN WC)		-2.0		-2.0	-2.0	-2.0	-2.0			
WEIGHT % SOLIDS									0.05	
DENSITY (LB/FT3)		TBD		TBD	TBD	TBD	TBD	62.4	62.4	
COMMENTS:	INTERMITTENT	NOTE 3			NOTE 5		NOTE 3	INTERMITTENT		INTERMITTENT

STREAM NUMBER	38	39	39A	40	41	42	43	44	45
STREAM DESCRIPTION	FEED TANK SLURRY TO PRODUCT MIXERS	FLY ASH TO RECEIVING BINS	CEMENT TO RECEIVING BINS	FLUSH WATER TO PRODUCT MIXERS, PRODUCT MIXER AND CONT. FILL ROOM SUMP PUMPS	PRODUCT MIXER VENTS TO PRODUCT MIXER HEADER	PRODUCT MIXER VENT HEADER	PROCESS WATER TO SLUICE/FLUSH WATER TANK AND PRODUCT MIXERS	PROCESS WATER TO SCRUBBER	FROM PRODUCT MIXER ROOM PUMPS
WATER (LB/DAY)	197,502			25,025	TBD	TBD	115,564	125	
K-65 SOLIDS (LB/DAY)	78,078								
POLYMER (LB/DAY)	30								
CEMENT (LB/DAY)			55,122		0.42	0.20			
FLY ASH (LB/DAY)		220,488			1.58	0.04			
RADON (pCi/L)					3.80E-03	3.80E-03			
TOTAL (LB/DAY)	275,610	220,488	55,122	25,025		0.3	115,564	125	
AIR FLOW (SCFM)					35	105			
FLOW (GPM-LIQ)/(CFM-SOL)	129	7.2	[illegible]	200			200	[illegible]	10
TEMPERATURE (DEG F)	70	AMBIENT	AMBIENT	AMBIENT	71-93	71-96	AMBIENT	AMBIENT	AMBIENT
PRESSURE (PSIG)	75			50			[illegible]	50	40
VACUUM (IN WC)					-2.0	-2.0			
WEIGHT % SOLIDS	28.33	100	100						
DENSITY (LB/FT3)	76.30	70.00	90.00	62.4	TBD	TBD	62.4	62.4	
COMMENTS:				INTERMITTENT	NOTES 2a	NOTES 2a, 5	INTERMITTENT	NOTE 6	INTERMITTENT

STREAM NUMBER	47	49	50	51	52	53	54	55	56	57
STREAM DESCRIPTION	PRODUCT TO CONTAINER	FROM EXTERNAL SUMPS, SLUICE/ SUPERNATANT AREA SUMPS, AND CLARIFIER SUMPS	SUPERNATANT TANK SETTLED SOLIDS TO REACTION TANK	SLUICE WATER TO TTA	SUPERNATANT TO SLUICE/FLUSH WATER TANK	PROCESS WATER FOR SLUICE/FLUSH WATER TANK [illegible]	FLUSH WATER TO SUPERNATANT TANK, AREA SUMPS, AND CLARIFIER SUMP PUMPS	SUPERNATANT WATER FROM BOTTOM OF TANK	PROCESS WATER [illegible]	FLY ASH FROM FLY ASH TRUCKS
WATER (LB/DAY)	[illegible]			400,407		145,439			160,464	
K-65 SOLIDS (LB/DAY)	78,078									
POLYMER (LB/DAY)	30									
CEMENT (LB/DAY)	55,122									
FLY ASH (LB/DAY)	220,488									220,488
RADON (pCi/L)										
TOTAL (LB/DAY)	551,221			400,407	0	145,439			160,464	220,488
AIR FLOW (SCFM)										1000
FLOW (GPM-LIQ)/(CFM-SOL)	289	40	10	300	300	300	200	200	320	
TEMPERATURE (DEG F)	96	AMBIENT	77	77-80	77	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
PRESSURE (PSIG)		40	50	200	ATM	[illegible]	60	50	104	0
VACUUM (IN WC)										
WEIGHT % SOLIDS	65									100
DENSITY (LB/FT3)	95.00			62.40	62.40	62.4	62.4		62.4	70.00
COMMENTS:	NOTE 1,8	INTERMITTENT	INTERMITTENT	2.7 HRS/DAY	INTERMITTENT		INTERMITTENT	INTERMITTENT		INTERMITTENT

STREAM NUMBER	58	59	60	61	62	63	64	65	66
STREAM DESCRIPTION	CEMENT FROM CEMENT TRUCKS	CEMENT FEED TO PRODUCT MIXERS	FLY ASH FEED TO PRODUCT MIXERS		TANK OVERFLOW FROM SUPERNATANT TO/FROM SLUICE/ FLUSH WATER TANK	SUPERNATANT FR/ MIDDLE OF SUPERNATANT WATER TANK	FLUSH WATER TO FLUSH LINES	PROCESS WATER TO PRODUCT MIXERS	FLUSH WATER TO ROOF SHIELDS/ REACTION TANK SUMP PUMPS
WATER (LB/DAY)						302,019	42,051		
K-65 SOLIDS (LB/DAY)									
POLYMER (LB/DAY)									
CEMENT (LB/DAY)	55,122	55,122							
FLY ASH (LB/DAY)			220,488						
RADON (pCi/L)									
TOTAL (LB/DAY)	55,122	55,122	220,488			302,019	42,051		
AIR FLOW (SCFM)	1000								
FLOW (GPM-LIQ)/(CFM-SOL)		11.11	14.29			300	200	100	200
TEMPERATURE (DEG F)	AMBIENT	AMBIENT	AMBIENT		77	77	AMBIENT	AMBIENT	AMBIENT
PRESSURE (PSIG)	0					80	60	94	60
VACUUM (IN WC)		-2.0	-2.0						
WEIGHT % SOLIDS	100	100	100						
DENSITY (LB/FT3)	90.00	90.00	70.00		62.4	62.4	62.4	62.4	62.4
COMMENTS:	INTERMITTENT				INTERMITTENT	INTERMITTENT		INTERMITTENT	INTERMITTENT

STREAM NUMBER	67	68	69	70	71	72	73	74	75
STREAM DESCRIPTION	SLURRY WASHWATER FROM ROOF SHIELD / REACTION TANK SUMPS	COMPRESSED AIR FOR CEMENT TRANSFER	COMPRESSED AIR FOR FLY ASH TRANSFER	VENT FROM CEMENT RECEIVING BINS AND WEIGH HOPPERS TO STORAGE BIN	VENT FROM FLY ASH RECEIVING BINS AND WEIGH HOPPERS TO STORAGE BIN	VENT CEMENT FEEDER TO STORAGE BIN	VENT FLY ASH FEEDER TO STORAGE BIN	CEMENT STORAGE BIN EXHAUST	FLY ASH STORAGE BIN EXHAUST
WATER (LB/DAY)									
K-65 SOLIDS (LB/DAY)									
POLYMER (LB/DAY)									
CEMENT (LB/DAY)				TBD		TBD		TBD	
FLY ASH (LB/DAY)					TBD		TBD		TBD
RADON (pCi/L)									
TOTAL (LB/DAY)				TBD	TBD	TBD	TBD	TBD	TBD
AIR FLOW (SCFM)		150	150	1000	1000	5	5	2000	2000
FLOW (GPM-LIQ)/(CFM-SOL)	40								
TEMPERATURE (DEG F)	AMBIENT	AMBIENT	AMBIENT	AVBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
PRESSURE (PSIG)	40	90	90	0	0	0	0	0	0
VACUUM (IN WC)									
WEIGHT % SOLIDS									
DENSITY (LB/FT3)	62.4								
COMMENTS:	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT

NOTES:

1. EACH OF THE THREE PRODUCT MIXERS IS SIZED TO PROCESS ONE PRODUCT CONTAINER VOLUME. EACH FEED TANK AND RECEIPT TANK IS SIZED TO ALLOW OPERATION IN TOP TWO THIRDS OF THE TANK VOLUME SO THAT THE AGITATOR IS BELOW THE LIQUID LEVEL AT ALL TIMES.
2. ASSUMPTIONS:
   A. TANK VENTING IS CALCULATED BASED ON ONE FEED TANK, ONE RECEIPT TANK AND TWO PRODUCT MIXER VOLUMES BEING FILLED AT THE SAME TIME.
3. CONSTANT LEVEL IN TANK, NEGLIGIBLE AIR FLOW.
4. STREAMS 13, 14, 15, 20, 22, 30, 46, AND 48 ARE NOT USED.
5. SOLIDS LOADING TO SCRUBBER IS BASED ON 2 GR/FT^3 AT A VENT RATE OF 33.3 SCFM FOR 20 MIN, FOR 33 BATCHES PER DAY EQUALING A TOTAL DUST MASS OF 6.3 LB/DAY. THE DISTRIBUTION OF DUST IS DIRECTLY PROPORTIONAL TO MIX RECIPE. THE SCRUBBER HAS AN ASSUMED PARTICULATE REMOVAL EFFICIENCY OF 99%.
6. SCRUBBER WATER USAGE IS BASED ON DAILY PURGE OF APPROXIMATELY 15 GALLONS OF WATER.
7. BASIS FOR HEAT BALANCE IS AS FOLLOWS:
   - TTA SLURRY IS RECEIVED AT 70 DEG F
   - MXA-13-1000A/B/C INPUT APPROXIMATELY 49,500 BTU/HR EACH (25 HP)
   - PMP-13-1000A/B/C INPUT APPROXIMATELY 102,000 BTU/HR EACH (50 HP)
   - MXA-15-1003A/B INPUT APPROXIMATELY 14,000 BTU/HR TOTAL (7 HP)
   - MXA-15-1004 INPUTS APPROXIMATELY 14,800 BTU/HR (7.5 HP)
   - PMP-15-1004A/B/C INPUT APPROXIMATELY 10,200 BTU/HR EACH (5 HP)
   - MXA-16-1000A/B/C INPUT APPROXIMATELY 300,000 BTU/HR EACH (150 HP)
   - OUTLET TEMPERATURE FROM FEED TANKS IS CONTROLLED TO 70 - 100 DEG F
     PMP-16-1000A/B/C INPUT APPROXIMATELY 10,200 BTU/HR EACH (15 HP)
     MXB-17-1000A/B/C INPUT APPROXIMATELY 410,000 BTU/HR EACH (200 HP)
   - 80% OF MOTOR HP CONVERTED TO HEAT FOR TEMPERATURE CALCULATIONS.
   - CHILLED WATER SYSTEMS ARE DESIGNED TO CONTROL SLURRY TEMPERATURE IN THE RECEIPT AND FEED TANKS TO 70°F
8. OUTLET TEMPERATURE FROM PRODUCT MIXER DOES NOT INCLUDE THE INITIAL HEAT OF HYDRATION OF CEMENT. IT IS ASSUMED THAT THE MAJORITY OF CEMENT HYDRATION WILL OCCUR IN THE PRODUCT CONTAINERS.

REF DWG NO.	DRAWING TITLE
F0100-F0115	PROCESS FLOW DIAGRAMS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
E	REMEDIAL DESIGN - ISSUED FOR REVIEW	08/02/02	NPK	GCS
D	GENERAL REVISION	07/03/02	NPK	WET
C	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WET
B	ISSUE FOR DESIGN	02/19/02	RWN	WET
A	CONCEPTUAL DESIGN - ISSUE FOR REVIEW	7/30/01	MPM	SWH

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY JACOBS

PROJECT NAME: SILOS 1 AND 2

DRAWING TITLE: FLOW DIAGRAMS PROCESS FLOW DIAGRAM MATERIAL BALANCE TABLES

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
JAMES H. ROSENBALM	7/30/01	NICHOLAS P. KOHUT	7/30/01	MICHAEL MALONE	7/30/01

PLANT/BLDG. NO. | FLOOR | SCALE NTS | CLASS U

SUBMITTED FOR 30% ISSUE — TECH LEAD — DATE | SUBMITTED FOR 60% ISSUE — TECH LEAD — DATE | SUBMITTED FOR 90% ISSUE — TECH LEAD — DATE

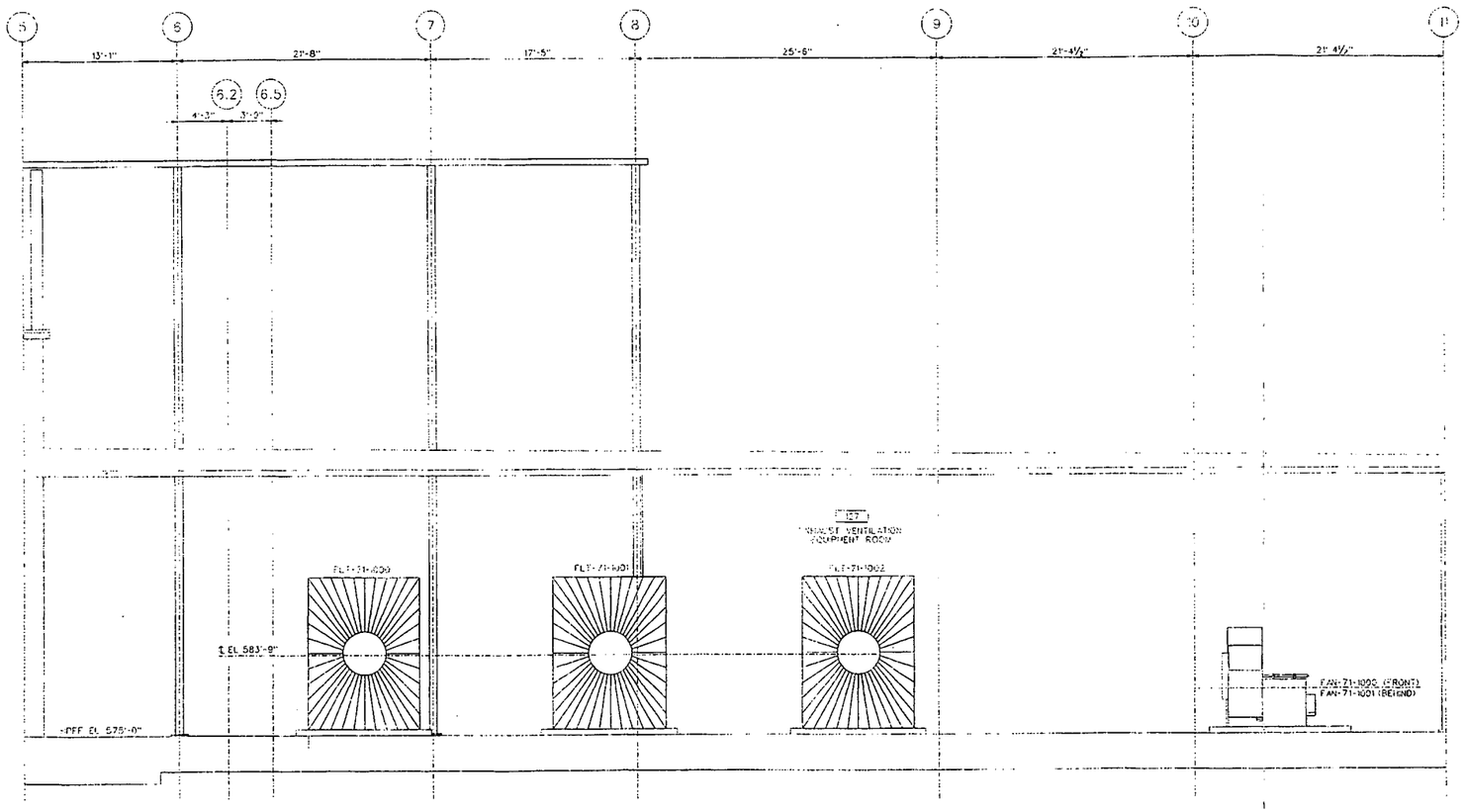
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-F-01185	F0100	E
JEG PROJECT NO. 35H19603	FILENAME 94XF1185.DGN			

PRELIMINARY
NOT FOR CONSTRUCTION

DATE: 08/02/02 USER: [illegible]
TIME: [illegible] DESIGN FILE: [illegible]94xf1185.dgn

000259

4654



SECTION
LOOKING NORTH
M0107 M0408

NUMBER OF DETAIL OR LETTER OF SECTION
DRAWING ON WHICH SECTION OR DETAIL IS TAKEN
DRAWING ON WHICH SECTION OR DETAIL IS SHOWN

SECTION AND DETAIL KEY

4 0 4 8 12 FT
SCALE: ¼" = 1'-0"

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
[illegible]	PIPING, VALVES AND MISCELLANEOUS
[illegible]	INSTRUMENTATION
[illegible]	EQUIPMENT AND MISCELLANEOUS
[illegible]	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	[illegible]
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
115 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-6600
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
SECTION G COLUMNS 5-11

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	N/A	¼" = 1'-0"	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

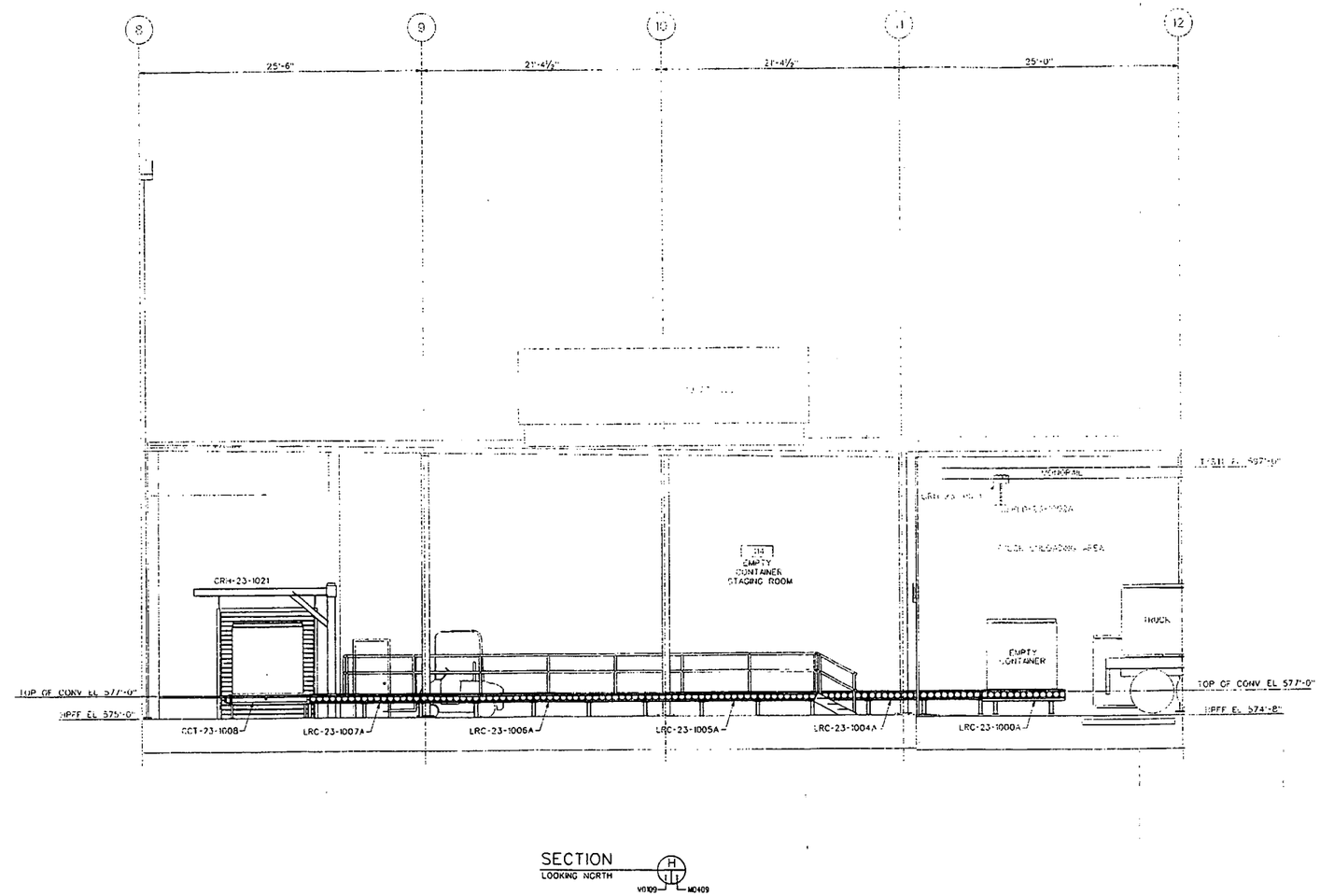
F.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01613	M0408	B

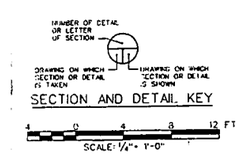
JEG PROJECT NO.	FILENAME
35H19603	94XM1613.DGN

DATE: 08/12/02
TIME: 10:01:24 AM
USER: DDavis
DESIGN FILE: [illegible]

260

4654





PRELIMINARY
NOT FOR CONSTRUCTION

EF DWG NO.	DRAWING TITLE
[illegible]	[illegible] AND MISCELLANEOUS
[illegible]	INSTRUMENTATION
[illegible]	EQUIPMENT AND MISCELLANEOUS
5000	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	MHR
9	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	[illegible]
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4000
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
SECTION H COLUMNS 8-12

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
	N/A	¼" = 1'-0"	H

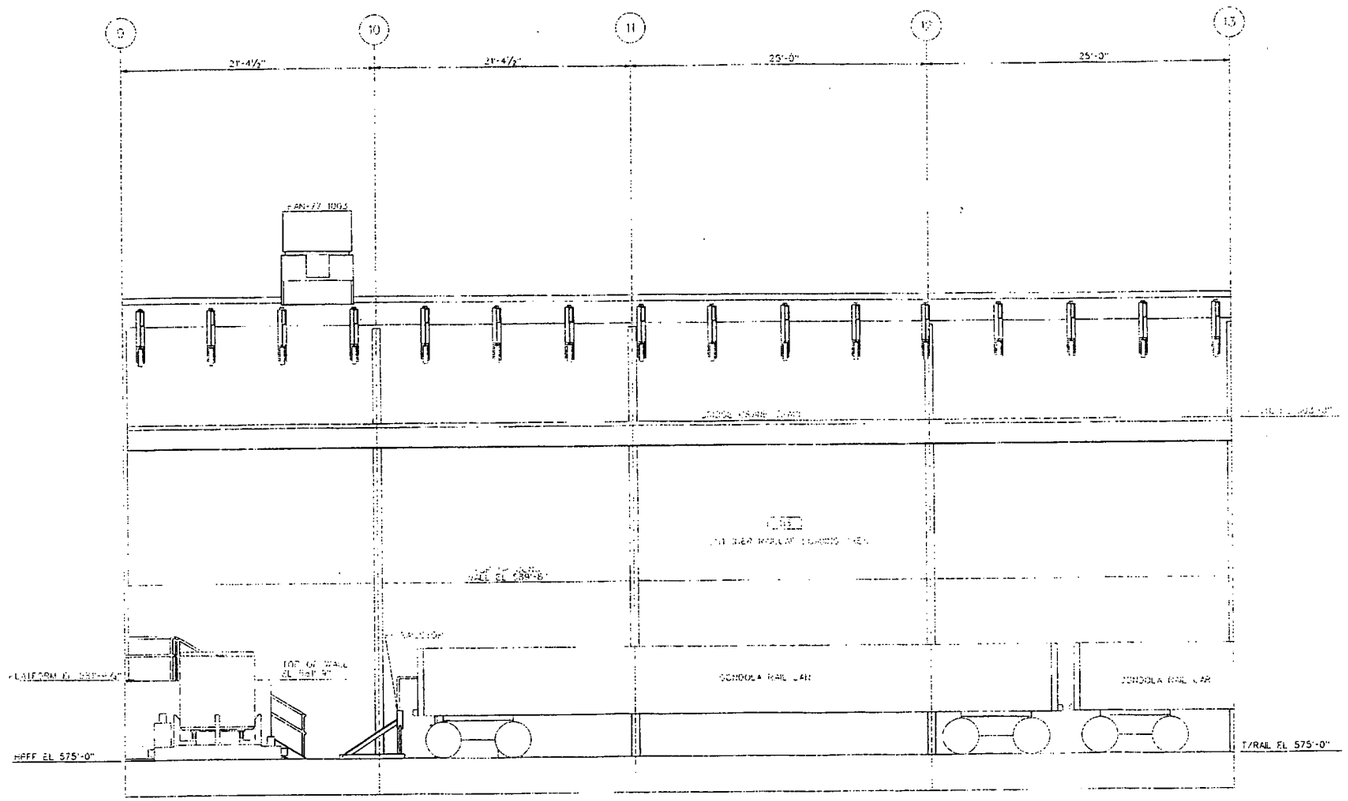
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01614	M0409	B

JEG PROJECT NO.	FILENAME
35H19603	94XM1614.DGN

DATE: 08/12/02
TIME: 10:11:31 AM
USER: DDavis
DESIGN FILE: [illegible]

000261



SECTION
LOOKING NORTH
M0328 M0410

NUMBER OF DETAIL OR LETTER OF SECTION
DRAWING ON WHICH SECTION OR DETAIL IS TAKEN
DRAWING ON WHICH SECTION OR DETAIL IS SHOWN
SECTION AND DETAIL KEY

SCALE: 1/4" = 1'-0"

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
M0001	[illegible]
M0005	INSTRUMENTATION
M0010	EQUIPMENT AND MISCELLANEOUS
M0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	[illegible]
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS
125 Broadway Ave. Oak Ridge, Tennessee 37830 Tel: 865-220-4800 Fax: 865-220-4170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
SECTION I COLUMNS 9-13

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1/4" = 1'-0"	

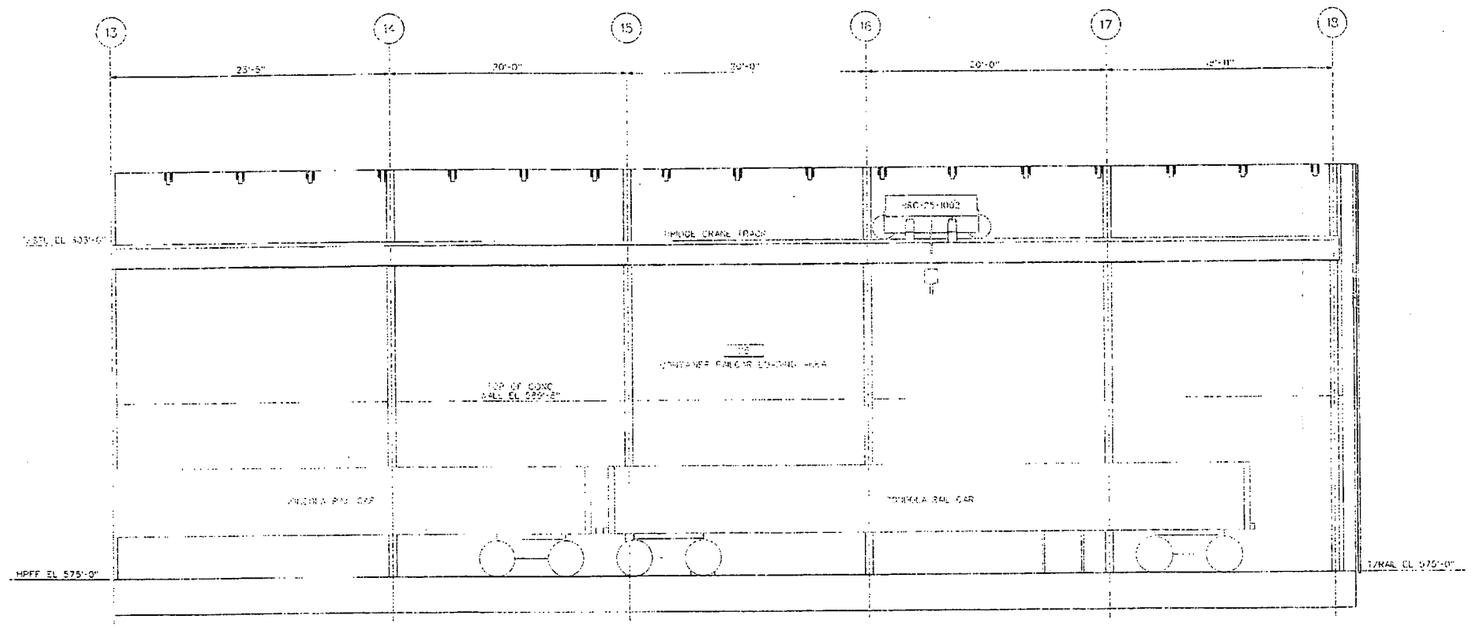
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01615	M0410	B

JE PROJECT NO.	FILENAME
35H19603	94XM1615.DGN

DATE: 08/12/02
TIME: 10:43:37 AM
USER: DDavis
DESIGN FILE: [illegible]

4654



SECTION
LOOKING NORTH
J
M0410
M0411

NUMBER OF DETAIL OR LETTER OF SECTION
DRAWING ON WHICH SECTION OR DETAIL IS TAKEN
DRAWING ON WHICH SECTION OR DETAIL IS SHOWN

SECTION AND DETAIL KEY

4 0 4 8 12 FT
SCALE: 1/4" = 1'-0"

000263

PRELIMINARY
NOT FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
M0411	PIPING, VALVES, AND MISCELLANEOUS
M0902	INSTRUMENTATION
M0903	EQUIPMENT AND MISCELLANEOUS
S0010	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS

REV NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR
B	REMEDIAL DESIGN - ISSUED FOR REVIEW	07/27/02	NPK	GLGS
A	PRELIMINARY DESIGN ISSUE	04/12/02	NPK	WT

DETAILS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-5900
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
SECTION J COLUMNS 13-18

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
PATRICK CROWE	4/12/02	GLEN SCHMIDT	4/12/02	NICHOLAS KOHUT	4/12/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1/4" = 1'-0"	

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING BODY CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-M-01616	M0411	B

J.E. PROJECT NO.	FILENAME
35H19603	94X3900M16.DGN

DATE: 08/12/02
TIME: 10:18:43 AM
USER: DDOW18
DESIGN FILE: J:\mpd\dh01\94xm016.dgn

LEGEND

EXISTING		NEW
	BUILDING/TRAILER	
	EDGE OF GRAVEL	
	ASPHALT PAVING	
	CONCRETE PAVING	
	RAILROAD	NA
	BOUNDARY FENCE	NA
	CHAIN-LINK FENCE	NA
BM12	SURVEY CONTROL MONUMENT	NA
	BOLLARD	
	SLOPE ARROW (DOWN)	NA
	DITCH/SWALE ℄	NA
NA	SILT FENCE	
	GUARDRAIL	NA
575	MAJOR CONTOURS	578
576	MINOR CONTOURS	578.5
NA	SPOT ELEVATION	578.5
	CLEARING LIMITS	NA
NA	COLUMN GRID	A
	RADON MONITOR	NA

ABBREVIATIONS

℄	CENTERLINE
CONC	CONCRETE
DIA	DIAMETER
EL	ELEVATION
EXIST	EXISTING
FFE	FINISHED FLOOR ELEVATION
HDPE	HIGH DENSITY POLYETHYLENE
ID	INSIDE DIAMETER
INV	INVERT
LF	LINEAR FOOT (FEET)
MIN	MINIMUM
OD	OUTSIDE DIAMETER
ODOT	OHIO DEPARTMENT OF TRANSPORTATION
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
R	RADIUS
REF	REFERENCE
SQ	SQUARE
STA	STATION
ST	STEEL
T.O.P	TOP OF PIPE
TYP	TYPICAL

NUMBER OF DETAIL OR SECTION

SHEET NUMBER WHERE DETAIL OR SECTION IS SHOWN

UNLESS OTHERWISE NOTED SECTION OR DETAIL IS SHOWN ON THIS SHEET

SECTION AND DETAIL KEY

UTILITY DESIGNATIONS

CS	CONTAMINATED SEWER
DW	LOW PRESSURE POTABLE WATER
FG	FUEL GAS
FD	HIGH PRESSURE FIRE WATER
FT	FILTRATE OR EFFLUENT
LCS	LEACHATE CONVEYANCE SYSTEM
SN	SANITARY SEWER
ST	STORM SEWER
TW	PROCESS WATER
WW	WASTE WATER

UTILITY SYMBOLS

EXISTING		NEW
	POST INDICATOR VALVE (PIV)	
	FIRE HYDRANT	NA
	MANHOLE (MH)	
	CATCH BASIN (CB)	
	UTILITY POLE	
	HEADWALL	NA
	VALVE	
	INSERT	
	GUY WIRE	

GENERAL NOTES:

1. EXISTING TOPOGRAPHY PROVIDED BY FLUOR FERNALD AND SURVEY BY B.L. PAYNE & ASSOCIATES, INC., DATED 10/11/2001.
2. HORIZONTAL CONTROL SHOWN ON THE DRAWINGS IS BASED UPON NORTH AMERICAN DATUM 1983 (NAD 83).
3. VERTICAL CONTROL SHOWN ON THE DRAWINGS IS BASED UPON NATIONAL GEODETIC VERTICAL DATUM 1929 (NGVD 29).
4. PROJECT SURVEY CONTROL SHALL BE ESTABLISHED USING THE COORDINATES AND ELEVATIONS OF THE FOLLOWING SURVEY CONTROL MONUMENTS:

   BM11 N 480149.12 E 1347018.47 ELEV 569.02 BRASS DISK #9911
   BM12 N 480368.83 E 1347842.41 ELEV 577.76 BRASS DISK #9912.
5. LOCATION AND DEPTH OF EXISTING UTILITIES SHOWN ARE APPROXIMATE. CONTRACTOR SHOULD BE AWARE THAT ADDITIONAL UTILITIES MAY BE PRESENT THAT ARE NOT SHOWN. PRIOR TO CONSTRUCTION, CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL LOCATIONS OF ALL UTILITIES WITHIN THE LIMITS OF CONSTRUCTION. THE CONTRACTOR SHALL PROTECT ALL EXISTING UTILITIES FROM DAMAGE DURING CONSTRUCTION.
6. VERIFY AMPLE CLEARANCE UNDER ABOVEGROUND ELECTRIC UTILITIES FOR CONSTRUCTION EQUIPMENT.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVAL OF STORMWATER COLLECTED IN AREAS EXCAVATED BELOW GRADE.

4654

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPD
0	ISSUED FOR BID	02/15/02		

DETAILS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JE JACOBS

PROJECT NAME: SILOS 1 AND 2

DRAWING TITLE: CIVIL
WAREHOUSE SITE
GENERAL NOTES AND LEGEND

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
	2/21/02		2/21/02		2/22/02

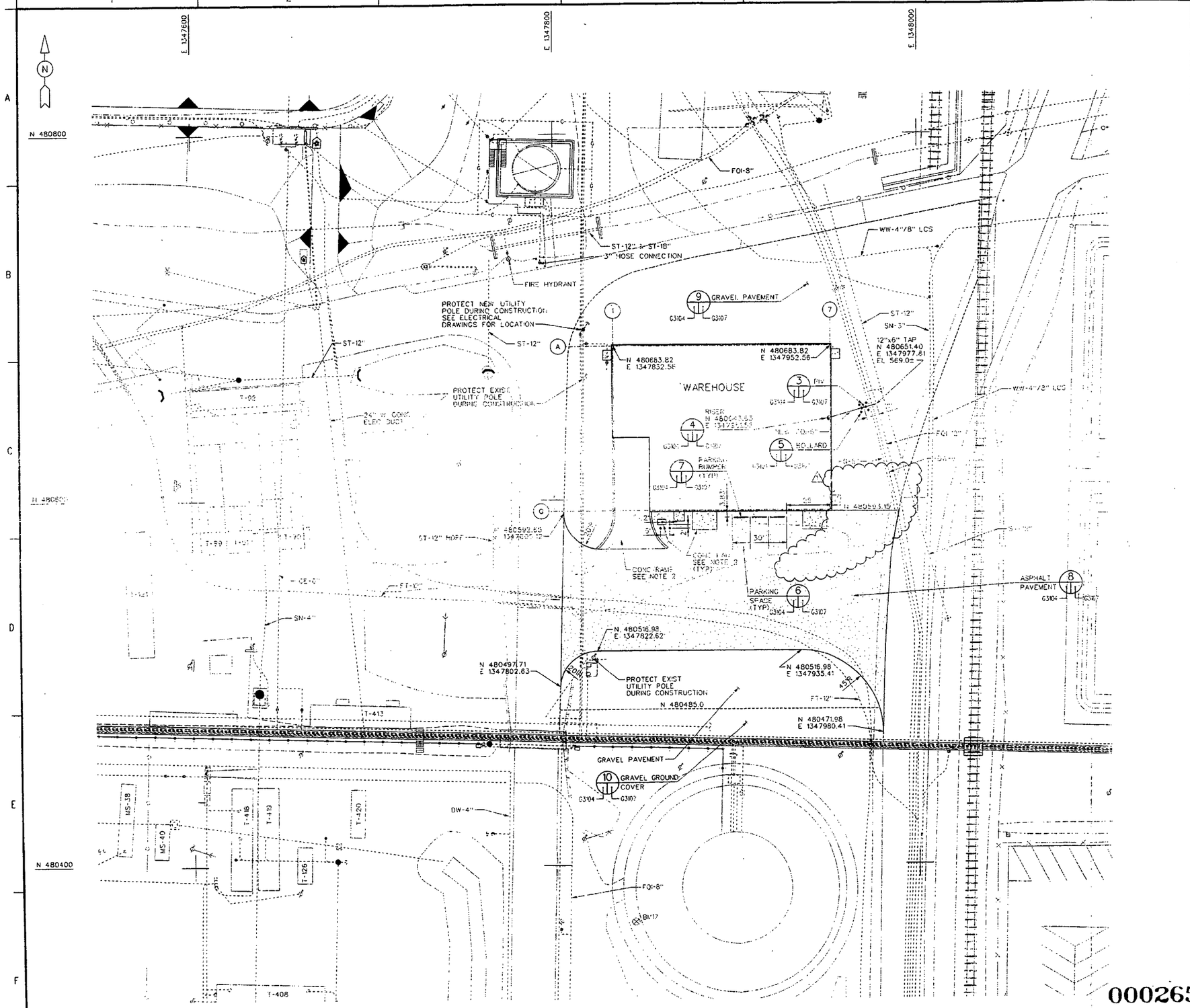
PLANT/BLDG NO | FLOOR | SCALE: NONE | CLASS: UA

SUBMITTED FOR 30% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 60% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 90% ISSUE — TECH LEAD — DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750			
JEC PROJECT NO	FILENAME			
35419603	94XC1148.DGN	94X-3900-G-01148	G3101	0

DATE: 02/20/02 TIME: 09:22:26 AM USER: JAMWOT

000264



NOTES:

1. FOR GENERAL NOTES, LEGEND AND UTILITY DESIGNATIONS SEE SHEET 94X-3900-G-01148.
2. SEE STRUCTURAL DRAWINGS FOR CONCRETE PADS AND CONCRETE RAMP.

4654

REF DWG NO.	DRAWING TITLE
G3101	WAREHOUSE SITE GENERAL NOTES AND LEGEND

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
1	REVISED PER DCN #40750-JEG-011	06/17/02	WD BARTON	WT
0	ISSUED FOR BID	02/15/02	FP, JR.	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
CIVIL
WAREHOUSE SITE
SITE/PAVING PLAN

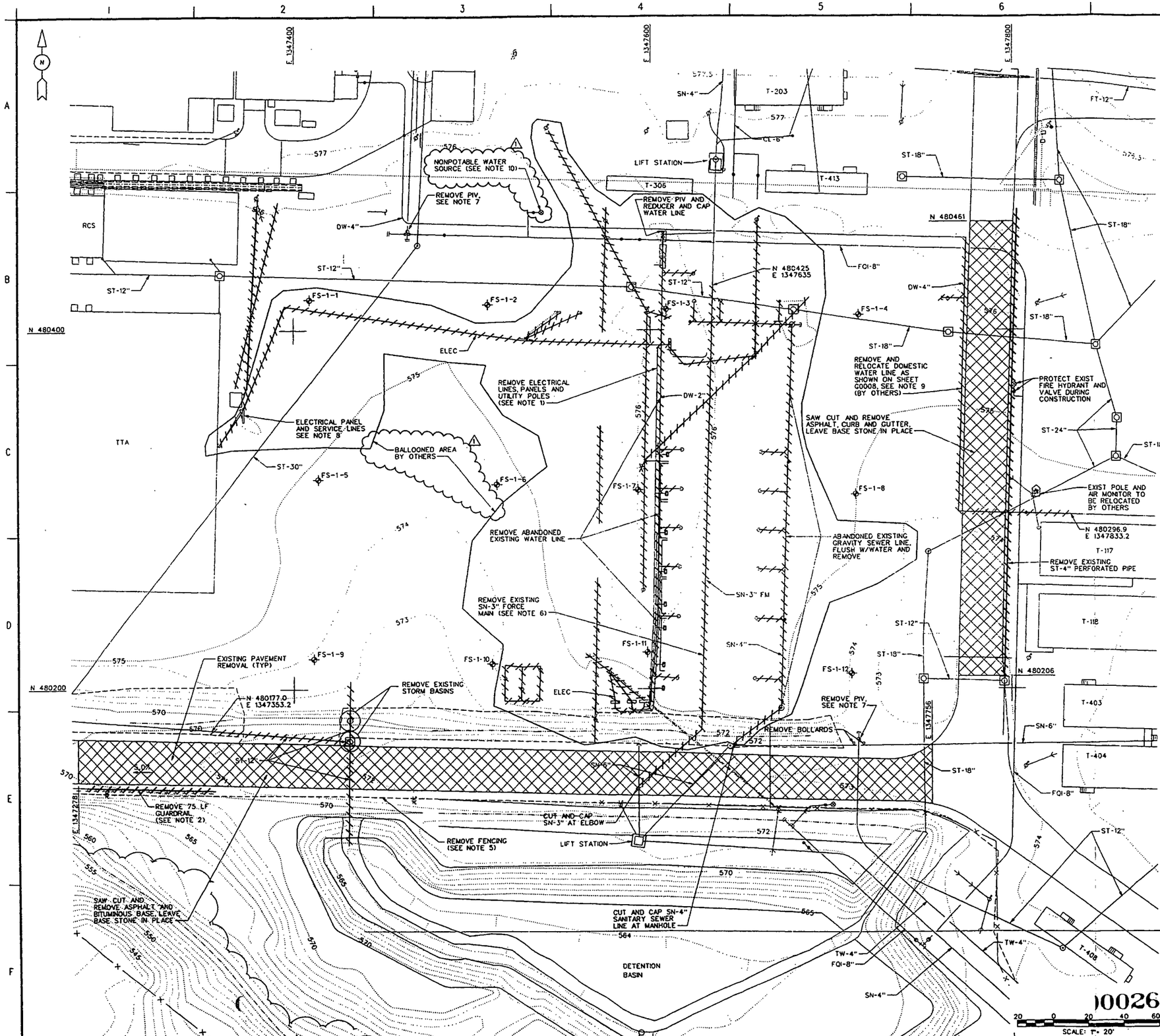
DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
J. ASHWORTH	02/15/02	W.D. BARTON III	02/15/02	F. PARTON, JR.	02/15/02
PLANT/BLDG. NO.		FLOOR		SCALE 1"=20'	CLASS U
SUBMITTED FOR 30% ISSUE		SUBMITTED FOR 60% ISSUE		SUBMITTED FOR 90% ISSUE	
TECH LEAD		TECH LEAD		TECH LEAD	
DATE		DATE		DATE	

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-G-01290	G3104	1
JEG PROJECT NO. 35H19603	FILENAME 94XG1290.DGN			

000265

20 0 20 40 60 FT
SCALE: 1"= 20'

DATE: 06/17/02 USER: JAshworth



NOTES:

1. ALL ELECTRICAL UNDERGROUND AND OVERHEAD LINES, PANELS, UTILITY POLES, GUY WIRES AND OTHER ELECTRICAL HARDWARE REMAINING WITHIN THE LIMITS OF EXCAVATION SHALL BE REMOVED. FOR REMOVAL DETAILS, SEE ELECTRICAL DRAWING 94X-3900-E-01575, PREVIOUSLY SUBMITTED IN TRAILER RELOCATION PACKAGE.
2. GUARDRAIL SHALL BE STORED AND REINSTALLED BY CONTRACTOR.
3. REMOVE PORTION OF 3" SANITARY FORCE MAIN AS SHOWN. FORCE MAIN SHALL BE REINSTALLED AS SHOWN ON SHEET G0008.
4. FOR GENERAL NOTES, LEGEND AND UTILITY DESIGNATIONS, SEE SHEET G0012.
5. REMOVED FENCING SHALL BE STORED AND REINSTALLED BY CONTRACTOR.
6. THE CONTRACTOR SHALL MAINTAIN THE SN-3" SANITARY FORCE MAIN IN CONSTANT SERVICE UNTIL PERMANENT LINE IS OPERATIONAL.
7. REMOVE POST INDICATOR AND INSTALL VALVE BOX.
8. ELECTRICAL PANEL AND FEED LINES SHALL REMAIN IN SERVICE AS TEMPORARY ELECTRICAL SERVICE FOR REMEDIATION FACILITY CONSTRUCTION ACTIVITIES. AT THE END OF CONSTRUCTION PANEL AND SERVICE LINES SHALL BE REMOVED AS SHOWN. CONTRACTOR SHALL PROTECT ELECTRICAL PANEL AND SERVICE LINES FROM DAMAGE DURING EXCAVATION ACTIVITIES.
9. COORDINATE REMOVAL OF EXISTING DW-4" AND INSTALLATION OF NEW DW-4" TO MINIMIZE LOSS OF WATER SERVICE TO TRAILER T-119.
10. THE CONTRACTOR MUST SHARE THE NONPOTABLE WATER SOURCE WITH OTHER CONTRACTORS IN THE AREA.

4654

REF DWG NO.	DRAWING TITLE
94X-3900-E-01575	GENERAL LAYOUT DEMOLITION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
1	ISSUED FOR CONSTRUCTION/DCN 40750-JEG-012	06/07/02	FP	WT
0	ISSUED FOR BID	05/07/02	FP, JR.	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-2000
Fax: 865-220-6179

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
CIVIL
REMEDIATION FACILITY FOUNDATION MAT
DEMOLITION PLAN

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
J.ASHWORTH	05/08/02	W.BARTON	05/08/02	F.PARTON,JR.	05/08/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1"=20'	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

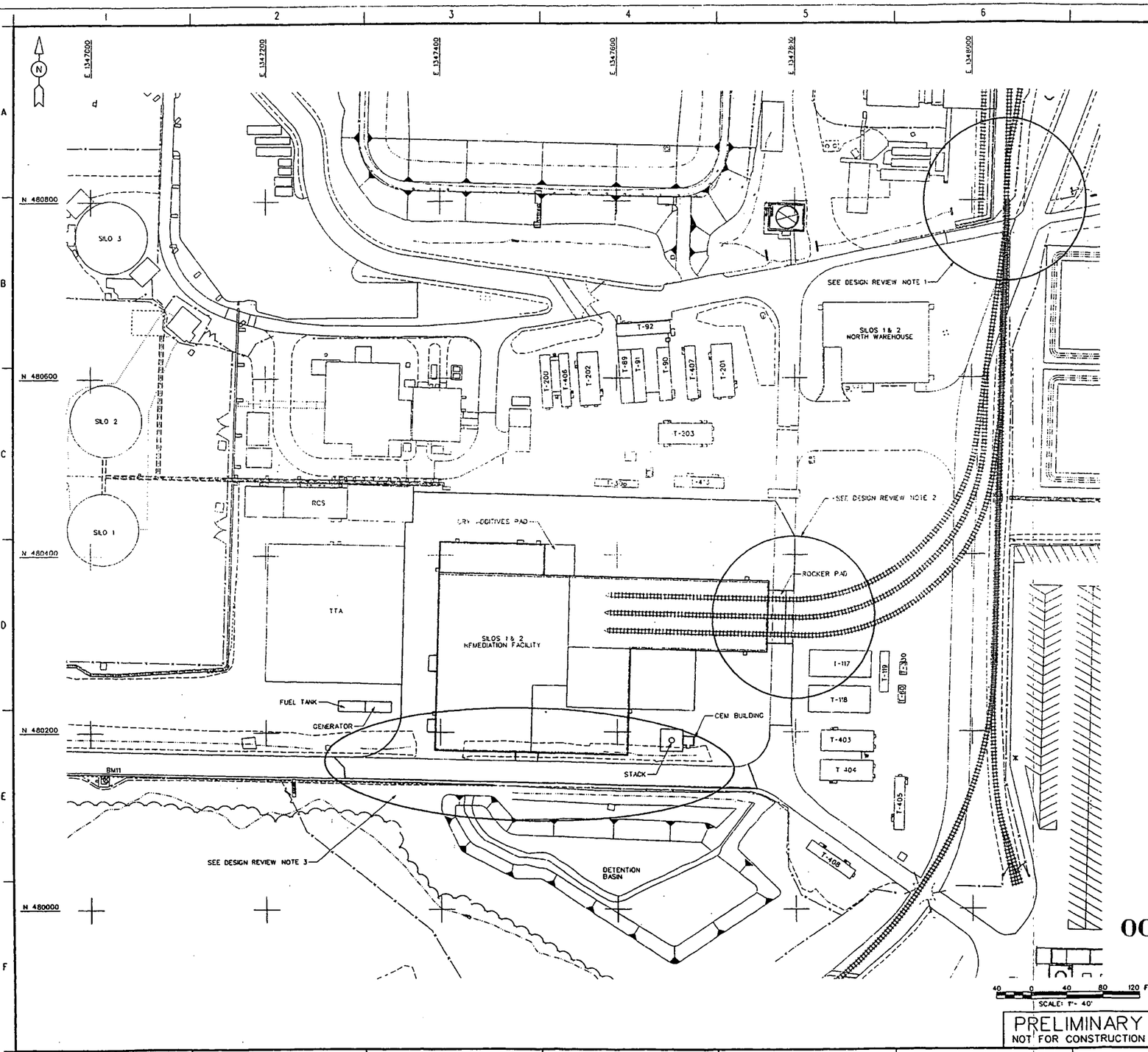
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-G-01367	G0004	1

JEG PROJECT NO.	FILENAME
35H19603	94XG1367.DGN

000266

DATE: 06/07/02 USER: JASHWORT DESIGN FILE: b:\ch\Drawings\94XG1367.dgn

#-4654



PRELIMINARY
NOT FOR CONSTRUCTION

NOTES:

1. FOR GENERAL NOTES AND LEGEND, SEE SHEET G0002.
2. NEW RAILROAD SHOWN OUTSIDE OF BUILDING, BEYOND ROCKER PAD, IS FUTURE AND SHOWN FOR REFERENCE ONLY.

DESIGN REVIEW NOTES:

THE FOLLOWING NOTES ARE INCLUDED IN THIS DESIGN REVIEW TO PROVIDE REVIEWERS WITH CONSTRAINTS AND INPUTS FROM WHICH DESIGN DECISIONS WERE MADE.

1) THE RAIL SPURS ARE A MAJOR CONSTRAINT TO THE DESIGN, FOR THE FOLLOWING REASONS:

a) THE NORTHERNMOST RAIL SWITCH CANNOT BE FURTHER NORTH WITHOUT INTERFERING WITH THE EXISTING SWITCH.

b) THE EXISTING RAILROAD SPUR SOUTH OF 2ND STREET IS ELEVATED TO CROSS THE K-65 TRENCH AND MUST BE LOWERED TO PROVIDE REASONABLE SLOPE. THE RAILROAD IS BEING REWORKED TO SLOPE FROM THE CONNECTION TO EXISTING TRACK NORTH OF 2ND STREET TO THE REMEDIATION FACILITY LOADING AREA FLOOR.

c) THE RAILROAD IS LAID OUT AT THE MINIMUM TURNING RADIUS FOR THE PROPOSED GONDOLA CARS, 210'.

d) THE RAILROAD CANNOT BE OFFSET TO THE EAST DUE TO THE LIKELIHOOD OF SOFT SOIL CONDITIONS.

2) THE ELEVATION OF THE REMEDIATION FACILITY FLOOR SLAB IS A COMPROMISE BETWEEN RAISING THE BUILDING TO MATCH THE RAILROAD AND LOWERING THE BUILDING TO MATCH THE INFRASTRUCTURE ROAD AT THE SOUTHWEST CORNER OF THE REMEDIATION FACILITY. EXISTING GROUND ELEVATION AT SW CORNER OF BUILDING = 571'±BUILDING FLOOR ELEV = 575'.

a) IT IS EASIER TO RAISE THE INFRASTRUCTURE ROAD TO MATCH THE BUILDING FLOOR THAN TO LOWER THE BUILDING AND THE RAILROAD. THUS THE EXISTING INFRASTRUCTURE ROAD SOUTH OF THE BUILDING IS BEING REWORKED TO RAISE IT TO NEAR BUILDING FLOOR LEVEL. BY RAISING THE INFRASTRUCTURE ROAD, IT WILL AVOID HAVING FOUNDATION WALLS 4 TO 5 FEET HIGH.

b) FOUNDATION WALLS 4 TO 5 FT HIGH COULD BE DESIGNED, BUT THERE ARE TWO FORK LIFT ENTRANCES TO THE BUILDING NEAR THE SW CORNER THAT WOULD REQUIRE EXTENSIVE RAMPS OR OTHER REDESIGN IF ELEVATED ABOVE THE ROADWAY GRADE.

3) THE LOCATION OF THE BUILDING IS A COMPROMISE BETWEEN THE RAILROAD CURVATURE REQUIREMENTS AND ACCESS AROUND THE REMEDIATION FACILITY ON THE WEST AND NORTH SIDES. THE BUILDING IS SHIFTED AS FAR SOUTH AS POSSIBLE BECAUSE OF THE RAILROAD TURNING RADIUS. THE BUILDING IS AS FAR EAST AS POSSIBLE TO PROVIDE ACCESS ON THE EAST SIDE FOR DELIVERIES AND MAINTENANCE.

REF DWG NO.	DRAWING TITLE

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
A	PRELIMINARY DESIGN ISSUE	04/12/02	[illegible]	[illegible]

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS
155 Wilkinson Avenue
Post Office Box 1000
Cincinnati, Ohio 45215-1000
Tel: 513-782-4000
Fax: 513-782-4170

PROJECT NAME
SILOS 1 AND 2

000267

DRAWING TITLE
CIVIL
REMEDIATION FACILITY
OVERALL SITE/FUTURE RAILROAD PLAN

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
[illegible]	4/12/02	[illegible]	4/12/02	[illegible]	4/12/02

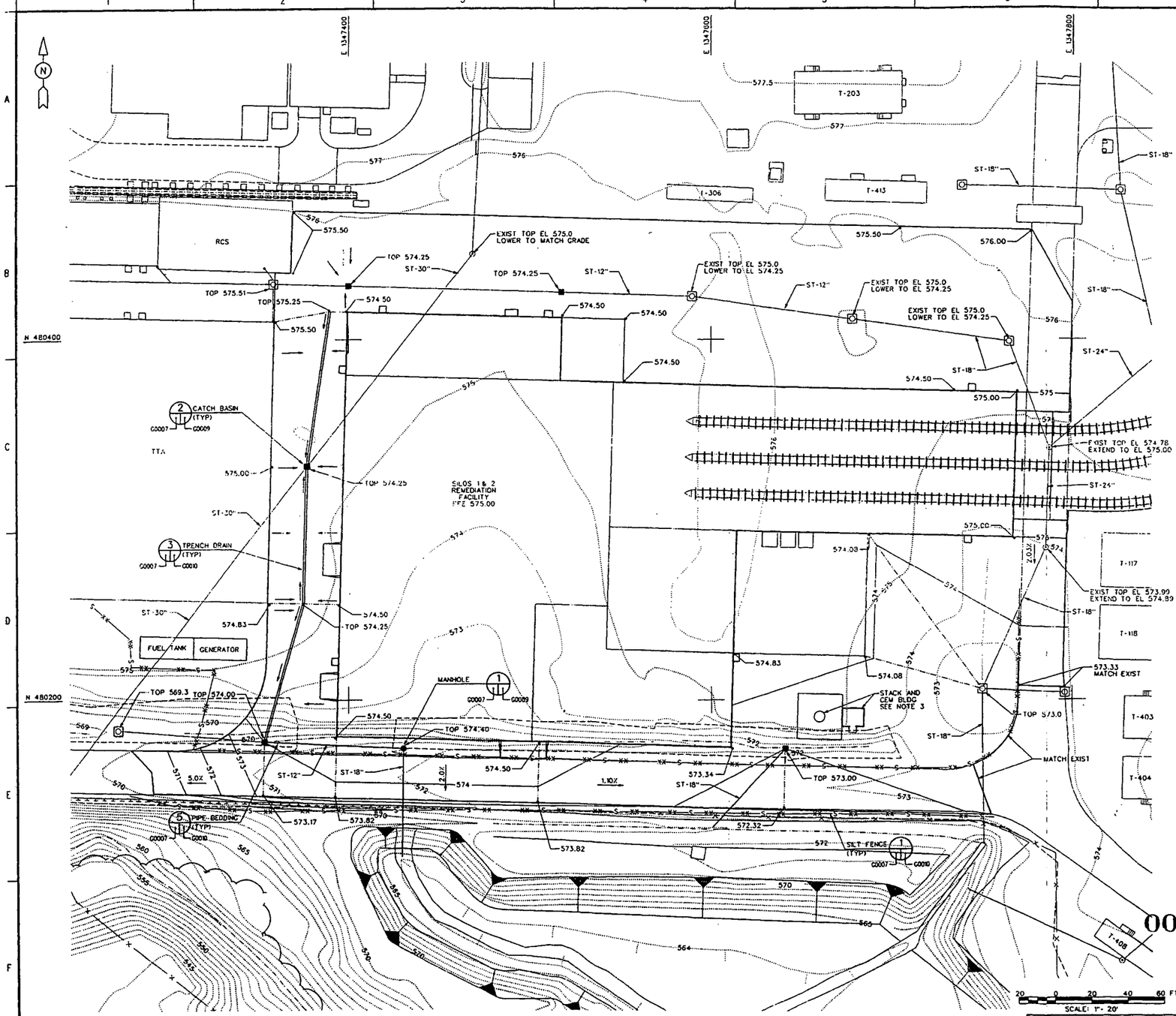
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1"=40'	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-G-01368	G0005	A
E&D PROJECT NO. 35H99603	FILENAME 94XG1368.DGN			

DATE: 04/08/02
TIME: 09:25:07 AM
USER: Bbarton
DESIGN FILE: h:\ctm\drawings\94XG1368.dgn

4654



NOTES:

1. FOR GENERAL NOTES, LEGEND AND UTILITY DESIGNATIONS SEE SHEET G0002.
2. SILT FENCE LOCATIONS SHOWN ARE APPROXIMATE. ADD ADDITIONAL SILT FENCE AND/OR ADJUST LOCATIONS AS NECESSARY TO MEET FIELD CONDITIONS.
3. HORIZONTAL AND VERTICAL LOCATIONS OF STACK, STACK PAD AND CEM BUILDING ARE ON HOLD.

REF DWG NO.	DRAWING TITLE

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR
A	PRELIMINARY DESIGN ISSUE	04/12/02	[illegible]	[illegible]

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JACOBS

PROJECT NAME
SILOS 1 AND 2

000268

DRAWING TITLE
CIVIL
REMEDIATION FACILITY
GRADING, DRAINAGE AND EROSION CONTROL PLAN

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
[illegible]	4/5/02	[illegible]	4/6/02	[illegible]	4/9/02

PLANT/BLDG. NO. | FLOOR | SCALE 1"=20' | CLASS U

SUBMITTED FOR 30% ISSUE | SUBMITTED FOR 60% ISSUE | SUBMITTED FOR 90% ISSUE
TECH LEAD | TECH LEAD | TECH LEAD
DATE | DATE | DATE

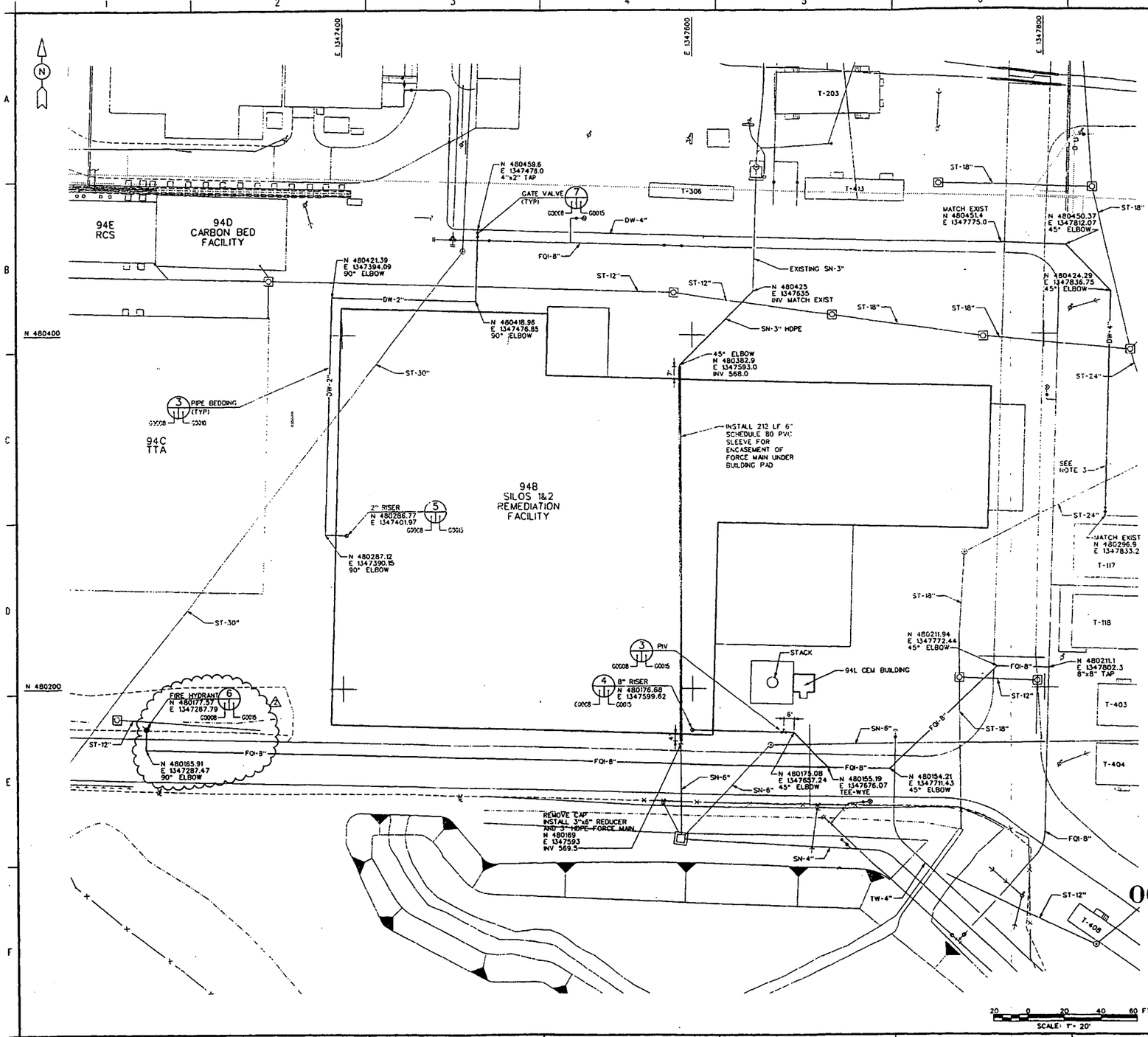
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-G-01370	G0007	A

JEG PROJECT NO.	FILENAME
35H19603	94XG1370.DGN

PRELIMINARY
NOT FOR CONSTRUCTION

DATE: 04/06/02 TIME: 04:24:32 PM USER: Mansart DESIGN FILE: k:\civil\drawings\94xg1370.dgn

4654



NOTES:

1. FOR GENERAL NOTES, LEGEND, UTILITY DESIGNATIONS AND EXCAVATION NOTES, SEE SHEET G0012.
2. NEW FQI-8" FIRE WATER LINE SHALL BE A MINIMUM 3'-6" DEEP TO TOP OF PIPE BELOW EXISTING GRADE. ADJUST ELEVATION AS NECESSARY TO AVOID CONFLICTS WITH OTHER UTILITY LINES.
3. FOR ELEVATIONS OF NEW DW-4" DOMESTIC WATER LINE, SEE PROFILE SHEET G0010.

REF DWG NO.	DRAWING TITLE

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
2	REVISED PER DCN # 40750-JEG-016	07/26/02		
1	ISSUED FOR CONSTRUCTION/DCN 40750-JEG-012	06/07/02	FP,JR.	WT
0	ISSUED FOR BID	05/07/02	FP,JR.	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JACOBS

PROJECT NAME
SILOS 1 AND 2

000269

DRAWING TITLE
CIVIL
REMEDIATION FACILITY FOUNDATION MAT
UTILITY PLAN

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
J.ASHWORTH	05/08/02	W.BARTON	05/08/02	F.PARTON,JR.	05/08/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1"=20'	U

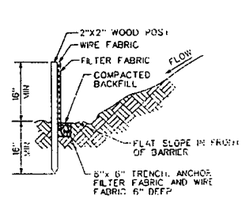
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 90% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

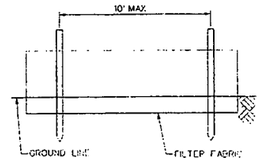
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-G-01371	G0008	2

JEG PROJECT NO. 35H19603 | FILENAME 94XG1371.DGN

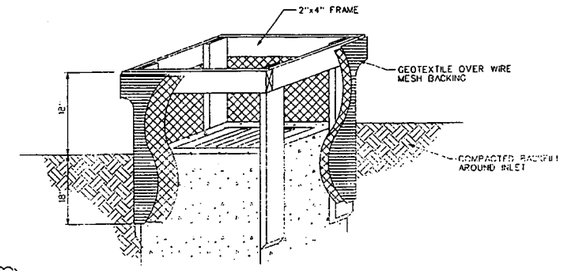
DATE: 01/25/02 TIME: 04:47:51 PM | USER: JAshworth DESIGN FILE: I:\Civil\Drawings\94XG1371.dgn

4654



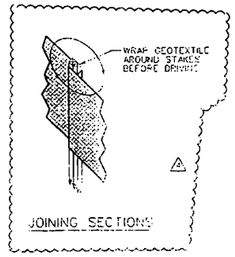


ELEVATION



NOTES:

1. PLACEMENT, CONSTRUCTION AND MAINTENANCE OF PERIMETER FILTER FABRIC FENCE AND TEMPORARY INLET PROTECTION FILTER FABRIC FENCE SHALL CONFORM TO OHIO DEPARTMENT OF NATURAL RESOURCES RAINWATER AND LAND DEVELOPMENT MANUAL, PAGES 115-125.
2. THE ENDS OF SILT FENCE SHALL BE CONSTRUCTED UPSLOPE TO PREVENT WATER PONDED BY THE FENCE FROM FLOWING AROUND THE ENDS.
3. SILT FENCE SHALL BE INSTALLED ALONG CONTOURS TO THE EXTENT PRACTICAL.
4. SECTIONS OF SILT FENCE ARE TO BE JOINED BY WRAPPING THE ENDS OF THE GEOTEXTILE AROUND THE STAKES BEFORE DRIVING.



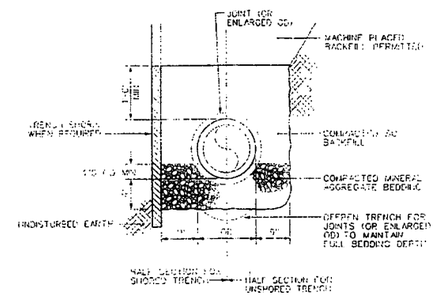
JOINING SECTIONS

TEMPORARY SILT FENCE (1)
NOT TO SCALE
G0010 G0010

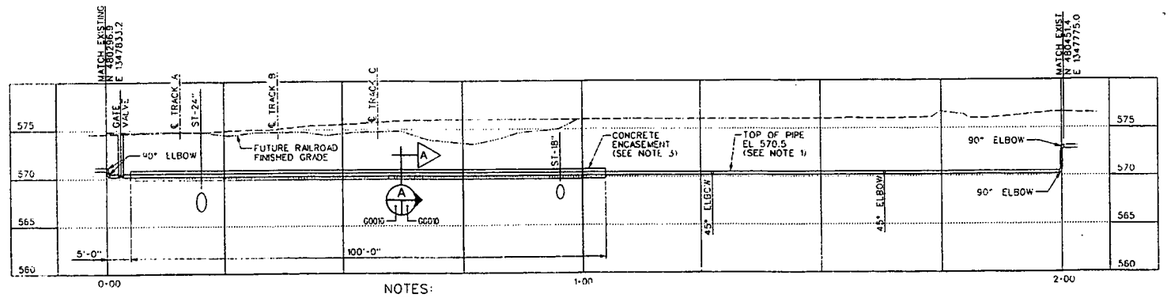
NOTES:

1. INLET PROTECTION SHALL BE CONSTRUCTED EITHER BEFORE UPSLOPE LAND DISTURBANCE BEGINS OR BEFORE THE STORM DRAIN BECOMES OPERATIONAL.
2. THE EARTH AROUND THE INLET SHALL BE EXCAVATED COMPLETELY TO A DEPTH OF LEAST 18 INCHES.
3. THE WOODEN FRAME SHALL BE CONSTRUCTED OF 2"x4" CONSTRUCTION GRADE LUMBER. THE 2"x4" POSTS SHALL BE DRIVEN 18" INTO THE GROUND AT FOUR CORNERS OF THE INLET AND THE TOP PORTION OF 2"x4" FRAME ASSEMBLED USING THE OVERLAP JOINT SHOWN. THE TOP OF THE FRAME SHALL BE AT LEAST 6" BELOW ADJACENT ROADS IF PONDED WATER WOULD POSE A SAFETY HAZARD TO TRAFFIC.
4. WIRE MESH SHALL BE OF SUFFICIENT STRENGTH TO SUPPORT FABRIC WITH WATER FULLY IMPOUNDED AGAINST IT. IT SHALL BE STRETCHED TIGHTLY AROUND THE FRAME AND FASTENED SECURELY TO THE FRAME.
5. GEOTEXTILE SHALL HAVE AN EQUIVALENT OPENING SIZE OF 20-40 SIEVE AND BE RESISTANT TO SUNLIGHT. IT SHALL BE STRETCHED TIGHTLY AROUND THE FRAME AND FASTENED SECURELY. IT SHALL EXTEND FROM THE TOP OF THE FRAME TO 18" BELOW THE INLET NOTCH ELEVATION. THE GEOTEXTILE SHALL OVERLAP ACROSS ONE SIDE OF THE INLET SO THE ENDS OF THE CLOTH ARE NOT FASTENED TO THE SAME POST.
6. BACKFILL SHALL BE PLACED AROUND THE INLET IN COMPACTED 6" LAYERS UNTIL THE EARTH IS EVEN WITH NOTCH ELEVATION ON ENDS AND TOP ELEVATION ON SIDES.
7. A COMPACTED EARTH DIKE OR A CHECK DAM SHALL BE CONSTRUCTED IN THE DITCH LINE BELOW THE INLET IF THE INLET IS NOT IN A DEPRESSION AND IF RUNOFF BYPASSING THE INLET WILL NOT FLOW TO A SETTLING POND. THE TOP OF EARTH DIKES SHALL BE AT LEAST 6" HIGHER THAN THE TOP OF THE FRAME.

INLET PROTECTION (2)
NOT TO SCALE
G0010 G0010



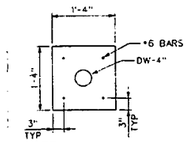
PIPE BEDDING (3)
NOT TO SCALE
G0010 G0010



NOTES:

1. DW-4" DOMESTIC WATER LINE TO BE INSTALLED AT TOP OF PIPE ELEVATION 570.5 TO AVOID CONFLICTS WITH FUTURE RAILROAD BALLAST, SUB-BALLAST, EXISTING AND FUTURE UTILITIES.
2. ELEVATION OF EXISTING DOMESTIC WATER LINE UNKNOWN, ASSUMED TO BE 3'-6" BELOW GRADE.
3. ENCASE RELOCATED 4" DOMESTIC WATER LINE 30"x10"x100' LF CONCRETE AS SHOWN. CONCRETE SHALL CONFORM TO THE FOLLOWING:
   A. 3000 PSIG 28 DAYS
   B. W/C NOT GREATER THAN 0.5
   C. AGGREGATE SHALL CONFORM TO ASTM C33, WITH MAXIMUM SIZE OF 3/4".

DW-4" WATER LINE PROFILE
HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=5'



NOTE:
INSTALL 4 #6 BARS, EACH 99'-6" LONG.

SECTION (A)
SCALE: 1" = 1'-0"
G0010 G0010

000270

10 0 10 20 30 FT
HORIZONTAL SCALE: 1"= 10'
5 0 5 10 15 FT
VERTICAL SCALE: 1"= 5'

REF DWG NO.	DRAWING TITLE

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
4	REVISED PER DCN # 40750-JEG-025	M/D/Y=6		
3	REVISED PER DCN # 40750-JEG-019	08/16/02	FP,JR.	WB
2	REVISED PER DCN # 40750-JEG-016	07/26/02	WB	FP,JR.
1	ISSUED FOR CONSTRUCTION/DCN 40750-JEG-012	06/07/02	FP,JR.	WT
0	ISSUED FOR BID	05/07/02	FP,JR.	WT

DETAILS AND DATE

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4400
Fax: 865-220-6110

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
CIVIL
REMEDIATION FACILITY FOUNDATION MAT
DETAILS - 2

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
J.ASHWORTH	05/08/02	W.BARTON	05/08/02	F.PARTON, JR.	05/08/02

PLANT/BLDG NO.	FLOOR	SCALE	CLASS
		SHOWN	U

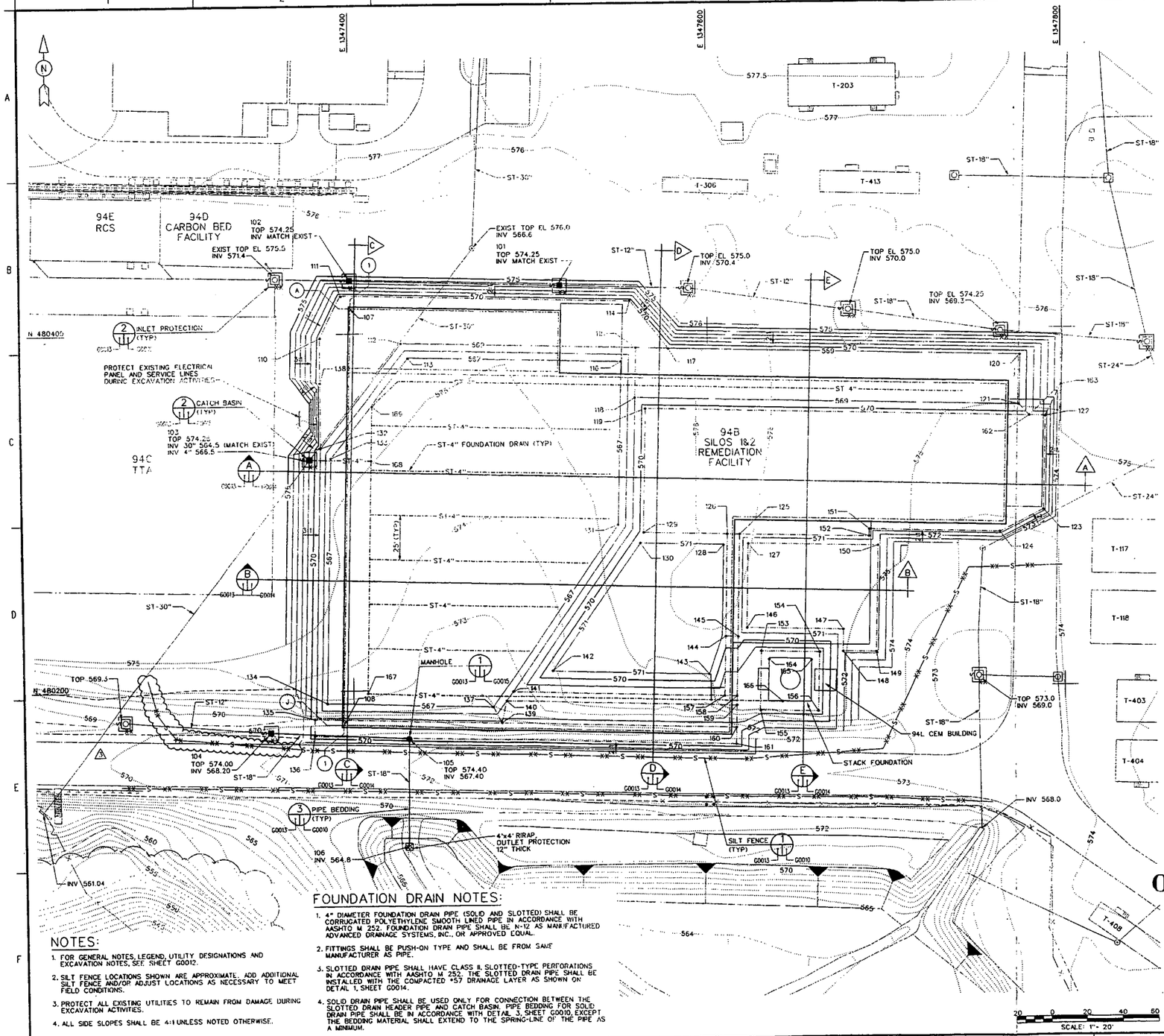
SUBMITTED FOR NOV ISSUE	SUBMITTED FOR NOV ISSUE	SUBMITTED FOR NOV ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-G-01373	G0010	4

JEG PROJECT NO. 35H19503 | FILENAME 94X01373.DGN

DATE: 10/23/02 TIME: 02:05:45 PM | USER: RAI HAS DESIGN FILE D:\Arch_Nav workings\94X01373.dgn

4654



NOTES:

1. FOR GENERAL NOTES, LEGEND, UTILITY DESIGNATIONS AND EXCAVATION NOTES, SEE SHEET G0012.
2. SILT FENCE LOCATIONS SHOWN ARE APPROXIMATE. ADD ADDITIONAL SILT FENCE AND/OR ADJUST LOCATIONS AS NECESSARY TO MEET FIELD CONDITIONS.
3. PROTECT ALL EXISTING UTILITIES TO REMAIN FROM DAMAGE DURING EXCAVATION ACTIVITIES.
4. ALL SIDE SLOPES SHALL BE 4:1 UNLESS NOTED OTHERWISE.

FOUNDATION DRAIN NOTES:

1. 4" DIAMETER FOUNDATION DRAIN PIPE (SOLID AND SLOTTED) SHALL BE CORRUGATED POLYETHYLENE SMOOTH LINED PIPE IN ACCORDANCE WITH AASHTO M 252. FOUNDATION DRAIN PIPE SHALL BE N-12 AS MANUFACTURED ADVANCED DRAINAGE SYSTEMS, INC., OR APPROVED EQUAL.
2. FITTINGS SHALL BE PUSH-ON TYPE AND SHALL BE FROM SAME MANUFACTURER AS PIPE.
3. SLOTTED DRAIN PIPE SHALL HAVE CLASS II, SLOTTED-TYPE PERFORATIONS IN ACCORDANCE WITH AASHTO M 252. THE SLOTTED DRAIN PIPE SHALL BE INSTALLED WITH THE COMPACTED #57 DRAINAGE LAYER AS SHOWN ON DETAIL 1, SHEET G0014.
4. SOLID DRAIN PIPE SHALL BE USED ONLY FOR CONNECTION BETWEEN THE SLOTTED DRAIN HEADER PIPE AND CATCH BASIN. PIPE BEDDING FOR SOLID DRAIN PIPE SHALL BE IN ACCORDANCE WITH DETAIL 3, SHEET G0010, EXCEPT THE BEDDING MATERIAL SHALL EXTEND TO THE SPRING-LINE OF THE PIPE AS A MINIMUM.

COORDINATE LISTING

POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
101	480426.1	1347517.7	—	CB
102	480429.7	1347400.0	—	CB
103	480359.7	1347377.1	—	CB
104	480177.0	1347353.2	—	CB
105	480173.1	1347430.9	—	CB
106	480112.6	1347429.9	—	END OF PIPE
107	480414.13	1347400.46	FFE 575.0	COLUMN A-1
108	480180.88	1347394.08	FFE 575.0	COLUMN H-1
109	—	—	—	NOT USED
110	480397.7	1347383.4	569.5	SPOT EL
111	480421.4	1347394.9	569.5	SPOT EL
112	480384.4	1347429.0	569.0	SPOT EL
113	480386.3	1347432.8	567.0	SPOT EL
114	480416.9	1347557.2	569.5	SPOT EL
115	480390.8	1347560.2	569.0	SPOT EL
116	480583.1	1347552.0	567.0	SPOT EL
117	480390.3	1347578.2	569.0	SPOT EL
118	480382.9	1347558.4	569.0	SPOT EL
119	480356.8	1347565.3	570.5	SPOT EL
120	480384.9	1347775.9	569.0	SPOT EL
121	480357.0	1347775.1	569.0	SPOT EL
122	480350.6	1347789.9	570.5	SPOT EL
123	480298.2	1347788.5	570.5	SPOT EL
124	480285.9	1347764.0	570.5	SPOT EL
125	480285.9	1347617.2	570.5	SPOT EL
126	480286.1	1347610.2	570.5	SPOT EL
127	480290.8	1347622.1	571.8	SPOT EL
128	480280.2	1347609.0	571.0	SPOT EL
129	480287.4	1347563.4	570.5	SPOT EL
130	480281.4	1347561.6	571.0	SPOT EL
131	480292.0	1347549.5	567.0	SPOT EL
132	480336.0	1347383.2	569.0	SPOT EL
133	480330.5	1347389.1	567.0	SPOT EL
134	480183.0	1347380.3	567.0	SPOT EL
135	480184.7	1347378.3	569.3	SPOT EL
136	480175.0	1347378.1	569.3	SPOT EL
137	480190.5	1347378.1	567.0	SPOT EL
138	480372.4	1347383.3	569.3	SPOT EL
139	480361.4	1347482.6	569.3	SPOT EL
140	480193.6	1347485.2	568.0	SPOT EL
141	480198.6	1347488.7	568.0	SPOT EL
142	480210.0	1347511.4	571.0	SPOT EL
143	480207.6	1347599.2	571.0	SPOT EL
144	480228.8	1347608.6	570.5	SPOT EL
145	480228.6	1347615.6	570.5	SPOT EL
146	480233.5	1347620.8	571.8	SPOT EL
147	480232.0	1347675.2	571.8	SPOT EL
148	480219.7	1347674.8	571.8	SPOT EL
149	480219.7	1347693.7	571.8	SPOT EL
150	480278.8	1347694.5	571.8	SPOT EL
151	480287.9	1347690.1	570.5	SPOT EL
152	480283.9	1347690.0	570.5	SPOT EL
153	480220.2	1347628.8	568.5	SPOT EL
154	480219.3	1347661.8	568.5	SPOT EL
155	480187.2	1347627.9	568.5	SPOT EL
156	480185.3	1347660.9	568.5	SPOT EL
157	480195.4	1347657.7	568.0	SPOT EL
158	480195.7	1347614.7	568.0	SPOT EL
159	480190.1	1347614.6	568.0	SPOT EL
160	480177.6	1347614.7	569.3	SPOT EL
161	480184.5	1347614.8	569.3	SPOT EL
162	480350.9	1347781.0	570.5	SPOT EL
163	480368.4	1347799.4	575.0	SPOT EL
164	480215.6	1347633.2	574.4	STACK FOUNDATION
165	480215.0	1347657.2	574.4	STACK FOUNDATION
166	480182.0	1347640.5	——	FOUNDATION DRAIN
167	480186.4	1347407.8	——	FOUNDATION DRAIN
168	480328.7	1347411.3	——	FOUNDATION DRAIN
169	480358.1	1347412.2	——	FOUNDATION DRAIN

REF DWG NO.	DRAWING TITLE

PE4 - Continue to the Sacramento Reactor (s.; (1B - Mine Complex - Hydrotests and Reactor.)
(1B) Mine Complex - Hydrotests and Reactor.)
Date: 10-24-02

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
3	REVISED PER DCN # 40750-JEG-025	10/15/02	WB	FP,JR.
2	REVISED PER DCN # 40750-JEG-016	07/26/02	WB	FP,JR.
1	ISSUED FOR CONSTRUCTION/DCN 40750-JEG-012	05/07/02	FP,JR.	WT
0	ISSUED FOR BID	05/07/02	FP,JR.	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS
175 Broadway Ave., Oak Ridge, Tennessee 37830
Tel: 865-220-4000
Fax: 865-220-4170

000271

PROJECT NAME: SILOS 1 AND 2

DRAWING TITLE: CIVIL
REMEDIATION FACILITY FOUNDATION MAT
GRADING, DRAINAGE AND EROSION CONTROL PLAN

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
J.JASHWORTH	05/08/02	W.BARTON	05/08/02	F.PARTON,JR.	05/08/02

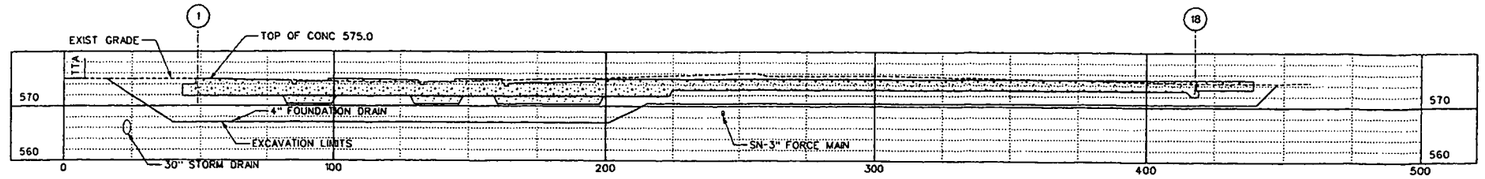
PLANT/BLDG NO	FLOOR	SCALE	CLASS
		1"=20'	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

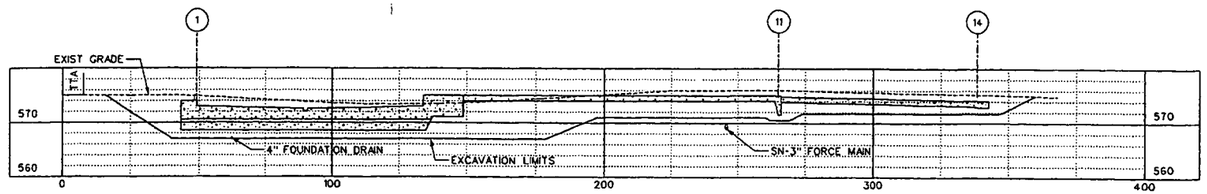
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-G-01376	G0013	3

JEG PROJECT NO	FILENAME
35H19603	94X01376.DGN

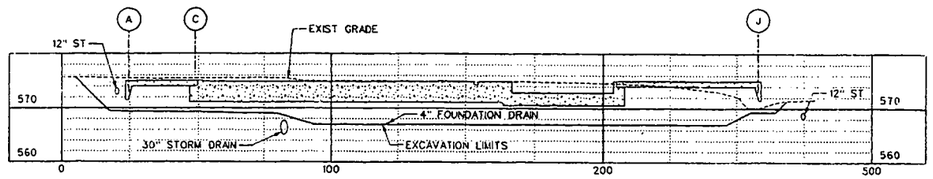
DATE: 10/23/02
TIME: 03:59:17 PM
USER: RAMONJ
DESIGN FILE: J:\ISTW\Drawings\94X01376.dgn



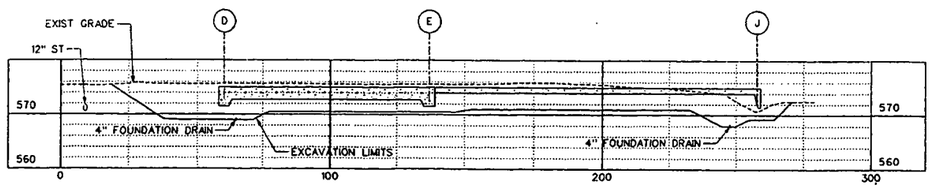
SECTION A
SCALE: 1"=20' HORIZONTAL
1"=10' VERTICAL
G0013 G0014



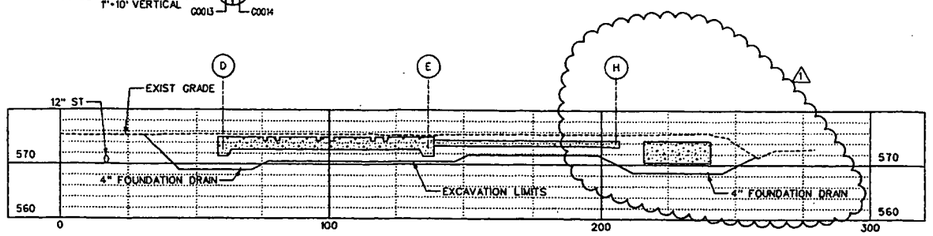
SECTION B
SCALE: 1"=20' HORIZONTAL
1"=10' VERTICAL
G0013 G0014



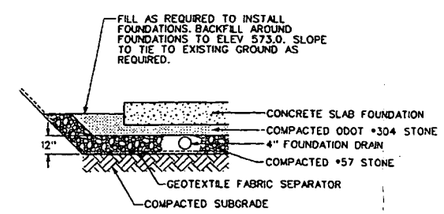
SECTION C
SCALE: 1"=20' HORIZONTAL
1"=10' VERTICAL
G0013 G0014



SECTION D
SCALE: 1"=20' HORIZONTAL
1"=10' VERTICAL
G0013 G0014



SECTION E
SCALE: 1"=20' HORIZONTAL
1"=10' VERTICAL
G0013 G0014



TYPICAL SUBGRADE BACKFILL
NOT TO SCALE
G0014 G0014

VERTICAL SCALE: 1"= 10'
HORIZONTAL SCALE: 1"= 20'

NOTES:
1. SEE STRUCTURAL DRAWINGS FOR FOUNDATION ELEVATIONS AND DIMENSIONS.

4654

REF DWG NO.	DRAWING TITLE

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
1	ISSUED FOR CONSTRUCTION/DCN 40750-JEG-012	06/07/02		WT
0	ISSUED FOR BID	05/07/02	FP, JR.	WT

INITIALS AND DATE

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS
175 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-6000
Fax: 865-220-6170

000272

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
CIVIL
REMEDIATION FACILITY FOUNDATION MAT
SECTIONS

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
J.ASHWORTH	05/08/02	W.BARTON	05/08/02	F.PARTON,JR.	05/08/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1"=20'	U

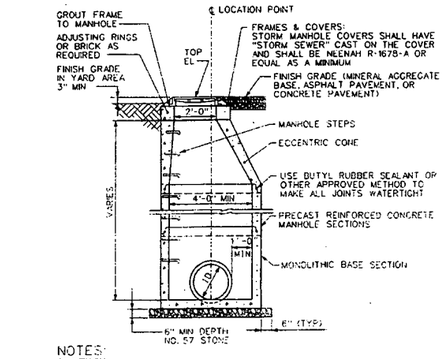
SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-G-01377	G0014	1

JEG PROJECT NO.	FILENAME
35H19603	94XG1377.DGN

DATE: 06/07/02 USER: JASHWORT

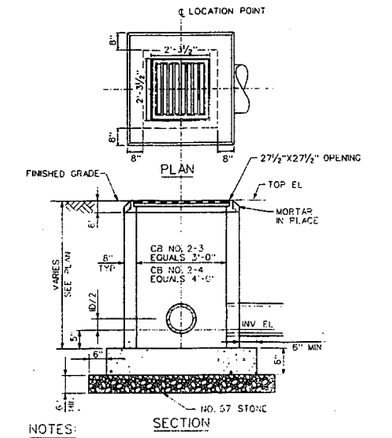
4654



NOTES:

1. ALL PRECAST RISERS, CONES, BASES, TOPS, AND STEPS SHALL CONFORM TO OHIO DEPARTMENT OF TRANSPORTATION STANDARDS.
2. GROUT ANNULAR SPACE BETWEEN WALL AND PIPE WITH NON-SHRINK MORTAR TO ENSURE WATERTIGHT SEAL.

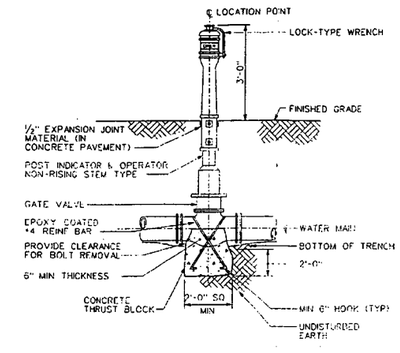
PRECAST CONCRETE MANHOLE (1)
NOT TO SCALE
G0015 — G0015



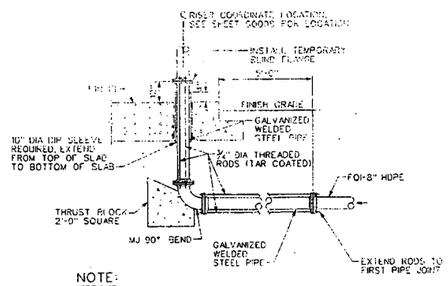
NOTES:

1. ALL PRECAST RISERS, BASES, TOPS, AND STEPS SHALL CONFORM TO OHIO DEPARTMENT OF TRANSPORTATION STANDARDS.
2. USE CB NO. 2-3 FOR 12 AND 18" RCP AND CB NO. 2-4 FOR 30" RCP.
3. GROUT ANNULAR SPACE BETWEEN WALL AND PIPE WITH NON-SHRINK MORTAR TO ENSURE WATERTIGHT SEAL.

PRECAST CATCH BASIN (2)
NOT TO SCALE
G0017 — G0015



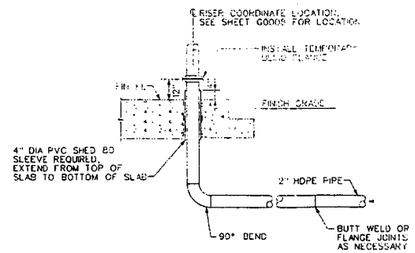
POST INDICATOR AND VALVE (3)
NOT TO SCALE
G0008 — G0015



NOTE:

GROUT ANNULAR SPACE BETWEEN SLEEVE AND PIPE WITH NON-SHRINK MORTAR TO ENSURE WATERTIGHT SEAL.

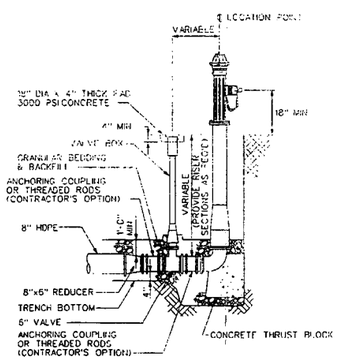
8" RISER (4)
NOT TO SCALE
G0008 — G0015



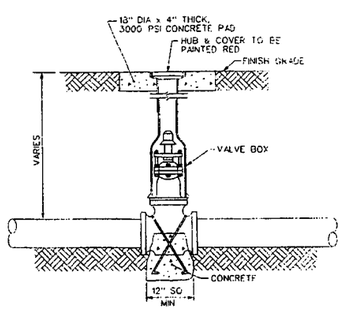
NOTE:

GROUT ANNULAR SPACE BETWEEN SLEEVE AND PIPE WITH NON-SHRINK MORTAR TO ENSURE WATERTIGHT SEAL.

2" RISER (5)
NOT TO SCALE
G0008 — G0015



FIRE HYDRANT (6)
NOT TO SCALE
G0008 — G0015



GATE VALVE (7)
NOT TO SCALE
G0008 — G0015

000273

REF DWG NO.	DRAWING TITLE

8-5-02

REV. NO.	REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR
2	REVISED PER DCN # 40750-JEG-016	07/26/02	MP	
1	ISSUED FOR CONSTRUCTION/DCN 40750-JEG-012	06/07/02	FP,JR.	WT
0	ISSUED FOR BID	05/07/02	FP,JR.	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS — 125 Broadway Ave., Oak Ridge, Tennessee 37830, Tel: 865-220-1800, Fax: 865-220-6150

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
CIVIL
REMEDIATION FACILITY FOUNDATION MAT
DETAILS - 1

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
J.ASHWORTH	05/08/02	W. BARTON	05/08/02	F.PARTON, JR.	05/08/02

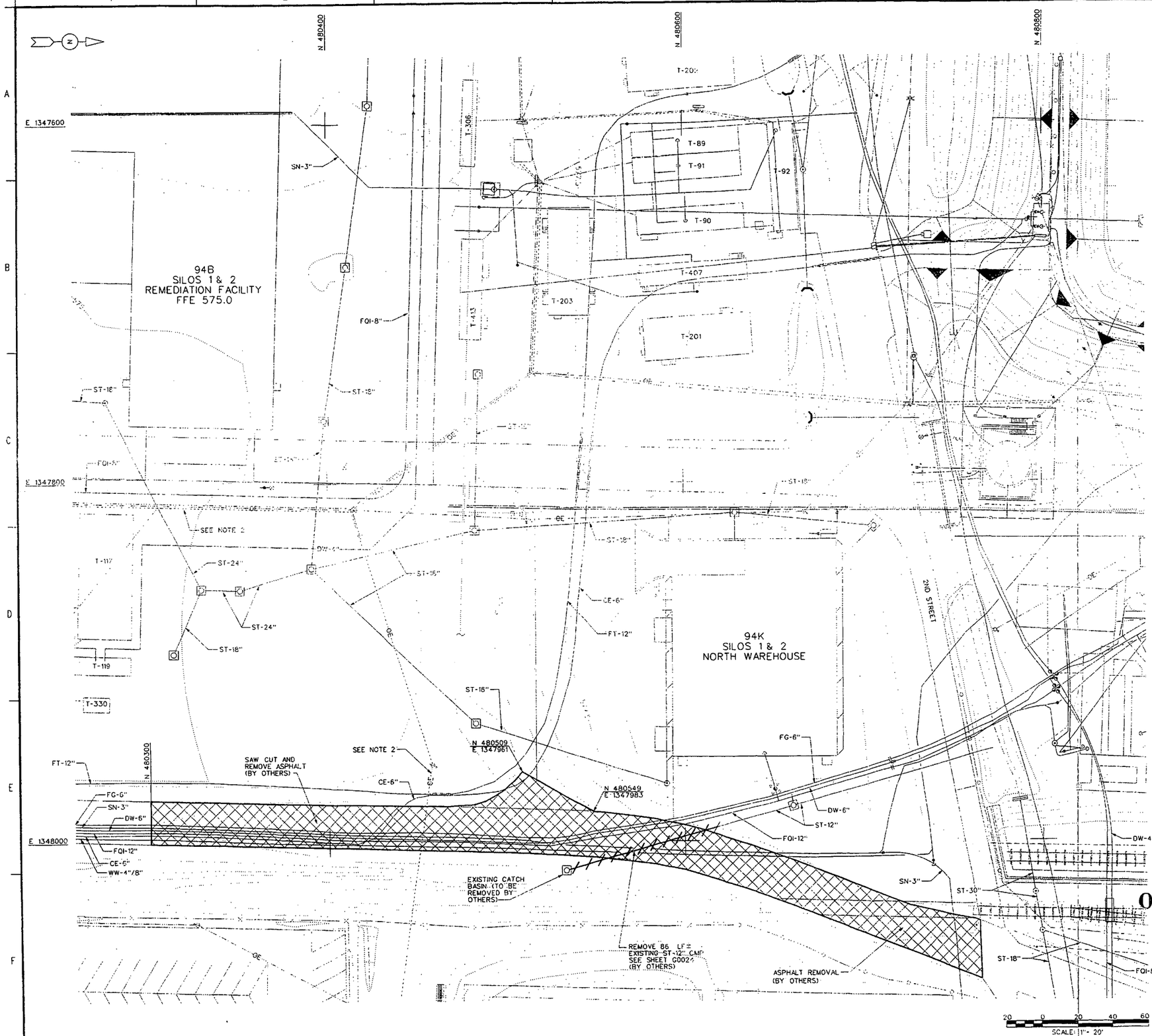
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO
N/A	40750	94X-3900-G-01378	G0015	2

JCE PROJECT NO.	FILENAME
35H19503	94XG1378.DGN

DATE: 07/25/02
TIME: 04:18:40 PM
USER: JASHWORT
DESIGN FILE: [illegible]



NOTES:

1. FOR GENERAL NOTES, LEGEND AND UTILITY DESIGNATIONS, SEE SHEET G0020.
2. EXISTING OVERHEAD LINES TO BE RELOCATED BY FLUOR FERNALD PRIOR TO CONSTRUCTION. CONTRACTOR TO VERIFY THAT A MINIMUM 30 FT. VERTICAL CLEARANCE IS AVAILABLE FROM TOP OF RAIL TO BOTTOM OF LOWEST WIRE.

4654

REF DWG NO.	DRAWING TITLE

NOTE: Exceptions to the Associated Attachments
Fluor Fernald Company, Inc. Acceptance Signature
7-25-02

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
0	ISSUED FOR BID	07/10/02		

DETAILS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-6110

000274

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
CIVIL
REMEDIATION FACILITY RAILROAD DESIGN
DEMOLITION PLAN

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
	7/9/02		7/9/02		7/9/02

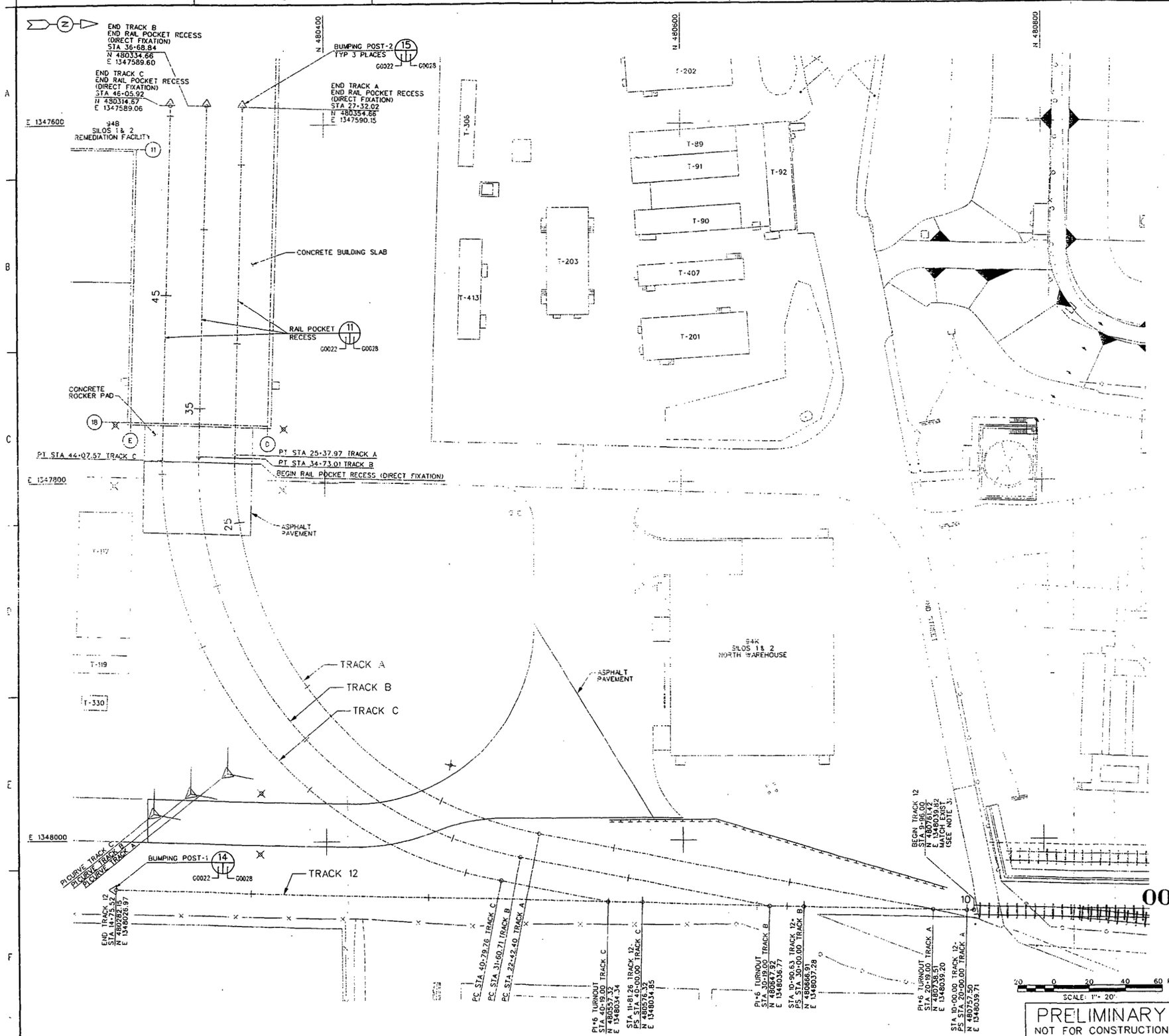
PLANT/BLDG NO.	FLOOR	SCALE	CLASS
		1"=30'	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-G-01942	G0021	0

JEG PROJECT NO.	FILENAME
35H19603	94XG1942.DGN

DATE: 07/09/02
TIME: 02:40:47 PM
USER: FASING
DESIGN FILE: H:\Civil\Drawings\94X01942.dgn



NOTES:

1. FOR GENERAL NOTES, LEGEND AND UTILITY DESIGNATIONS SEE SHEET G0020.
2. FOR CENTERLINE TOP OF RAIL ELEVATIONS, SEE PROFILES ON SHEETS G0025 AND G0026.
3. EXTENT OF EXISTING TRACK REMOVAL UNKNOWN. CONTRACTOR TO VERIFY TIE-IN POINT AND ADJUST STATIONING AS REQUIRED.

4654

CURVE DATA

TRACK A	TRACK B	TRACK C
PI-N 480344.47	PI-N 480324.16	PI-N 480303.84
E 1347962.16	E 1347973.47	E 1347984.78
R 210.36'	R 222.27'	R 233.31'
L 295.57'	L 312.31'	L 327.82'
Lc 292.74'	Lc 309.63'	Lc 325.27'
T 178.10'	T 188.18'	T 197.53'
Delta 80° 30'17"	Delta 80° 30'17"	Delta 80° 30'17"
Dc 27° 30'00"	Dc 25° 30'00"	Dc 24° 45'00"

REF DWG NO	DRAWING TITLE

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
A	ISSUED FOR REVIEW	06/04/02		WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JE JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-1600
Fax: 865-220-6170

000275

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
CIVIL
REMEDIATION FACILITY RAILROAD DESIGN
TRACK PLAN

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
	06/04/02		6-04-02		6/4/02

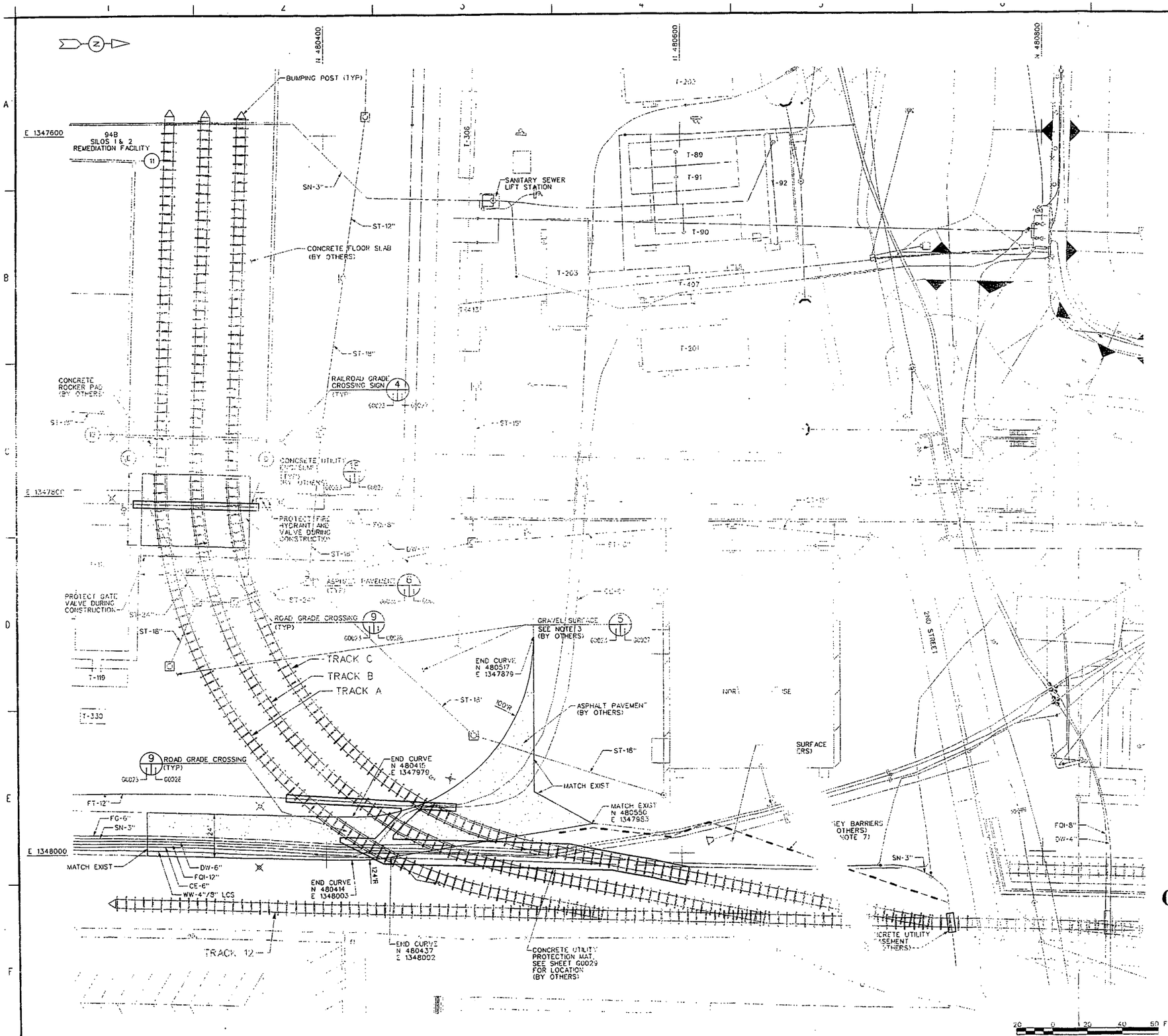
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1"=20'	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-G-01943	G0022	A

JEG PROJECT NO.	FILENAME
35H19603	94X01943.DGN

DATE: 06/04/02
TIME: 06:44 PM
USER: T.Brown
DESIGN FILE: J:\Fernald\35H19603\Civil\Drawings\94X01943.dgn



NOTES:

1. FOR GENERAL NOTES, LEGEND AND UTILITY DESIGNATIONS SEE SHEET G0020.
2. FOR CENTERLINE TOP OF RAIL ELEVATIONS, SEE PROFILES ON SHEETS G0025 AND G0026.
3. ALL UNPAVED DISTURBED AREAS SHALL HAVE 4" GRAVEL SURFACE.
4. CONTRACTOR TO INSTALL TEMPORARY CONSTRUCTION FENCE AROUND PERIMETER OF CONSTRUCTION AREA (BY OTHERS).
5. CONTRACTOR SHALL INSTALL ITS OFFICE TRAILER IN THE VICINITY OF TRAILER T-404, AS DIRECTED BY FLUOR FERNALD, INC.
6. CONTRACTOR'S TEMPORARY NON-POTABLE WATER SOURCE IN VICINITY OF TRAILER T-404.
7. INSTALL JERSEY BARRIERS IN APPROXIMATE LOCATION SHOWN (BY OTHERS).

4654

REF DWG NO.	DRAWING TITLE

N/A - Contractor to the Subcontract Technical Lead
1/3 - Major Component Manager or Subcontractor
4/6 - Discipline Engineer
Date 7-26-02

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
0	ISSUED FOR BID	07/10/02	G	WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JE JACOBS
125 Broadway Ave.
P.O. Box 1000
Oak Ridge, Tennessee 37830
Tel: 865-220-4800
Fax: 865-220-4110

000276

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
CIVIL
REMEDIATION FACILITY RAILROAD DESIGN
SITE/UTILITY PLAN

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
B. G. Blatt	7/9/02	[illegible]	7/9/02	[illegible]	7/9/02

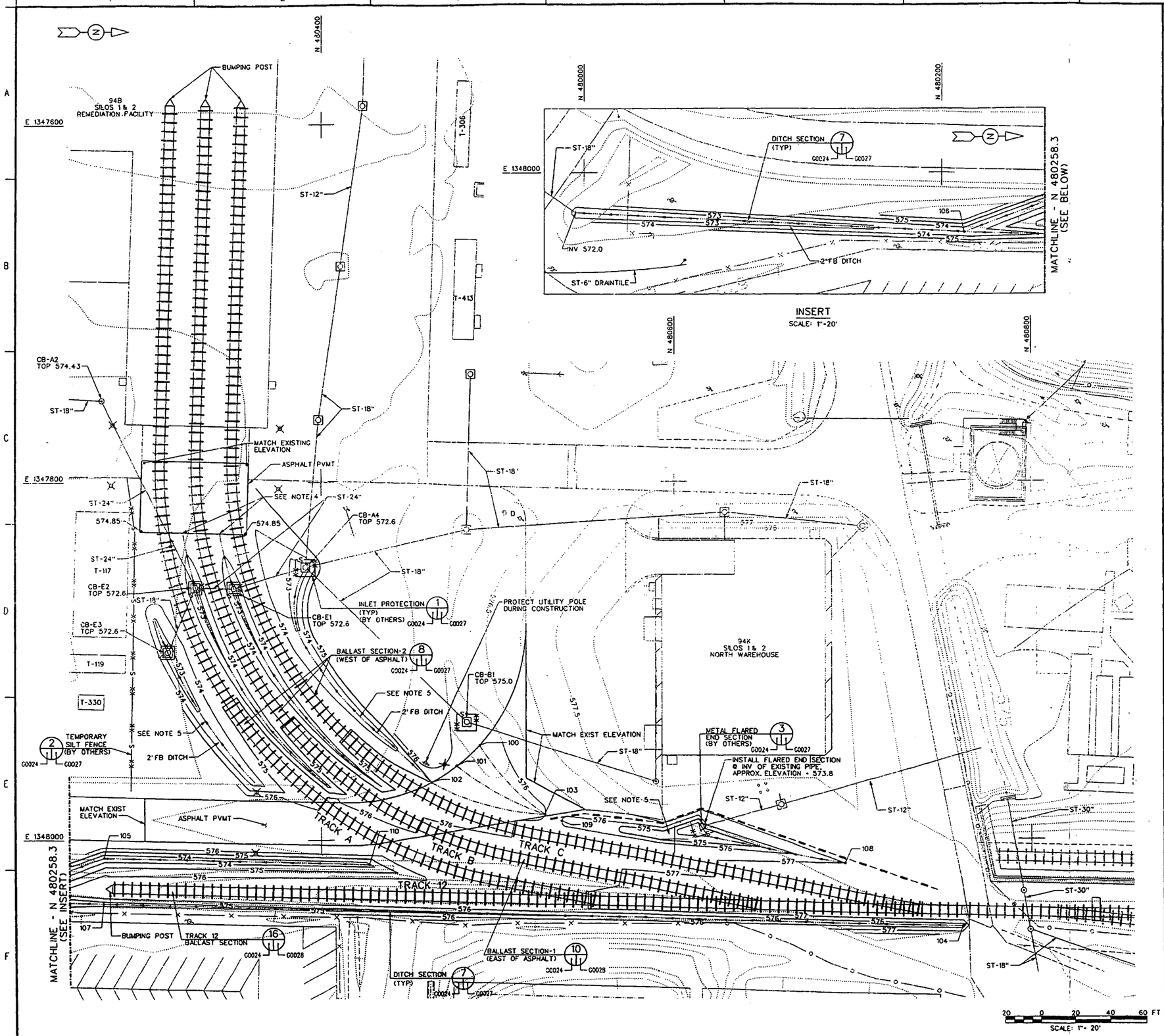
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1"=20'	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-G-01944	G0023	0

E.G. PROJECT NO.	FILENAME
35H19503	94XG1944.DGN

DATE: 07/09/02
TIME: 09:29:31 PM
USER: [illegible]
DESIGN FILE: [illegible]



NOTES:

1. FOR GENERAL NOTES, LEGEND AND UTILITY DESIGNATIONS SEE SHEET G0020.
2. FOR CENTERLINE TOP OF RAIL ELEVATIONS, SEE PROFILES ON SHEETS G0025 AND G0026.
3. SILT FENCE LOCATIONS SHOWN ARE APPROXIMATE. ADD ADDITIONAL SILT FENCE OR ADJUST LOCATIONS AS NECESSARY TO MATCH FIELD CONDITIONS.
4. BETWEEN END OF ASPHALT PAVEMENT AND EXISTING CATCH BASINS TRANSITION BALLAST FROM SWALE AT CATCH BASINS TO MATCH GRADE AT EDGE OF ASPHALT.
5. FIELD LOCATE DRAINAGE DITCHES IN AREAS SHOWN TO PROVIDE POSITIVE DRAINAGE TO EXISTING STORM DRAIN STRUCTURES.

4654

COORDINATE LISTING

POINT	NORTHING	EASTING	ELEV	DESCRIPTION
100	480490	1347947	575.3	LP EDGE OF PVMT
101	480477	1347959	575.9	HP EDGE OF PVMT
102	480463	1347968	575.3	LP EDGE OF PVMT
103	480528	1347986	576.0	SPOT EL
104	480761	1348049	575.4	BEGIN V-DITCH
105	480277	1348010	573.6	PI 2' FB DITCH
106	480213	1348033	573.3	INT 2' FB DITCH AND BEGIN 2' FB DITCH
107	480277	1348036	574.4	END V-DITCH
108	480695	1348013	577.0	BEGIN V-DITCH
109	480537	1347990	576.0	SPOT EL
110	480428	1348014	573.9	BEGIN 2' FB DITCH

REF DWG NO.	DRAWING TITLE
G3105	WAREHOUSE SITE-GRADING, DRAINAGE & EROSION CONTROL PLAN
G3106	WAREHOUSE SITE-STORM DRAIN PROFILES

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
0	ISSUED FOR BID	07/10/02		

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JACOBS

PROJECT NAME

000277 SILOS 1 AND 2

DRAWING TITLE

CIVIL
REMEDIATION FACILITY RAILROAD DESIGN
GRADING, DRAINAGE & EROSION CONTROL PLAN

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
	7/9/02		7/9/02		7/9/02

PLANT/BLDG. NO. | FLOOR | SCALE 1"=20' | CLASS U

SUBMITTED FOR 30% ISSUE | SUBMITTED FOR 60% ISSUE | SUBMITTED FOR 90% ISSUE

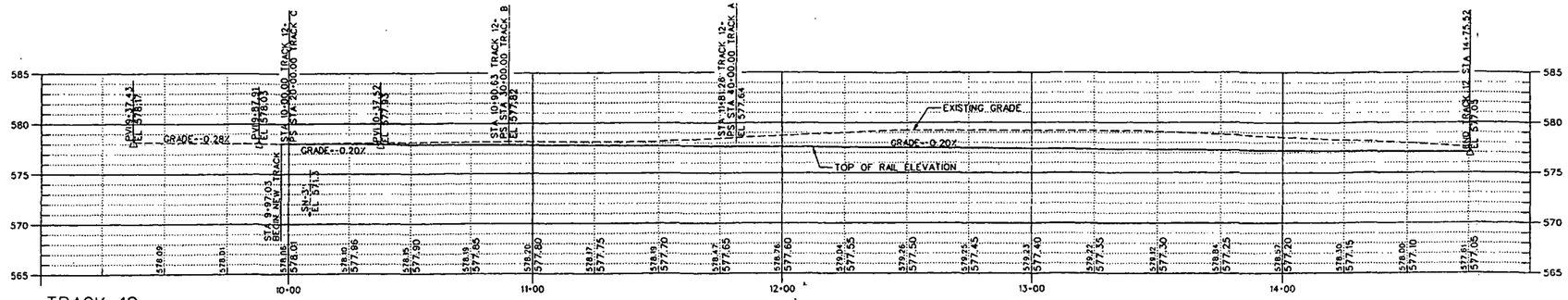
TECH LEAD | TECH LEAD | TECH LEAD

DATE | DATE | DATE

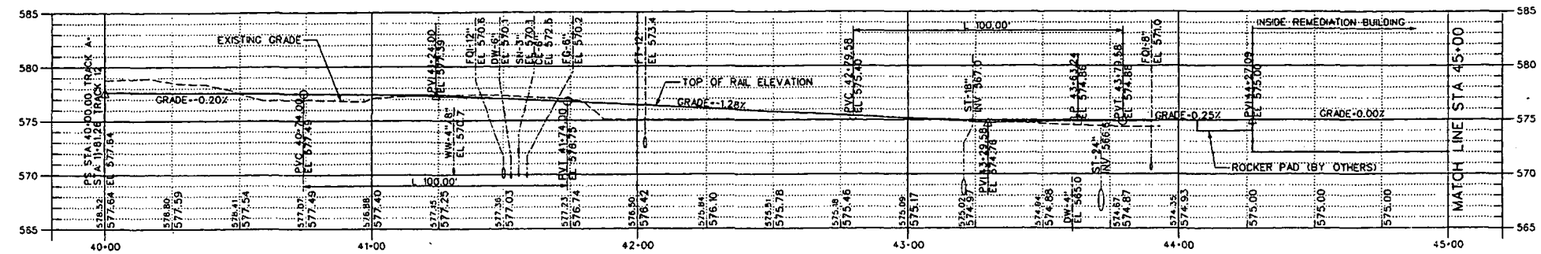
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-G-01945	G0024	0

JEG PROJECT NO. 35H19603 | FILENAME 94XG1945.DGN

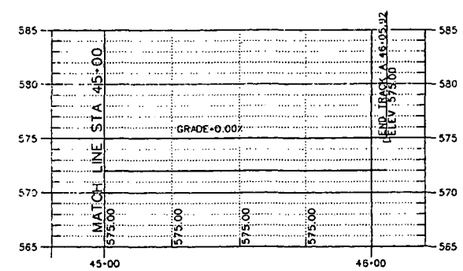
DATE: 07/09/02 TIME: 03:42:57 PM | USER: KAKing | DESIGN FILE: b:\Civil\Drawings\94XG1945.dgn



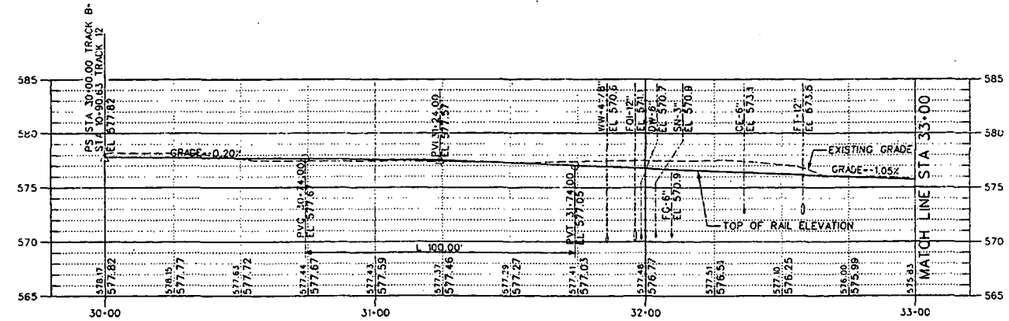
TRACK 12
SCALE: 1"=20' HORIZONAL
1"=5' VERTICAL



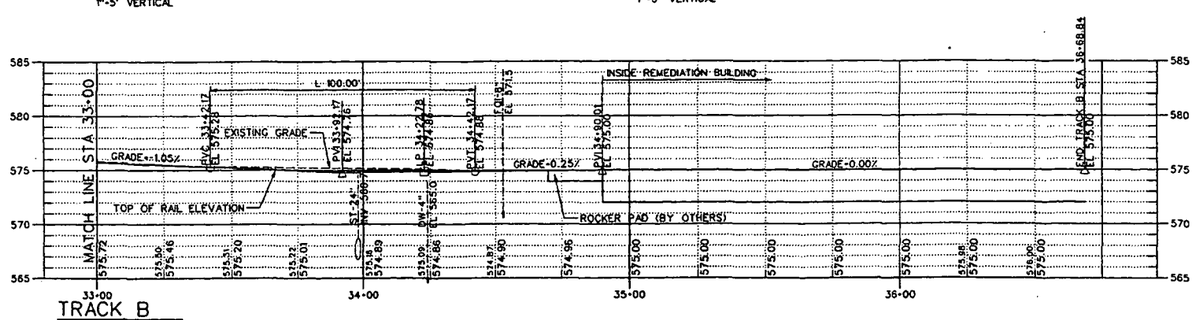
TRACK A
SCALE: 1"=20' HORIZONAL
1"=5' VERTICAL



TRACK A
SCALE: 1"=20' HORIZONAL
1"=5' VERTICAL



TRACK B
SCALE: 1"=20' HORIZONAL
1"=5' VERTICAL



TRACK B
SCALE: 1"=20' HORIZONAL
1"=5' VERTICAL

SCALE: 1"= 20' HORIZONTAL

SCALE: 1"= 5' VERTICAL

NOTES:

1. FOR GENERAL NOTES, LEGEND AND UTILITY DESIGNATIONS SEE SHEET G0020.
2. FOR HORIZONTAL RAIL LOCATION, SEE SHEET G0022.
3. ELEVATIONS GIVEN TO TOP OF PIPE UNLESS NOTED OTHERWISE.

4654

REF DWG NO.	DRAWING TITLE

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR
0	ISSUED FOR BID	07/10/02		WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

JACOBS

000278

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
CIVIL
REMEDIATION FACILITY RAILROAD DESIGN
PROFILES - 1

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
	7/1/02		7/1/02		7/9/02

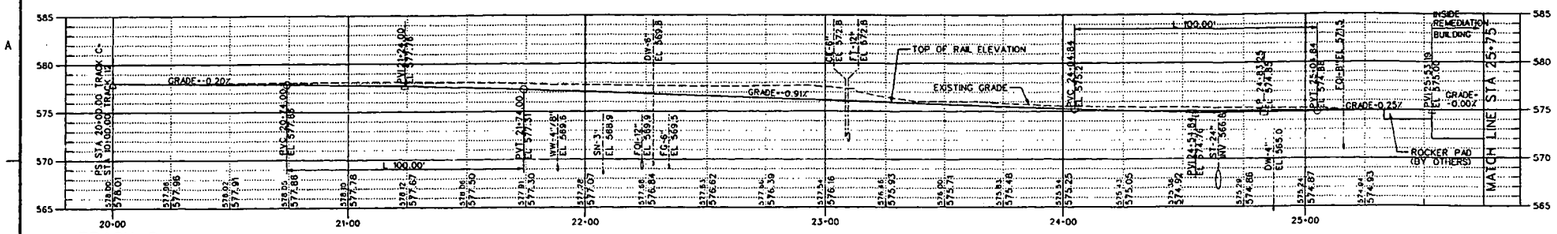
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1"=20'	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

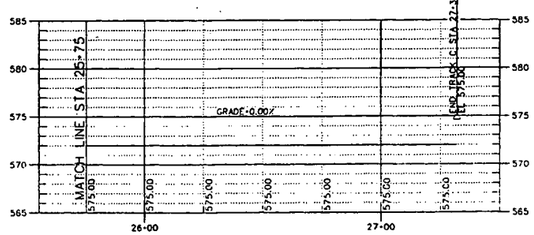
T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-G-01946	G0025	0

JEC PROJECT NO.	FILENAME
35H19603	94XG1946.DGN

DATE: 07/09/02
TIME: 02:38:43 PM
USER: KAKing
DESIGN FILE: I:\Civil\Drawings\94XG1946.dgn



TRACK C
SCALE: 1"=20' HORIZONAL
1"=5' VERTICAL



TRACK C
SCALE: 1"=20' HORIZONAL
1"=5' VERTICAL

NOTES:

1. FOR GENERAL NOTES, LEGEND AND UTILITY DESIGNATIONS SEE SHEET G0020.
2. FOR HORIZONTAL RAIL LOCATION, SEE SHEET G0022.
3. ELEVATIONS GIVEN TO TOP OF PIPE UNLESS NOTED OTHERWISE.

-4654

REF DWG NO.	DRAWING TITLE

7-25-02

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR
0	ISSUED FOR BID	07/10/02		

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JACOBS

000279

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
CIVIL
REMEDIATION FACILITY RAILROAD DESIGN
PROFILES - 2

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
	7/7/02		7/7/02		7/7/02

PLANT/BLDG NO.	FLOOR	SCALE	CLASS
		SHOWN	U

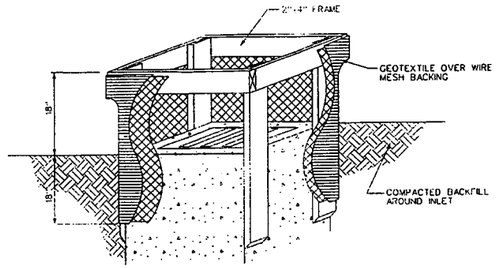
SUBMITTED FOR 30% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 60% ISSUE — TECH LEAD — DATE
SUBMITTED FOR 90% ISSUE — TECH LEAD — DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV NO
N/A	40750	94X-3900-G-01947	G0026	0

JEG PROJECT NO.	FILENAME
35H19603	94XG1947.DGN

20 0 20 40 60 FT
SCALE: 1"= 20' HORIZONTAL
5 0 5 10 15 FT
SCALE: 1"= 5' VERTICAL

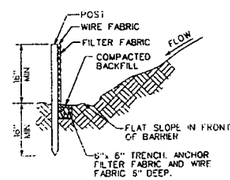
DATE: 07/09/02
TIME: 02:33:47 PM
USER: KAKUNE
DESIGN FILE: S:\CIVIL\Drawings\94XG1947.dgn

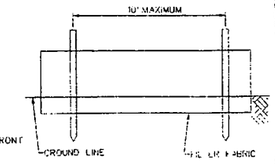


NOTES:

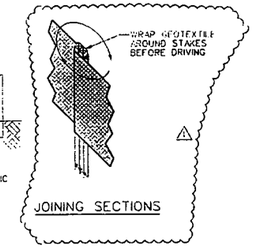
1. INLET PROTECTION SHALL BE CONSTRUCTED EITHER BEFORE UPSLOPE LAND DISTURBANCE BEGINS OR BEFORE THE STORM DRAIN BECOMES OPERATIONAL.
2. THE EARTH AROUND THE INLET SHALL BE EXCAVATED COMPLETELY TO A DEPTH AT LEAST 18 INCHES.
3. THE WOODEN FRAME SHALL BE CONSTRUCTED OF 2"x4" CONSTRUCTION GRADE LUMBER. THE 2"x4" POSTS SHALL BE DRIVEN 18" INTO THE GROUND AT FOUR CORNERS OF THE INLET AND THE TOP PORTION OF 2"x4" FRAME ASSEMBLED USING THE OVERLAP JOINT SHOWN. THE TOP OF THE FRAME SHALL BE AT LEAST 6" BELOW ADJACENT ROADS IF PONDED WATER WOULD POSE A SAFETY HAZARD TO TRAFFIC.
4. WIRE MESH SHALL BE OF SUFFICIENT STRENGTH TO SUPPORT FABRIC WITH WATER FULLY IMPOUNDED AGAINST IT. IT SHALL BE STRETCHED TIGHTLY AROUND THE FRAME AND FASTENED SECURELY TO THE FRAME.
5. GEOTEXTILE SHALL BE STRETCHED TIGHTLY AROUND THE FRAME AND FASTENED SECURELY. IT SHALL EXTEND FROM THE TOP OF THE FRAME TO 18" BELOW THE INLET NOTCH ELEVATION. THE GEOTEXTILE SHALL OVERLAP ACROSS ONE SIDE OF THE INLET SO THE ENDS OF THE CLOTH ARE NOT FASTENED TO THE SAME POST.
6. BACKFILL SHALL BE PLACED AROUND THE INLET IN COMPACTED 6" LAYERS UNTIL THE EARTH IS EVEN WITH NOTCH ELEVATION ON ENDS AND TOP ELEVATION ON SIDES.

INLET PROTECTION (1)
NOT TO SCALE
(BY OTHERS)
G0024 — G0027





ELEVATION

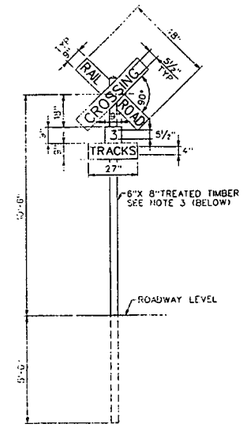


JOINING SECTIONS

NOTES:

1. PLACEMENT, CONSTRUCTION AND MAINTENANCE OF PERIMETER FILTER FABRIC FENCE AND TEMPORARY INLET PROTECTION FILTER FABRIC FENCE SHALL CONFORM TO OHIO DEPARTMENT OF NATURAL RESOURCES RAINWATER AND LAND DEVELOPMENT MANUAL, PAGES 118-125.
2. THE ENDS OF SILT FENCE SHALL BE CONSTRUCTED UPSLOPE TO PREVENT WATER PONDED BY THE FENCE FROM FLOWING AROUND THE ENDS.
3. SILT FENCE SHALL BE INSTALLED ALONG CONTOURS, TO THE EXTENT PRACTICAL.

TEMPORARY SILT FENCE (2)
NOT TO SCALE
(BY OTHERS)
G0024 — G0027

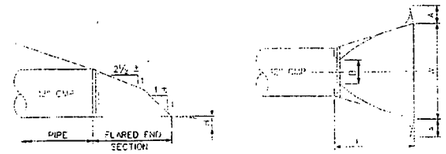


NOTES:

1. LOCATE SIGN AT SUCH POINTS AS WILL GIVE THE BEST VIEW BY PERSONS APPROACHING THE CROSSING.
2. SIGN SHALL BE W9-2 RAILROAD CROSSING (CROSSBUCK) SIGN (N15-1-21) IN ACCORDANCE WITH MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES, LATEST ED.
3. TREATED TIMBER SHALL BE BY THE PRESSURE PROCESS PER AMERICAN WOOD PRESERVERS' ASSOCIATION STANDARDS WITH A MIN. 0.6 PCF OF PRESERVATIVE RETENTION

RAILROAD GRADE CROSSING SIGN (4)
NOT TO SCALE
G0023 — G0027

INFORMATION ONLY

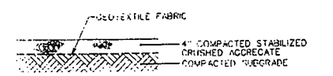


NOTES:

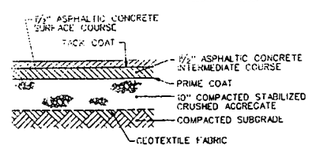
1. THE CONNECTION BETWEEN METAL FLARED END SECTION AND CORRUGATED METAL PIPE WILL BE A DIMPLE BAND COLLAR FIELD BOLTED TO END SECTION. PIPE WILL BE INSERTED INTO THE BAND COLLAR TO MEET THE END SECTION. OTHER TYPE CONNECTION PERMISSIBLE IF RECOMMENDED BY MANUFACTURER AND APPROVED BY THE FLUOR FERNALD, INC.
2. INTERLINE OF FLARED END SECTION MUST ALIGN WITH INTERLINE OF PIPE.
3. DIMENSIONS SHOWN ARE APPROXIMATE AND MAY VARY BETWEEN MANUFACTURERS.

FLARED END SECTION DIMENSIONS						
PIPE SIZE	A ±1"	B (MAX)	H ±1"	L ±1½"	W ±2"	
12"	6"	5"	8"	31"	24"	

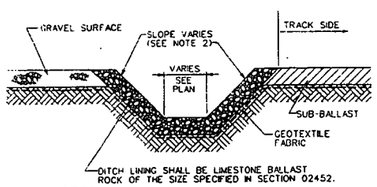
METAL FLARED END SECTION (3)
NOT TO SCALE
(BY OTHERS)
G0024 — G0027



GRAVEL SURFACE (5)
NOT TO SCALE
(BY OTHERS)
G0023 — G0027



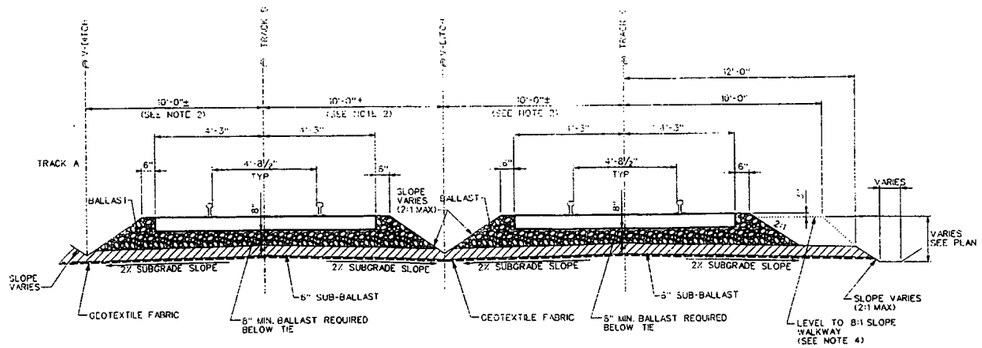
ASPHALT PAVEMENT (6)
NOT TO SCALE
G0023 — G0027



NOTES:

1. DETAIL AND CONSTRUCTION OF DITCH LINING SHOWN APPLICABLE TO V-DITCH AND FLAT BOTTOM DITCH.
2. CONTRACTOR TO VARY SLOPE AS REQUIRED FOR GRADING. MAXIMUM PERMISSIBLE SLOPE IS 2H:1V.

DITCH SECTION (7)
NOT TO SCALE
G0024 — G0027



NOTES:

1. CROSS SECTION FOR TRACK A IS MIRROR IMAGE OF CROSS SECTION TRACK C.
2. ACTUAL DISTANCE TO CENTERLINE OF SWALE VARIES AS THE DISTANCES BETWEEN THE TRACKS VARIES.
3. THIS SECTION APPLIES TO THE RAILWAY BETWEEN THE NEWLY PAVED ACCESS ROAD AND THE CONCRETE ROCKER PAD ADJACENT TO THE SILOS 1 AND 2 REMEDIATION FACILITY. SEE SHEET G0024.
4. WALKWAYS TO BE CONSTRUCTED OUTSIDE OF TRACK A AND TRACK C.

BALLAST SECTION-2 (8)
NOT TO SCALE
G0024 — G0027

REF DWG NO.	DRAWING TITLE

REV NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
1	REVISED PER DCN 40750-JEC-025	11/14/02		
0	ISSUED FOR BID	07/10/02	GM	WT

STATUS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS
125 Broadway Ave.
Oak Ridge, Tennessee 37830
Tel: 865-220-4600
Fax: 865-220-6170

PROJECT NAME
SILOS 1 AND 2

DRAWING TITLE
CIVIL
REMEDIATION FACILITY RAILROAD DESIGN
DETAILS - 1

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
K. KING	07/09/02	T. BROWN	07/09/02	C. MORAR	07/09/02
PLANT/BLDG NO		FLOOR		SCALE NONE	CLASS U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-C-01948	G0027	1

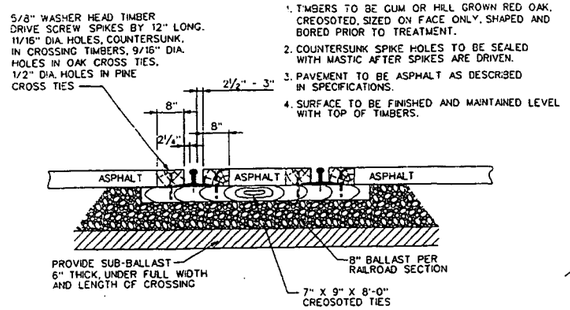
JEC PROJECT NO. 35H19603 — FILENAME 94X01948.DGN

DATE: 10/23/02
TIME: 04:00:05 PM
USER: KKING
DESIGN FILE: h:\Civil\Drawings\94X01948.dgn

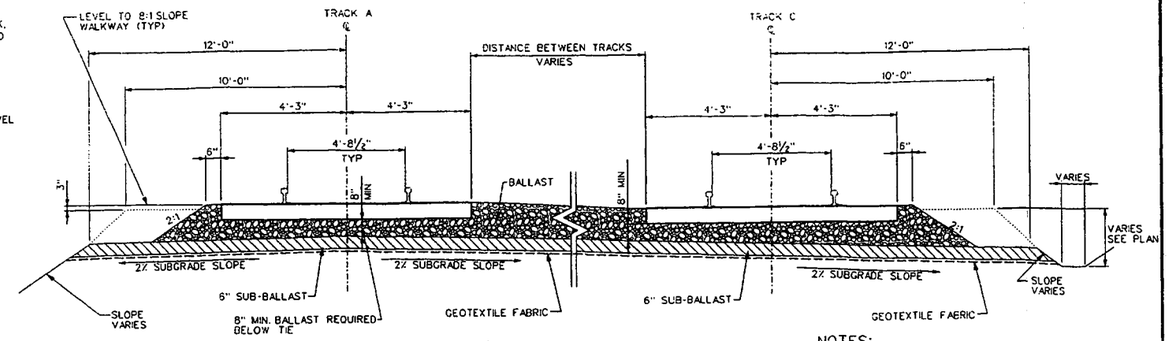
000280

NOTES:

1. TIMBERS TO BE GUM OR HILL GROWN RED OAK, CREOSOTED, SIZED ON FACE ONLY, SHAPED AND BORED PRIOR TO TREATMENT.
2. COUNTERSUNK SPIKE HOLES TO BE SEALED WITH MASTIC AFTER SPIKES ARE DRIVEN.
3. PAVEMENT TO BE ASPHALT AS DESCRIBED IN SPECIFICATIONS.
4. SURFACE TO BE FINISHED AND MAINTAINED LEVEL WITH TOP OF TIMBERS.



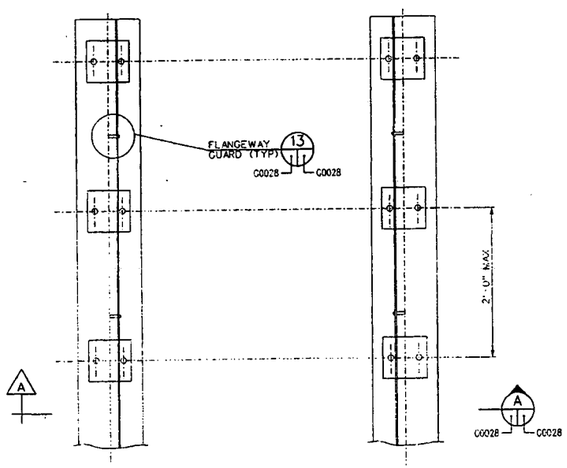
ROAD GRADE CROSSING (9)
NOT TO SCALE
G0023 — G0028



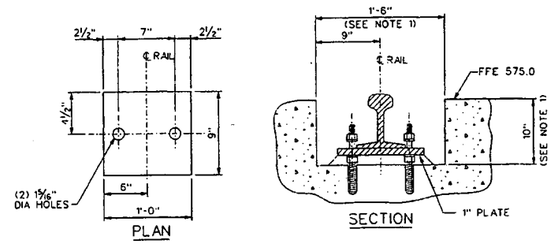
BALLAST SECTION-1 (10)
NOT TO SCALE
G0024 — G0028

NOTES:

1. TRACK B NOT SHOWN FOR CLARITY.
2. THIS SECTION APPLIES TO THE RAILWAY BETWEEN THE NEW PAVED ACCESS ROAD AND TRACK 12.



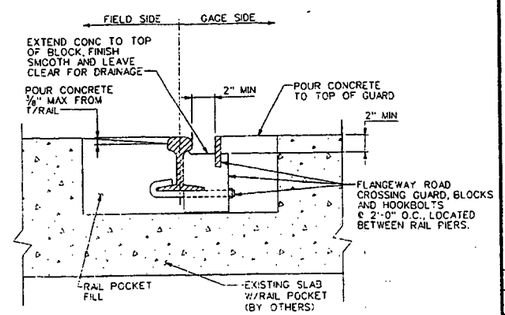
RAIL POCKET (DIRECT FIXATION) (11)
NOT TO SCALE
G0022 — G0028



NOTES:

1. REMEDIATION BUILDING SLAB AND RAIL POCKET BY OTHERS. VERIFY DIMENSIONS PRIOR TO INSTALLING RAIL.
2. FLANGEWAY GUARD AND GROUNDWIRE NOT SHOWN FOR CLARITY.

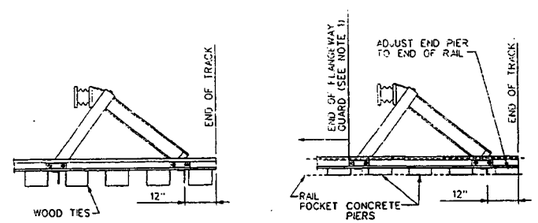
RAIL BASE PLATE (12)
NOT TO SCALE
G0028 — G0028



NOTE:

FLANGEWAY GUARD TO BE INSTALLED IN CONCRETE POCKER PAD AND IN REMEDIATION BUILDING SLAB

FLANGEWAY GUARD (13)
NOT TO SCALE
G0028 — G0028

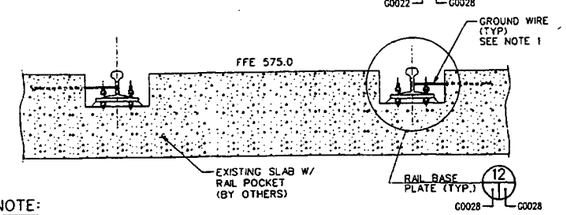


NOTE:

1. END FLANGEWAY GUARD AND RAIL POCKET RECESS FILL AT BUMPER POST ATTACHMENT.

BUMPING POST-1 (14)
NOT TO SCALE
G0022 — G0028

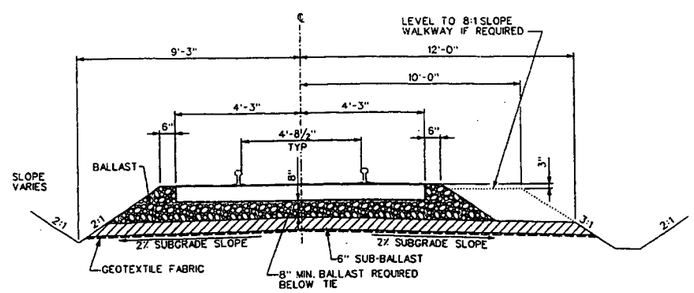
BUMPING POST-2 (15)
NOT TO SCALE
G0022 — G0028



NOTE:

1. ATTACH EXISTING GROUND WIRE TO WEB OF RAIL WITH CADWELD CONNECTION IN ACCORDANCE WITH SPECIFICATION SECTION 02452. SEE ELECTRICAL GROUND DRAWING E0102 IN FOUNDATION MAT PACKAGE FOR APPROXIMATE LOCATIONS OF GROUNDWIRES. FIELD TO DETERMINE BEST LOCATION OF CADWELD AND REMOVE EXCESS PIGTAIL WIRE AS APPROPRIATE.

SECTION (A)
NOT TO SCALE
G0028 — G0028



TRACK 12 BALLAST SECTION (16)
NOT TO SCALE
G0024 — G0028

-4654

REF DWG NO.	DRAWING TITLE
E0102	SILOS 1 & 2 REMEDIATION FACILITY GROUNDING SYSTEM 1ST FLOOR

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
0	ISSUED FOR BID	07/10/02		WT

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
JE JACOBS
125 Broadway Ave. Oak Ridge, Tennessee 37830
Tel: 865-220-6000
Fax: 865-220-6170

000281

PROJECT NAME: SILOS 1 AND 2

DRAWING TITLE: CIVIL
REMEDIATION FACILITY RAILROAD DESIGN
DETAILS - 2

DRAWN BY	DATE	TECHNICAL LEAD	DATE	CHECKED BY	DATE
	7/1/02		7/1/02		7/9/02

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	U

SUBMITTED FOR 30% ISSUE	SUBMITTED FOR 60% ISSUE	SUBMITTED FOR 90% ISSUE
TECH LEAD	TECH LEAD	TECH LEAD
DATE	DATE	DATE

T.O. NUMBER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
N/A	40750	94X-3900-G-01949	G0028	0

JEG PROJECT NO.	FILENAME
35N9503	94X01949.DGN

DATE: 07/09/02
TIME: 03:22:06 PM
USER: Jashwort
DESIGN FILE: N:\Civil\Drawings\94X01949.dgn