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UNH NEUTRALIZATION PROJECT INDEPENDENT DESIGN REVIEW REPORT, VOLUME 1 - FEBRUARY 1, 1995

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February 1, 1995

UNH NEUTRALIZATION PROJECT INDEPENDENT DESIGN REVIEW REPORT

ENG-IDR-101

February 1, 1995

Fernald Environmental Restoration Management Corporation

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UNH NEUTRALIZATION PROJECT
INDEPENDENT DESIGN REVIEW REPORT

RECOMMENDED FOR APPROVAL

Robert Heck — FERMCO Engineering

Ron Worsley — FERMCO Engineering

Ken Roberts — Fluor Daniel Power, Chicago

Craig Miller — FD Nuclear Material Liquid Handling, Irvine

Harry Kortnicki — FD Nuclear Material Liquid Handling, Irvine

Bill Kortier — FERMCO Engineering, Chairperson

UNH NEUTRALIZATION PROJECT
INDEPENDENT DESIGN REVIEW REPORT

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UNH NEUTRALIZATION PROJECT
INDEPENDENT DESIGN REVIEW REPORT

Executive Summary

As a result of the problems which have been encountered on the UNH Neutralization project, an Independent Design Review (IDR) Team was commissioned to review the design and its implementation through procurement and construction. Utilizing checklists which were produced and convening daily coordination meetings, this IDR team reached the following key conclusions:

- Safety Analysis Report (SAR)
  - There are differences between the system description in the SAR and the detailed design. Since the SAR does not require any Structures, Systems, or Components (SSCs) to ensure safety to offsite populations, onsite workers, or project workers, the system and process as designed appears to be within the safety basis.
- Piping Stress
  - Certain systems are unnecessarily constrained which potentially could exceed code allowable stresses.
  - Allowable pipe stresses were not exceeded in the area of the failed weld.

Revision 1 2/6/95

Executive Summary (cont.)

- Secondary Containment (Confinement)

  - Based on discussions with DOE and team consensus, secondary confinement was determined to be a requirement which was only partially incorporated and was not formally waived prior to constructing the UNH Neutralization system.

  - The only documented discussion was located in the SAR.

- Welding Verification

  - The single case of weld failure was attributed to poor weld quality which could not withstand the probable combination of stresses.

  - The weld had improper fit-up resulting in extensive lack of penetration, lack of adequate weld thickness, and tightly butted root faces.

- UNH Pump Change

  - The double diaphragm pumps were installed and were being tested without adequate engineering justification for use of these pumps. Installation followed the design concept provided, but did not comply with the mounting details.

Executive Summary (cont.)

- Control Philosophy/Instrumentation Design Basis

  - Schedule constraints drove the installation and testing of the double diaphragm pumps prior to complete engineering evaluation and establishment of a revised control philosophy and design basis.

- Vendor Deliverables - Material Conformance

  - Field changes were not being controlled

  - Purchase Order records lacked complete material documentation as required by design specifications.

  - A number of purchase orders lacked the supplemental documentation required by specifications, or lacked sufficient shipping documentation to thoroughly establish material identity.

  - Two (2) out of 267 purchase orders evidenced receipt of out of specification material.

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UNH NEUTRALIZATION PROJECT
INDEPENDENT DESIGN REVIEW REPORT

1. PURPOSE

The Independent Design Review (IDR) Team was commissioned by the FERMCO Office of the President to perform an Independent Design Review of the UNH Neutralization Project. This review was performed according to appropriate portions of the Engineering Division Policy and Procedures, specifically "Independent Design Review, 12-4008". The goal of the UNH Independent Design Review Team was to review the design documents and facility as built condition to assess whether it meets or exceeds the original design basis/criteria.

2. MEMBERSHIP

The IDR Team was organized under the Chairmanship of William Kortier of the Environmental Engineering and Technology Division. Meetings began on January 10, 1995 and continued on a daily basis. Team membership was established according to the following list, recognizing that other members/disciplines would be called upon as necessary. The qualifications of personnel involved in the review are presented in Attachment A.

Membership List

Robert Heck	FERMCO Engineering
Bill Kortier	FERMCO Engineering
Ken Roberts	Fluor Daniel Power, Chicago
Ron Worsley	FERMCO Engineering
Craig Miller	FD Nuclear Material Liquid Handling, Irvine
Harry Kortnicki	FD Nuclear Material Liquid Handling, Irvine

3. PLAN/PROCEDURE FOR IDR TEAM

The independent design reviews were performed as requested by the Office of the President and the UNH Project Manager. (Letter, J. W. Thiesing to Jack Craig, DOE, "UNH Design Review Team," dated January 6, 1995 - C:OP:95-0019; Letter, Dave Brettschneider to Bob Heck, "Request for a Design Review of the UNH Project," dated January 18, 1995 - M:RSO:(FP):95-0019 (Attachment A)) Specific topics were identified for detailed reviews.

- Adequacy of the design specifications
- Accurate translation of design specifications into procurement documents
- Procured materials meet specification requirements
- As-built configuration of the UNH facility meets design basis requirements

The team members were supplied with Engineering procedures and with documents supplied by the UNH project prior to conducting detailed reviews (see Attachment B). Checklists were completed by the IDR Team members to establish the direction of the review. Daily "Plan of the Day" meetings were conducted to establish key issues for further investigation and preparation of summary minutes occurred during the process. (checklists are in Attachment C and Plan of the Day in Attachment D) This procedure allowed the IDR Team to develop a detailed plan through daily work sessions which led to the following key issues or areas of concern:

- Safety Analysis Report
- Piping Stress Analysis
- Secondary Containment
- Welding Verification
- Heat Tracing
- UNH Pump Change to Double Diaphragm
- Control Philosophy/Instrumentation Design Basis
- Vendor Deliverables - Material Conformance
- Operability/Maintainability Issues

4. DISCUSSION OF KEY ISSUES

4.1 Safety Analysis Report

The Safety Analysis Report (SAR) is the primary means of documenting that the system has been thoroughly analyzed to insure that all applicable safety and environmental requirements will be met. The SAR is controlled under Configuration Management and any changes to the SAR must be addressed according to Engineering Procedure 12-5004. The design review was conducted using the Revision 1 draft SAR as supplied by project personnel. Specific concerns raised by the team were:

Safety Basis Versus Design Comparison

A key issue which the design review team investigated was compliance of the UNH design to the safety basis as described in the Safety Analysis Report (SAR). Upon review of the SAR, it was determined that the SAR does not require any Structures, Systems, or Components (SSCs) to ensure safety to offsite populations, onsite workers, or project workers. The system and process as designed appears to be within the safety basis as described by the SAR.

Significance of Batch Concentrations Versus the SAR

The SAR describes a 100 gram per liter uranium concentration which is a process parameter developed to obtain optimum results and most efficiently utilize the reagents within the UNH process. A criticality safety analysis was referenced in the SAR which concluded that there is no criticality potential on the UNH project.

It was further determined that the uranium concentrations will be controlled using the batch formula sheets which define the source and amount of constituents to be used in each neutralization batch during processing.

As a result of this review it was found that the 100 gram per liter uranium concentration is a parameter established to maximize efficiency of the process and does not affect the safety basis for the UNH project.

4. DISCUSSION OF KEY ISSUES (cont.)

4.1 Safety Analysis Report (cont.)

Comparison of SAR System Descriptions to Detailed Design

The SAR did contain a system and process description of the UNH Neutralization project which was reviewed against the design with the results shown in Attachment E-1. Included is a list of items for the project which differs from the SAR and needs to be evaluated.

As a result of this comparison it was determined that there are discrepancies between the system description in the SAR and the actual design. These differences do not appear to impact safety because as referenced in SAR Section 4.0, there were no safety significant or safety class SSCs. These discrepancies will be forwarded for review as described in the Unreviewed Safety Question (USQ) section of the SAR.

4.2 Piping Stress Analysis

The UNH system consists of several hundred feet of stainless and carbon steel piping. Because the stresses were unknown and suspect, a review of the piping system was performed to determine if the pipe installation could lead to weld failure (see Section 4.4).

Three complete systems were modelled. The first model was for the 3-inch carbon steel filter effluent transfer line from Plant 8 to tanks F1-25 and F1-26 in Plant 2/3. The second model was for the 3-inch carbon steel neutralized and diluted UNH transfer line from tanks F1-25 and F1-26 in Plant 2/3 to Plant 8. The third model was for the 3-inch stainless steel UNH transfer lines from the various UNH tanks to the F1-25 and F1-26 tanks. Additional models of portions of the 3-inch stainless steel UNH transfer lines were made to represent the specific configurations needed for the transfer of UNH from individual tanks. The models included heat tracing and insulation as defined by section 15060 of the Performance Specification identified in Attachment B.

The piping systems were evaluated at a pressure of 150 psi and temperatures of 50°, 150°, and 250° F for piping material properties identified by specifications and procurement documents. The stresses in the line containing

4. **DISCUSSION OF KEY ISSUES** (cont.)

4.2 **Piping Stress Analysis** (cont.)

the failed weld was also calculated at 350°, 450°, and 550° F in order to fully define the effects of thermal expansion (Attachment E-2). Additional calculations were generated to confirm any changes needed to reduce stress levels.

The stress analysis data (see Attachment E-8, Volume 2) indicates that the as-installed piping system does not meet ANSI B31.3 code requirements. Portions of the piping were improperly constrained and could exceed the code allowable stresses (from thermal expansion forces). In addition, a number of U-bolts on pipe supports could experience thermal expansion loads above their rated capacity.

Based on the stress analysis and as-built data, the problem was caused by the use of "Support Tight Fit" U-bolts on the pipe in places where a U-bolt "Guide Loose Fit" should have been installed (see drawing number 92X-5900-P-00066, Detail 3). Simply stated, the pipe was tightly clamped in places where it should be allowed to move freely along its length. Current efforts are under way to eliminate unnecessary clamping.

The maximum calculated stress in the area of the failed weld was 10,500 psi which corresponds to a minimum wall thickness requirement of 0.053 inch. This stress level was calculated using the combined loads from dead weight, internal pressure, and thermal expansion. The resulting stress value is well below the Code allowable stress of 41,600 psi.

One material discrepancy, discovered during the review, was included in the stress analysis. The use of seam welded pipe in the carbon steel piping limits the allowable stresses to 85% of the seamless pipe that was specified. This would not be a problem for this application because the wall thickness specified (and installed) was more than adequate for the service, 0.216 inch actual versus 0.120 inch minimum wall required.

The piping stresses in the area containing the failed weld were reviewed as part of the failure investigation. The results of the stress analysis indicate that this area was not subject to high stresses based on the pipe wall thickness specified and installed. The tight fit U-bolt supports actually decreased the stress levels due to thermal expansion in this area.

4. **DISCUSSION OF KEY ISSUES** (cont.)

4.3 Secondary Containment (Confinement)

The design review team in conjunction with DOE determined that double-walled pipe or pipes contained within a secondary confinement structure were required for the UNH Neutralization project. Division 13, Special Facilities of DOE 6430.1A applies to all nuclear facilities. The UNH Neutralization Project meets the criteria for a Nonreactor Nuclear Facility based upon total uranium inventory compared to DOE-STD-1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports.

As a result of this review (both interviews and team consensus) it was determined that secondary confinement is a requirement which was only partially incorporated and was not formally waived prior to constructing the UNH Neutralization system. (see Section 1300-7.4 of DOE 6430.1A, Attachment E-3) The only documented discussion of the exception was presented in Section 2.12.1 of the SAR. In the SAR, it was stated that portions of piping not within secondary confinement were considered adequate based on administrative control, compliance with Ohio Administrative Code (OAC 3745-66-93), and surface water runoff in the area flows to a pH monitored manhole which connects to Storm Water Retention Basin.

4.4 Welding Verification

The design for UNH piping system specified that the requirements of ASME B31.3 be met. A weld in a carbon steel pipe section failed and several others were examined and found to contain similar deficiencies, thus raising concern about the quality and integrity of other welds in the carbon steel piping sections. This concern also is related to confirming high integrity of the entire UNH piping system which is necessary to obtain a waiver from secondary confinement.

An independent weld failure analysis (Attachment E-4) was used to determine the cause of the weld failure and the likelihood that other welds would fail. The primary cause of weld failure was attributed to poor weld quality due

4. DISCUSSION OF KEY ISSUES (cont.)

4.4 Welding Verification (cont.)

to improper fit-up, tightly butted root faces, and extensive lack of penetration. The resulting weld (thickness) was inadequate to handle stresses exceeding normal thermal expansion stresses calculated by the stress analysis of the piping (see Section 4.2).

4.5 Heat Tracing

The UNH piping system was designed and installed with steam and electric heat tracing to avoid freezing in cold weather operation. Field inspections have raised a concern over the steam pressure level (and resulting temperatures) being used to heat the lines. The original design specification called for the piping system to be heat traced with 80 psig steam (340° F). A field change was implemented tying the steam tracing directly into the 150 psig steam main (saturated steam temperature 366° F). The temperature difference between 80 pound and 150 pound steam is not seen as a significant factor since the resultant heat flux (BTU input per foot of pipe) increases approximately five percent.

The heat flux generated by steam tracing should be regulated by temperature, time of application, or both. The uncontrolled application of heat from high temperature (300° F +) steam tracing to liquid filled pipe lines in a prolonged no-flow condition could cause the liquid to vaporize and eventually abruptly return to the liquid phase, potentially creating a severe system shock from a condensation induced water hammer.

4.6 UNH Pump Change to Double Diaphragm

The progressive cavity pumps which were initially specified and procured for use on the UNH Neutralization Project were found to be defective. These pumps were returned to their manufacturer for repair or replacement. Due to schedule restraints management decided to substitute available double diaphragm pumps for the progressive cavity pumps.

4. DISCUSSION OF KEY ISSUES (cont.)

4.6 UNH Pump Change to Double Diaphragm (cont.)

Letter No. C:RSO:(FP):94-0002 dated October 21, 1994 (Attachment E-5) provided direction to PARSONS to redesign any piping and instrumentation changes required for the pump substitution. PARSONS responded by producing sketches for the double diaphragm pump hookups and specifications for their associated instrumentation (Attachment E-5).

A review of the capabilities of the double diaphragm pumps was conducted concurrent with pump installation and testing. The letter PARSONS ID#:04:119:223:0545-94 (Attachment E-5) transmitted the results of this comparison. Diaphragm pumps were considered to be suitable for the UNH system.

Upon review of the chain of events associated with the pump substitution, it was determined that the double diaphragm pumps were installed and were being tested prior to engineering justification and subsequent identification of system impacts, i.e., pulsation forces on supports, piping, and control instrumentation. Specific areas of concern included changes to the control and instrumentation, mounting of the pump due its reciprocating action, and confirmation of pump nozzle loadings.

4.7 Control Philosophy/Instrumentation Design Basis

The initial design basis specified numerous automatic controls to prevent accidents or spills during transfer, mixing, neutralization, and filtering of UNH solutions. Changes occurred during field construction based on FCRs, however, the control philosophy and design basis were not updated prior to installation and testing of the double diaphragm pumps. Efforts are currently underway to formally update both of these items.

Upon substituting the double diaphragm pumps for the progressive cavity pumps, the progressive cavity pump skid and associated instrumentation was utilized without reevaluation of the design which would have evaluated the operating characteristics of the pump.

4. **DISCUSSION OF KEY ISSUES** (cont.)

4.7 Control Philosophy/Instrumentation Design Basis (cont.)

The flow totalizer which provides flow indication and batch control was part of the skid which was retrofitted for application with the double diaphragm pump. A pressure transducer was installed in the air exhaust of the pump to generate a signal for each stroke of the pump.

It was observed during the System Operability Test that at low pressures (low flow conditions) the flow indication was erratic.

The change of pumps from progressive cavity to double diaphragm has a major impact on the control philosophy. Air-driven diaphragm pumps will not have the same flow control characteristics as variable speed electric pumps. The simple transfer of UNH solutions between tanks can be safely accomplished with proper flow control of diaphragm pumps.

It was determined that schedule constraints drove the installation and testing of the double diaphragm pumps prior to complete and integrated engineering evaluation and establishment of a revised control philosophy and design basis.

4.8 Vendor Deliverables - Material Conformance

A subteam was chartered to review documentation of procurements. The process for review and approval of Field Change Requests (FCRs) was reviewed with the PARSONS UNH Neutralization Project Manager.

The FCRs are initially reviewed and approved using a yellow Routing Card and then the FCR is returned to FERMCO. The interdisciplinary review and approval by PARSONS (PARSONS Procedure ENG-21, Section 7 Requirements) is completed at the time the FCR is incorporated into a drawing. PARSONS does not perform interdisciplinary review of FCRs from sketches. For the UNH Project, it was stated that the first 55 FCRs were incorporated in the revised drawings approved on 12/14/94. These FCRs spanned a time from 4/20/94 to 11/15/94. This would indicate that FCRs were being incorporated into the constructed facility prior to the interdisciplinary review required by Procedure ENG-21. It was concluded that the technical interface between PARSONS and FERMCO is not fully developed and programmatic implications should be reviewed by the FERMCO COR.

4. **DISCUSSION OF KEY ISSUES** (cont.)

4.8 **Vendor Deliverables - Material Conformance** (cont.)

A review of material conformance to the design specifications also raised some concerns. Material specifications, purchase orders, receiving inspections, and vendor submittals were reviewed to confirm that materials received and installed in the UNH Neutralization system, particularly piping, met the design specifications.

Comparisons were made to determine:

a. whether the Purchase Order as written (which was generally taken verbatim from the Purchase Requisition) adequately described actual Specification requirements (language),

b. whether the Purchase Order as written adequately addressed documentation deliverables as required by the Specification,

c. whether the vendor's shipping invoice (packing list) adequately described the items shipped so as to verify Purchase Order requirements,

d. whether the vendor supplied documentation adequately fulfilled documentation deliverables as required by the Purchase Order (lesser design importance, but still of procurement significance)

Items (a) and (b) were undertaken in conjunction with FERMCO Acquisitions while (c) and (d) were coordinated through the PARSONS discipline engineers.

There were 267 Purchase Orders written for the UNH Neutralization Project through 1/11/95. At present, a summary review of all 267 Purchase Orders evidence only two (2) which represent out of specification material (ERW carbon steel pipe). A thorough review of each Purchase Order is in progress, the current results of which are presented in Attachment E-6. Identified concerns are related to the adequacy of procurement documentation and vendor documentation submittals.

4. DISCUSSION OF KEY ISSUES (cont.)

4.9 Operability/Maintainability Issues

Several concerns were raised about operability and maintainability of the UNH system as a result of field walk-through by several members of the design review team. These concerns include OSHA recommended access to valves required for operations, and piping sections requiring a means of draining UNH solutions between transfer operations.

The location and access to the instruments and controls are adequate considering the temporary nature and duration of the planned operation. Maintenance activities on top of the tanks require personnel to be tied off in a full body safety harness. The placement of certain shutoff valves is less than optimum requiring scaffolding, extended chain operators, etc. to actuate them. The limited number of operational cycles anticipated during the life of the project makes it difficult to justify repositioning the valves in the lines or constructing permanent steel platforms for improved access. There does not appear to be a discrepancy with the SAR, however reviews should be conducted per the Unreviewed Safety Question (USQ) section of the SAR.

The portion of the UNH transfer line that may be regarded as an undrainable dead leg without opening the valve to the tank is due to the location of the valve approximately thirty-four feet from the branch connection. Insufficient pitch to the origin of the branch connection may allow the pumped fluid to collect in the branch piping.

5. Findings

The following presents a summary of the findings of the review. Corrective actions are to be developed and implemented to resolve the concerns raised by the findings.

- Safety Analysis Report
  - No significant findings based on draft furnished to team, Rev. 1 draft, dated January 1995.

5. Findings (cont.)

Safety Basis Versus Design Comparison

The system and process as designed appears to be within the safety basis as described by the Safety Analysis Report, however, there are differences between the system description in the SAR and the actual design that need to be addressed.

Significance of Batch Concentrations Versus the SAR

The 100 gram per liter uranium concentration is a parameter established to maximize efficiency of the process and does not affect the safety basis for the UNH project.

Comparison of SAR System Descriptions to Detailed Design

There are discrepancies between the system description in the SAR and the actual design and these differences need to be addressed.

Note: The version of the SAR provided to the design review team was not under CM control in accordance with UNH Neutralization Project Configuration Management Instruction, dated December 1994.

- Piping Stress

  - Certain systems are unnecessarily constrained which potentially could exceed allowable code stress limits.

  - Allowable pipe stresses were not exceeded in the area of the weld failure. The weld failure was not caused by normal operating stresses from things like thermal expansion alone.

5. **Findings** (cont.)

- Secondary Containment (Confinement)

  - Secondary containment, determined to be a DOE Order 6430.1A requirement through discussions with DOE, was only partially incorporated and was not formally waived prior to constructing the UNH Neutralization system.

  - Portions of piping not within secondary confinement were considered adequate based on administrative control, compliance with Ohio Administrative Code (OAC 3745-66-93), and surface water runoff in the area flows to a pH monitored manhole which connects to Storm Water Retention Basin.

- Welding Verification

  - Weld failure is attributed to poor weld quality due to improper fit-up, tightly butted root faces, and extensive lack of penetration. This resulted in inadequate weld thickness over most of the weld length. When subjected to the most probable combination of thermal expansion and condensate induced water hammer and/or thermal shock, it cracked. A significant observation was that the crack stopped where full penetration (thickness) of weld existed.

- Heat Tracing

  - The change from 80 psig steam to 150 psig steam was not significant. A field measurement of temperature was taken.

5. **Findings** (cont.)

- UNH Pump Change

  - The double diaphragm pumps were installed and were being tested prior to adequate engineering justification and design evaluation of impacts to the support and control system.

- Control Philosophy/Instrumentation Design Basis

  - Schedule constraints drove the installation and testing of the double diaphragm pumps prior to complete engineering evaluation and formal establishment (see Plan of the Day 5 and 7, Attachment D) of a control philosophy and design basis.

- Vendor Deliverables - Material Conformance

  - Field changes were not being controlled.

  - Purchase Order documentation and vendor submittals were not in compliance with specifications.

  - The majority of purchase orders had incomplete or missing documentation.

  - Two (2) out of 267 purchase orders evidenced receipt of out of specification material.

- Operability/Maintainability

  - No significant safety issues were observed.

  - Operability and maintainability input to the design process should be improved.

ATTACHMENT A
AUTHORIZATION AND TEAM QUALIFICATIONS

Fernald Environmental

FERMCO

Restoration Management Corporation

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INTEROFFICE MEMORANDUM

To:	Bob Heck	Date:	January 18, 1995
Location:	Springdale, MS 81-3	Reference:	None
From:	Dave Brettschneider	FERMCO #:	M:RSO:(FP):95-0019
Location:	Fernald, MS 52-5	Client:	DOE DE-AC24-92OH21972
Extension:	738-6101	Subject:	Request for a Design Review of the UNH Project

c: File Record Storage Copy 106.4.10.11
Jim Thiesing, MS 2

In accordance with our previous discussions, I am formally requesting that the Engineering Division perform a design review of the UNH project to ascertain the following:

1) Adequacy of the design specifications
2) Accurate translation of design specifications into procurement documents
3) Procured materials meet specification requirements
4) As-built configuration of the UNH facility meets design requirements

The primary drivers for the design review will be RM-0012 Quality Assurance Program Description and the Engineering Division Policy and Procedures Manual.

Please use the necessary resources to ensure the execution of the above requirements.

DJB:dsm

FS-F-3934 (11/28/94)

6587

Fernald Environmental
FERMCO
Restoration Management Corporation P.O. Box 398704 Cincinnati, Ohio 45239-8704 (513) 738-6200

January 6, 1995

U. S. Department of Energy
Fernald Environmental Management Project
Letter No. C:OP:95-0019

Mr. Jack R. Craig, Director
Department of Energy
Fernald Area Office
P. O. Box 538705
Cincinnati, Ohio 45253-8705

Dear Mr. Craig:

CONTRACT DE-AC24-92OH21972, UNH DESIGN REVIEW TEAM

As a result of UNH system design problems which have been encountered, I have commissioned a complete design review of the UNH project. The major activities are: "As-Built" confirmation of the field installation; review of drawings and specifications; identification of key issues; recommendations for change; and finally, the updating of the design documents to reflect the preferred installation.

After the completion of this activity, we will proceed to make the appropriate changes in the design documents and system physical configuration.

We have also changed the project engineer on the project to a senior individual who has a nuclear power background and has been at the site for several years.

We are assembling a team of independent experts for the review of this project. The team is already active in the "as-building" activity and review of current documents. We have included on the team three individuals from the Fluor Daniel Corporation (two from Irvine and one from Chicago) with specific relevant experience in nuclear material liquids handling. The activities of the team are summarized on the page attached.

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FERMCO
Restoration Management Corporation

Mr. Jack R. Craig
Letter No. C:OP:95-0019
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We share your concern over the current condition of the design aspects of the project. We will keep your team members involved and aware of our activities during the next few days.

If you have any questions, please feel free to call me at (513) 648-3313.

Sincerely,

J. W. Thiesing
Deputy President

RPH/JWT:kmb
Attachment

c: D. J. Brettschneider
R. P. Heck
A. E. Hunt
R. E. Kline
D. Ofte
L. E. Parsons, DOE Contract Specialist
M. K. Yates
File Record Storage Copy 102.1

DESIGN REVIEW TEAM

- Assembling a team now to do design review
- Now walking down existing piping and preparing isometric sketches to reflect construction as-built
- Develop a model for pipe installation, support and equipment
- Run pipe stress program to analyze for potential areas exposed to unallowable stress
- Review and revise heat tracing system as required
- Validate the system design and final installation with independent review team
- Verification of (as-built) condition with design documentation
- Team members are:

Robert Heck	FERMCO Engineering
Bill Kortier	FERMCO Engineering (now PE for UNH)
Ken Roberts	Fluor Daniel Power, Chicago
Ron Worsley	FERMCO Engineering
Craig Miller	FD Nuclear Material Liquid Handling, Irvine
Harry Kortnicki	FD Nuclear Material Liquid Handling, Irvine

Robert P. Heck, II

Experience Summary:
Mr. Heck is currently Vice President of Engineering for FERMCO, the managing contractor for the DOE's - Fernald Project Site. This position includes responsibility for all capital, facilities, and remediation design. It includes projects, as vitrification, drying, soil washing, landfills, Advanced Waste Water Treatment, removal actions, etc. He also served in numerous senior management positions with responsibilities spanning all environmental, engineering, construction, operations and maintenance disciplines. Mr. Heck brings twenty-two years of experience to this position with more than 15 of those in project and operations management.

Related Experience: With *Fluor Daniel (1979 - Present)*, Mr. Heck has functioned as Corporate officer, Project Manger, engineering manager with increasing responsibilities in the broad spectrum of Fluor Daniel projects. Mr. Heck has managed five regional environmental operations offices which perform a full scope of characterization, regulatory, design evaluation and design and construction implementation of preferred alternatives for solving environmental challenges. During that time, his responsibility included more that $200,000,000 worth of projects including more than 100 active sites involving more that 30 superfund sites requiring RA's, RI/FS's and RD/RA and RIFS oversight as well as more than 70 non-CERCLA sites involving PA's Site Discoveries and Site Inspections. Many of these sites were included in an ARCS contract for Regions VI, VII, and VIII. These projects utilize a wide spectrum of technologies including RCRA landfill design, incineration, solidification, bioremediation, ground water pump and treat, decontamination and dismantling, soil venting, and sludge treatment, for the remediation of hazardous. nuclear, and mixed waste contamination. This management responsibility for North American operations involved between 200 to 400 people at any specific time. It also includes the management of numerous subcontractors as part of the cleanup activities. Mr. Heck has directly engineered and managed environmental projects which included regulatory activities, waste minimization, waste treatment, and material processing. Mr. Heck has designed and managed the design of air, water and solid waste treatment systems, utilizing fermentation, separation, solvent recovery, purification, dust control and adsorption technology as well as other relevant process approaches used in environmental treatment plants. He has directed soils and topographic surveys, designed test well layout programs and supervised their installation and use.

Mr. Heck has also functioned as the Vice President of Fluor Daniel's 750 person Operations Center in Chicago with responsibilities for providing all engineering and administrative support for environmental, power, biotech, pharmaceutical and other Corporate projects. Among these projects were three superfund sites and numerous front-end consulting projects. Prior to this he directed the Heavy Industry and Manufacturing services projects which included 15 projects totalling more than $100,000,000 such as the performance of operational maintenance and upgrade for fuel fabrication facilities for Westinghouse (as a client) and project/construction management of $40,000,000 TV Glass facility for Corning Glass.

Mr. Heck has also managed a project office in Cincinnati, successfully providing more than $200,000,000 worth of engineering and construction services to a single client. He also

managed 3 regional offices, 2 project offices and 5 sales offices with a total organization of 350 people and projects with installed cost of $100,000,000 annually prior to has relocation to Cincinnati. He also created and managed, as the President, a Fluor Daniel services company to provide professional personnel to clients on a fast, as needed basis.

While at ***Mason & Hanger, Silas Mason Co. (1972-1979)*** he was head of the Environmental Department responsible for numerous environmental programs including the development of newly patented processes for oxidation, coagulation, dewatering and membrane separation. He was the Project Design Manager for permitting of all air, water, and solids waste treatment systems, pollution control systems for the Mississippi Army Ammunition Plant. He was Project Design Manager over Title I, II and III design services for 7 waste water treatment facilities for organic wastes at three ammunition plants. He was responsible for all aspects including planning, scheduling, and managing all engineering activities for lump sum fees. These projects included concept studies, treatability studies, economic feasibility studies and title I and II design and title III engineering service during construction and startup for the required wastewater treatment plants. These projects included collection, equalization, cooling, filtration, adsorption, and recycle of treated waste water where possible.

While at Mason Hanger, he also designed solvent storage facilities, underground tank farms and pumping stations including soils studies and monitoring wells. Title I and II tank farm designs, drainage and pipelines. His earlier work as a project engineer included dust abatement designs for portable asphalt plants, rock crushers and drills. These systems included dust suppression, water supply, collection and recycle, and solids removal. These early assignments included pH control systems, storage and piping systems and development of installation details for low BTU gasfires. He designed systems for treating organometallic waste waters and developed a program for evaluating ozonation with UV light, wet oxidation and carbon adsorption. he has developed vapor recovery systems, air filtration systems and systems for processing the byproducts of metal planting facilities.

Throughout his twenty-two years of environmental design and construction management he has directed or supported the regulatory support necessary to make each of his programs a success. Therefore his expertise includes RFI's, RI/FS's, Environmental Assessments and all the ancillary permitting activities required to build and operated the many facilities and processes discussed above. He is familiar with EPA regulations under RCRA, TSCA, CERCLA, SARA, and NEPA. He has prepared air and water quality permits. He is knowledgeable in the use of laboratories and laboratory processes having developed testing protocols for numerous environmental challenges.

Education:
MS Civil/Environmental Engineering, Texas A&M University, [redacted]
BA Chemistry, Elmhurst College, [redacted]

Professional Development and Achievements:
Registered Professional Engineer in eight states, numerous continuous education classes and technical papers, responsible for Environmental Services Business Unit Excellence and FD TQM programs for all North American operations.

William E. Kortier
[redacted]

General Background:

Over thirty years experience in coordination and management of high technology projects. Presently Manager of Engineering Design responsible for the direction of the environmental remediation and restoration of a former DOE production facility contaminated with both radioactive and nonradioactive hazardous chemical waste products. Have held a number of management positions at the Westinghouse Nuclear Systems Divisions monitoring the direction of projects which included the design, construction and startup testing of Nuclear Steam Supply Systems (NSSS) for commercial plants; implementation of a standardized approach to licensing of nuclear power plants and the application of risk assessment to nuclear plant safety. Also directed the development of isotope fueled auxiliary power supplies for space applications and coordinated the startup and operation of a test reactor.

Job Experience:

Fernald Environmental Restoration Management Corporation

1992 to Present: Manager, Remediation Design Engineering Department Supervise engineering staff of 70 people assigned to environmental restoration projects defined by CERCLA/RCRA Units. Site technical expert for establishing the standards and requirements for engineering design which satisfy EPA (CERCLA), DOE Orders and a court ordered consent decree for the Fernald Project. Responsible for the staffing and development of procedures to define the engineering design function for the total restoration of the facility.

Westinghouse Environmental Management Company of Ohio

1988 to 1992: Manager, RMI Program Designated Contracting Officer's Technical Representative (COTR), which included planning and technical direction of subcontracts with RMI Titanium Company, R. M. Parsons architect engineers, and others as required to implement project goals. Responsible for formulating DOE required Five-Year Environmental Restoration and Waste Management Plan. The $136M project required the application of environmental restoration regulations and delicensing guidance provided by the EPA, NRC, and DOE and involved upgrades to existing quality assurance, training and waste management practices. Participated in congressional meetings to present the DOE position regarding weapons facilities shutdown and planning strategies for site restoration. Other responsibilities included shipment of Low Level Waste (LLW) to the Nevada Test Site (NTS) and treatment and disposal of mixed wastes.

Westinghouse Electric Corporation, Nuclear Energy Systems

1984 to 1988: Manager, Midland and West Region Nuclear Projects Supervised project managers located at the Westinghouse Energy Center and plant construction site. Developed organizational arrangement to maximize effectiveness of NSSS supplier in completing projects in Illinois (Commonwealth Edison), Texas (Houston Lighting & Power), and Tennessee (TVA) with direct reporting project staff of 30 people. Managed $1B in base contracts plus contract "up sales" of special engineering services (peak year 100M). Introduced field application of Computer Aided Design (CAD) to expedite certified engineering. Also developed business plan for privately financed consortium to acquire Marble Hill Station including a Project Plan for turnkey completion of design, construction, and licensing; analysis of service area sales revenues and cash flow to the project. In formulating the Plan, interfaced with special consultants to Governors office, investment banking firms, and legal counsel.

1972 - 1984: Manager, Commonwealth Edison Projects Overall responsibility for NSSS's during construction phase of Zion station, including ACRS review, public hearings, plant start-up, and testing. Both Zion reactors achieved commercial status within one year after start-up, with total project completion time under six years. Successful execution of the Zion Reactor Projects led to the sale of 4 additional NSSS's to Commonwealth Edison. Additional responsibilities/achievements during this assignment included participation in 3-year standardization plan to achieve design replication under NRC rules, an approach which was utilized in the licensing of a number of nuclear plants. Also led Westinghouse team in performing Probabilistic Risk Assessment (PRA) relating to nuclear plant accident consequences.

1970 - 1972: Senior Project Engineer Coordinated the design, licensing, and early construction of Cook and Zion stations (first generation of 1000 MWe plants). Contributed to Final Safety Analysis Report (FSAR) preparation and licensing defense.

Battelle-Columbus Laboratories

1963 - 1969: Successive assignments as Senior Research Engineer, Assistant Division Chief, and Division Chief, Materials Systems Engineering Division. As Division Chief, headed staff of 30 with diverse responsibilities including the direction of major R&D contracts involving isotope-fueled thermoelectric generators, design of nuclear handling equipment, measurements laboratory, library of computer programs, and the transport of spent reactor fuel.

The Martin Company, Nuclear Division

1961 - 1963: Assistant Project Engineer, SNAP-13 Participated in design and development of lightweight isotope-fueled thermionic power supply for use in space applications.

National Aeronautics & Space Administrative (NASA), Plumbrook Reactor Facility

1958 - 1961: Program Coordinator, for Plumbrook Materials Test Reactor
Responsible for on-site coordination of start-up of materials testing reactor facility. Special assignment as training officer for non-professional staff and for support of public information program.

Memberships, Patents, Publications:

Member, Sigma Pi Sigma (Physics, honorary) and American Nuclear Society
Patent on Thermoelectric Module
Several published articles, including "A Program Plan for Analyzing Severe Accidents"

Education:

[redacted] BS Capital University, Columbus, Ohio - (Physics)
MS Ohio University, Athens, Ohio - (Physics)
- Present Attended a number of reactor technology, business management, and environmental laws and regulations courses.

PROFESSIONAL SUMMARY

KENNETH T. ROBERTS

LEAD MECHANICAL ENGINEER

EDUCATION:
B.S. in Mechanical Engineering, University of Oklahoma

PROFESSIONAL LICENSES:
Professional Engineer, IL
Professional Engineer, IA
Professional Engineer, CT

PROFESSIONAL SOCIETIES:
American Society of Mechanical Engineers (ASME)

SIGNIFICANT EXPERIENCE IN THE FOLLOWING INDUSTRIES:

Nuclear Facilities	Fossil Power
Gas Turbines	Environmental

SUMMARY OF EXPERIENCE

Mr. Roberts has over 28 years of experience in the mechanical/nuclear field. He has worked in mechanical and project engineering assignments and has been both an engineering and project manager. For the past 16 years, Mr. Roberts has been involved in modifications to existing nuclear and fossil plants. Prior work includes industrial plants, gas turbine installations, and hydraulic system testing.

FLUOR DANIEL, CHICAGO, ILLINOIS (1988 to Present)

SUPERVISING ENGINEER

Millstone Unit 2 - SGRP	Northeast Utilities Company
(Steam Generator Replacement Project)	Chicago, IL and Waterford, CT
1990 - Present (1993)	
Large	Home office and On-site
Closed shop	Lump Sum (Guaranteed Maximum)
EPC	

Lead mechanical engineer for the steam generator replacement at Millstone Station Unit 2. Responsible for all home office and field mechanical engineering activities, from development of procedures to design and procurement of equipment for new systems. This included planning and scheduling, tracking progress, cost control, estimating scope change costs and line management of the engineering-design work, plus coordinating the engineering-design activities with the client, preparing monthly progress reports and giving technical briefings to the client. In this capacity, he interfaced directly with Northeast Utilities personnel in engineering, operations, nuclear records, Q.A., maintenance and construction.

Zion VETIP
(Vendor Equipment Technical Information Program)
1988-1989
Small
Closed shop
Engineering

Commonwealth Edison Company
Zion, IL

On-Site
Reimbursable Cost

Lead Engineer of an on-site task force for the development of a Vendor Equipment Technical Information Program designed to satisfy the requirements of the NRC, INPO and station personnel. Responsible for the preparation of a station procedure defining the program, initiation of a computer program to store and retrieve information on the program manuals, identification of interfaces (personnel and/or groups) needed to obtain and to share the information used in the program, and refinement of the process to produce controlled vendor manuals for use by client personnel (maintenance, operation, analysis and/or modification).

FIELD ENGINEER

Kewaunee SSFI Resolution
(Safety System Functional Inspection)
1989-1990
Small
Closed shop
Engineer

Wisconsin Public Service
Kewaunee, WI

On-Site
Reimbursable Cost

Performed technical evaluations of items identified during a safety system functional Inspection of the closed cooling water system at the Kewaunee Nuclear Power Plant. Identified options for addressing the SSFI items, consulted with station and/or corporate personnel, recommended dispositions, and wrote responses to the SSFI report issues.

Kewaunee OEA Processing
(Operating Experience Assessment)
1989
Small
Closed shop
Engineering

Wisconsin Public Service
Kewaunee, WI

On-Site
Reimbursable

Performed technical evaluations on a series of Operating Experience Assessment (OEA) issues as part of a short term, fast track assignment to assist a client in eliminating a backlog of OEA's. Also identified options for addressing the issues involved, consulted with the appropriate station and/or corporate personnel, recommended dispositions, and expedited the disposition process.

CYGNA ENERGY SERVICES, CHICAGO, IL (1987 to 1988)

MECHANICAL SECTION MANAGER, CHICAGO OFFICE

Responsible for supervising the technical work of the Chicago office mechanical staff. In this capacity, Mr. Roberts recruited, trained, and lead a group of mechanical engineers, providing systems design and equipment specification support on a broad range of projects.

Mr. Roberts was also the Client Manager for two clients: Commonwealth Edison Company (Zion Station projects) and Iowa Electric (Duane Arnold Energy Center projects). This responsibility included developing new work and overseeing all of these clients' projects to ensure client satisfaction.

CATALYTIC, INC. (1976 to 1987)

PROJECT MANAGER

Prior to joining Cygna, Mr. Roberts worked at Catalytic, Inc. and its successor, Stearns Catalytic Corp. for 10-1/2 years. He started as a Principal (Mechanical) Engineer and progressed through Lead Engineer, Project Engineer, and Engineering Manager to the position of Project Manager. He worked on a variety of projects ranging from feasibility studies for utilization of the exhaust gas fuel value from carbon black plants to the comprehensive design of (and project management for) a complex chemical handling and processing facility to support the chemical cleaning of the primary system of a nuclear power plant. He has extensive experience with backfit modifications for nuclear power plants (to change existing systems or to add new ones).

FLUOR PIONEER (1974 to 1976)

MECHANICAL ENGINEER

Responsible for mechanical design, analysis, specification, and system engineering on fossil and nuclear power plant projects, he also performed field engineering, acceptance testing, and start-up support services.

TURBO POWER & MARINE SYSTEMS (1969 to 1974)

MECHANICAL ENGINEER

Responsible for field check out, start-up, testing and training of operating personnel for gas turbine installations, he also directed the field developmental testing group responsible for in-service evaluation of new components and systems.

THE BOEING COMPANY (1965 to 1969)

MECHANICAL ENGINEER

Responsible for developmental testing of aircraft hydraulic systems and components, he developed test procedures, designed test fixtures, conducted tests, prepared test reports, and managed test program budgets and schedules.

RONALD C. WORSLEY

[redacted]

SUMMARY

A Mechanical Engineer (BSME) with thirty-two years experience in technical and project management, engineering design, specification and startup of major equipment and processes. Heavy emphasis in the areas of construction management, plant engineering, facilities design and maintenance. Knowledgeable in regards to troubleshooting and maintenance requirements for mechanical, civil and electrical systems.

EXPERIENCE

MARCH 1983 - PRESENT FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

Manager ***September, 1994 - Present***
Facilities Engineering Department

Directing the activities of the Engineering Support Section, CADD Services Section, Project Management Section and Maintenance Engineering Group within the Facilities Engineering Department.

Manager ***May, 1991 - September, 1994***
Engineering Support

Handled planning, staffing, directing, organizing and controlling to assure the Engineering Support Section provided successful technical support to the Managing Contractor and the Department of Energy. Directed the section personnel to provide preliminary and design engineering on technically diverse tasks, performed design reviews, prepared cost estimates and reviewed vendor submittals. Established work assignments for the group and actively participated in all phases of the engineering effort.

Senior Project Engineer ***April, 1989 - May, 1991***
Environmental Engineering

Responsible for scope development and related technical evaluations for the five operable units for the ERA project. Prepared the CDR for the engineered waste storage facility. Engineering support for the thorium overpack project, storm water retention system, manhole 180 cleanup, Silo 4 demolition specifications. Designed and evaluated Low Level waste shipping containers, load capacity and safety studies for rigging and material handling equipment. Prepared the RCRA Waste Storage Plan.

Senior Project Engineer *April, 1985 - April, 1989*
Plant Engineering and Technical Services

Responsible for line item and special projects. Developed portable HEPA filter Plant 8 4A Project - Airborne contaminant control radiation exposure reduction. Responsible for technical support, design reviews, Biodenitrification project. Designed Plant 5 and 9 dust collectors, utilities upgrade CDR. Developed hoist and crane inspection program. Major contributor to the 4A project support, work order procedure development. Prepared site process flow sheets.

Project Engineer *March, 1983 - March, 1985*
Engineering Division

Responsible for the specification, procurement, installation and startup of equipment involved in the conversion of feed materials into uranium metal for the U. S. Department of Energy. Project for the design and construction of a new billet casting and machining operation within existing facilities. Designed special material handling systems, pollution abatement equipment, procured machine tools and developed material flow and equipment layouts. Responsible for the design and implementation of remedial measures to contain airborne emissions of radioactive particulates from existing operations. Designed, procured and started up $5 million worth of equipment in the renovation of an existing heavy metals processing facility. Responsible for the preparation of all mechanical and electrical equipment specifications and installation drawings.

JULY 1962 - DECEMBER 1982 *THE PROCTER & GAMBLE COMPANY*

Mechanical Manager *December, 1969 - December, 1982*
Manufacturing Division

Responsible for the management of various large building construction projects, materials handling systems and equipment maintenance programs. Resident Engineer for the installation of a new $4.4 million interplant conveyor system consisting of 2,500 feet of structural bridges and over 13,000 feet of conveyors and mechanized case handling equipment. Managed the construction activities for the installation of a $2.5 Million truck staging area and maintenance facility. Supervised two engineers working on the same project. Acted as Plant Safety Engineer and managed the Employee Services Program in a plant employing 250 people.

Resident Engineer *November, 1965 - August, 1967*
Engineering Division/Pulp & Paper

Provided technical services support for various plants engaged in the conversion of pulp to paper products. Achieved 25% production increases at the Green Bay and Cheboygan plants as a result of the design, installation and startup of new tissue making equipment.

Process Engineer *July, 1962 - November, 1965*
Engineering Division/Thermal Power

Involved in the design of piping and auxiliaries for various boiler projects. Responsible for the piping design, flowsheet preparation and management of field construction personnel for the erection of a 400,000 lb/hr steam boiler and turbo generator.

CRAIG E. MILLER

LEAD MECHANICAL ENGINEER

EDUCATION:

B.S. in Engineering, [redacted]
M.S. in Mechanical Engineering, [redacted]
California State University
Fullerton, California

PROFESSIONAL REGISTRATION:
Professional Engineer,
California No. 19017 (1978)
Community College Instructor Credential,
California No. 211 MIL 001 (1976)

Mr. Miller has 22 years of varied mechanical engineering experience in conceptual design, front end engineering, and detail design for a wide variety of process plants such as synfuels, gas separation, crude oil refining, chemical fertilizer, nuclear hot cell operations, uranium enrichment, nuclear fuel reprocessing, raw and wastewater treating plants, liquefied natural gas, and crude oil production platforms.

EXPERIENCE:

- Lead Mechanical Engineer, 1980 to Present, Fluor Daniel, Inc., Advanced Technology Division. Lead engineer for coal gasification enhancement studies utilizing Texaco and Shell gasification processes. Determined equipment optimizations and performed trade off studies for various process schemes. Major equipment included gasifier vessels, syngas coolers, air separation plants, gas turbine generators, steam turbine generators, cooling towers, water treating equipment, separators, scrubbers and various other mechanical equipment items. Participated in numerous studies using proprietary amine solutions for gas scrubbing. Also performed mechanical equipment applications for bio-engineering studies using "bugs" for sulfur removal from process streams. Supervised a group of 40 engineers and designers performing conceptual and detail design on several synthetic fuels plants which were to produce transportation fuels and other products from coal, shale oil, lignite, and other raw materials. Equipment included air separation plants, complete with air, oxygen and nitrogen compressors, process vessels, heat exchange equipment, pumps and miscellaneous processing equipment. Directed the activities of several mechanical engineers on a

RESUME: CRAIG E. MILLER

EXPERIENCE: (Continued)

water washdown and wastewater treating plant for a space vehicle launching facility. Performed conceptual design and detail design for the project. Prepared mechanical equipment specifications and preliminary design and layout data for cranes, hoists, shielding doors and other equipment used for spent fuel cask handling on the Process Facility Modification Project at Hanford, Washington. Other equipment included RR car pullers for positioning casks under the cranes, vacuum pumps, filtration equipment, chemical make-up systems and others.

Also prepared equipment specifications, equipment cost estimates, advanced conceptual designs for modifications to nuclear waste handling facilities at Idaho Falls, Idaho and Richland, Washington.

- Senior Design Engineer, 1979 to 1980, Santa Fe Engineering Services Company. Lead Mechanical Engineer coordinating the activities of five mechanical engineers and 10 designers performing detail front end engineering on offshore oil drilling and production platforms. Determined the manpower requirements and developed the schedule to meet the project completion for these platforms.

- Senior Mechanical Engineer, 1972 to 1979, Fluor Engineers, Inc. Specified mechanical equipment used in crude oil refineries, chemical plants, and other process facilities in the petrochemical field. Included functions were equipment capability analysis, quotation requests, bid analysis, equipment vendor selection and purchase order preparation, drawing review and subsequent engineering work until successful operation at the jobsite.

- Assistant Shipping Manager, West Coast, 1971 to 1972, Great Lakes Carbon Corporation. Coordinated domestic and foreign shipments of petroleum coke, including preparation of customs documents for export vessel and rail shipments. Coordinated and arranged for teamsters, longshoremen, and railway unions for successful loading operations. As shift foreman, supervised employees on rotating shifts operating rotating kilns calcining petroleum coke.

SECURITY CLEARANCES: DOE-Q, DOD-Secret

RESUME: CRAIG E. MILLER

PUBLICATIONS:

Miller, C.E., "Case Study of Regulatory Approaches in Engineering," Proceedings of Society of Material and Process Engineering, San Diego, California, April 1977,

Hines, J.M., Miller, C.E., and Drake, R.M., "Mechanical Equipment Requirements for Inflatable Lunar Structures", Journal of Aerospace Engineering, (American Society of Civil Engineers) Vol. 5, Number 2, April 1992.

HARRY KORTNICKI

PRINCIPAL MECHANICAL ENGINEER

EDUCATION:

B.S. in Mechanical Engineering, [redacted]
University of Colorado
M.S. in Engineering Systems, [redacted]
University of California, Los Angeles

REGISTRATION

Mechanical Engineer, 1978, California

Mr. Kortnicki has 16 years of experience, a majority in DOE nuclear related facility design. This experience has been on a wide variety of projects ranging from fuel enrichment and assembly, waste processing and disposal, and Special Nuclear Materials (SNM) research and development facilities. His experience has encompassed conceptual design, Titles I and II design, and Title III field support. Mr. Kortnicki's major expertise is in the area of system analysis, including extensive experience in operational analysis of plant operations using computer simulation of discrete events logistical systems. He also has experience in computer-based engineering and design (CAD/CAE) applications including 2-D and 3-D CAD, programming, and microcomputer hardware and software. His mechanical experience includes selecting and specifying mechanical equipment such as remote handling equipment, centrifuge-floor module machine mounts, refrigeration and material handling systems.

EXPERIENCE:

- Fluor Daniel Inc., Advanced Technology Division, 1975 to Present. Mr. Kortnicki is currently assigned as a field Project Engineer at the Rocky Flats Nuclear Weapons Plant near Golden, Colorado. Fluor Daniel is upgrading the plant's safeguards and security systems to the requirements of DOE Order 5632.2A, Protection of SNM and Vital Equipment. Mr. Kortnicki is planning and controlling the design activities in the Plutonium Reprocessing and Recovery Buildings (Buildings 771 and 371) at the Rocky Flats site.

  Mr. Kortnicki was Lead Mechanical/Vessel Engineer for detailed design of a new SNM Research and Development Laboratory. He directed the selection and specification of mechanical equipment and vessels and space allocation in heavily congested areas of the laboratory. He also led CAD activities including forecasting and interface control.

MAY 1991

RESUME: HARRY KORTNICKI

EXPERIENCE: (Continued)

Mr. Kortnicki was Lead Mechanical/Vessel Engineer for conceptual design of a permanent waste repository for high level nuclear waste packages to be permanently placed in a deep-mined, underground, salt formation for the High Level Nuclear Waste Repository in Salt Project. He was responsible for the repository simulation model, a primary design analysis tool during the project. He directed the activities of Mechanical, Vessels, and Fire Protection Engineers and Mechanical Designers and prepared and monitored manpower budgets and forecasting. Mr. Kortnicki directed Mechanical Engineering in investigations to formulate conceptual design of plant facilities, including waste receiving, short-term storage, and inspection/repackaging; he directed optimization studies of alternative designs; and defined budgetary cost estimates for capital equipment, construction, and operating costs.

As Material Handling and Mechanical Design Engineer on the DOE Gas Centrifuge Enrichment Plant (GCEP) project, Mr. Kortnicki conducted a comprehensive UF_6 cylinder handling study and authored a study report on the investigation and design of the feed and withdrawal building, which handles all feed and product UF_6 cylinders going into and out of the plant. He specified requirements for cylinder handling cranes to handle the cylinders containing the hazardous material safely and efficiently in accordance with defined government and industry safety standards. He also specified associated cylinder handling equipment, including motorized dollies, hydraulic lifts and high precision accountability scales. Mr. Kortnicki specified and coordinated structural integrity of the centrifuge machine mounts during all operational conditions. He also co-authored a study report on centrifuge handling systems including rigid mast cranes, transporters and tow tractors.

On the New Waste Calcining Facility (NWCF) for INEL, Mr. Kortnicki designed and specified material handling equipment to support the operation and maintenance of contact and remote process equipment. He also performed Title III support activities including vendor bid analysis and shop coordination.

ATTACHMENT B
DOCUMENT REVIEW TYPES

Configuration Managed

Safety Analysis Report

Technical Safety Requirement

Project Order Plan

Design Criteria

Process Flow Diagram 92X-5900-F-00069 Rev. 2 12/14/94

Health and Safety Plan

Design Documents

Specifications

No.	Title	Rev.	Date
00001	Title Page	1	08/19/94
00002	Approval Sheet	1	08/19/94
00003	Table of Contents	1	08/19/94
09900	Painting	0	03/25/94
11501	Scrubber System	0	05/13/94
13400	Instruments & Ctls	1	08/19/94
13410	Pump Skid Instrum.	2	03/29/94
15060	Pipes, Ftgs, Valves	2	08/19/94
15090	Piping Supports	1	03/25/94
15160	Pump Skid Systems	0	02/03/94
15170	Pump Skid Motors	0	02/03/94
15171	Scrubber Motors	0	05/13/94
15250	Insulation	0	03/25/94
15526	Pipeline Heater	1	02/23/94
16050	Basic Elec Matls-PS	0	02/03/94
16051	Basic Elec Mtls/Mthd	0	03/25/94
16052	Basic Elec Mtls/Scrub	0	03/25/94
16170	Grounding and Bonding	0	03/25/94
16462	Dry Transf./Panelbds	0	03/25/94
16483	Var. Freq. Drives	1	03/07/94
16855	Heating Cables	0	03/25/94

ATTACHMENT B
DOCUMENT REVIEW TYPES

Design Documents

Drawings No.	Title	Rev.	Date	
92X-5900-				
X-00070	Title Sheet	0	03/30/94	
X-00071	Drawing Index	4	12/14/94	
X-00072	Legend and Symbols	0	03/30/94	
F-00069	Process Flow Diagram	2	12/14/94	CM
P-00058	Piping	2	12/14/94	
P-00059	Piping	1	12/14/94	
P-00060	Piping	1	12/14/94	
P-00061	Piping	1	12/14/94	
P-00062	Piping	1	12/14/94	
P-00063	Piping	3	12/14/94	
P-00064	Piping	1	12/14/94	
P-00065	Piping	3	12/14/94	
P-00066	Piping	0	12/14/94	
P-00067	Piping	0	12/14/94	
P-00096	Piping	3	12/14/94	
P-00111	Piping	0	12/14/94	
E-00093	Electrical	0	03/30/94	
E-00094	Electrical	0	03/30/94	
E-00077	Electrical	1	12/14/94	
E-00100	Electrical	2	12/14/94	
E-00080	Electrical	1	06/30/94	
E-00101	Electrical	0	03/30/94	
E-00078	Electrical	0	03/30/94	
E-00079	Electrical	2	08/16/94	
E-00081	Electrical	0	03/30/94	
E-00095	Electrical	1	08/16/94	
E-00097	Electrical	1	08/16/94	
E-00098	Electrical	1	08/16/94	
E-00082	Electrical	0	03/30/94	
E-00107	Electrical	0	08/16/94	

ATTACHMENT B
DOCUMENT REVIEW TYPES

Design Documents

Drawings (cont.)

No.	Title	Rev.	Date
92X-5900-			
N-00073	Instrumentation	3	11/26/94
N-00074	Instrumentation	3	12/14/94
N-00075	Instrumentation	4	12/14/94
N-00076	Instrumentation	3	12/14/94
N-00083	Instrumentation	0	03/30/94
N-00084	Instrumentation	0	03/30/94
N-00085	Instrumentation	0	03/30/94
N-00086	Instrumentation	0	03/30/94
N-00087	Instrumentation	0	03/30/94
N-00088	Instrumentation	1	06/30/94
N-00092	Instrumentation	0	03/30/94
N-00089	Instrumentation	0	03/30/94
N-00090	Instrumentation	2	12/14/94
N-00091	Instrumentation	1	06/30/94
N-00106	Instrumentation	2	12/14/94

ATTACHMENT B
DOCUMENT REVIEW TYPES

Design Documents

Field Changes

	No.	Document	Date	Change
CONS/1585:	01	15160	4/20/94	Skid Fabr.
	02	15060	4/19/94	Inspect req
	03	15060	4/19/94	Add mat'ls
	04	Drg. P-0059	5/13/94	Layout
	05	Drg. P-0066		
		15090	5/16/94	Insul. inst'l
	06	Drg. P-0064	5/13/94	Clarify
	07	Drg. P-0065	5/18/94	Relocate pipe
	08r2	Drg. P-0065	7/12/94	Valve change
	09		5/23/94	Pipe slope
	10	Drg. P-0063	5/26/94	Add flange
	11	Drg. P-0058	5/25/94	Relocate spool
	12	Drg. P-0065	5/25/94	Add flange
	13	Drg. P-0063/65	5/27/94	Add valves
	14	11501	6/13/94	Delete Tech Rep
	15	Drg. P-0063/96	6/13/94	Pipe mat'l
	16	Drg. P-0065/76	6/17/94	Pipe mat'l
	17	15250	6/17/94	Mat'l Substitute
	18	Drg. P-0063/74		
		13400	6/17/94	Spec conflict
	19	Drg. P-0063/74	6/16/94	Valve type
	20	Drg. P-0065	5/18/94	Relocate valve
	21	Drg. P-0063/64	6/30/94	Dip tube
	22	Drg. P-0063/64	6/30/94	Pipe fit
	23	15250	7/06/94	Insul. jacket
	24	15060	7/13/94	Valve mat'l
	25r1	Submittal	8/25/94	Hole size
	26	15060	7/13/94	Tie-in method
	27	15060	7/11/94	Valve type
	28	Drg. P-0059	7/14/94	Layout
	29	Drg. P-059/63/65/96	7/25/94	Pipe fit
	30		7/25/94	Pump support
	31		7/29/94	Not appvd
	32	Drg. P-0063	7/26/94	Spec conflict
	33	Drg. P-0067	8/01/94	Trac'g mount

ATTACHMENT B
DOCUMENT REVIEW TYPES

Design Documents

Field Changes (cont.)

	No.	Document	Date	Change
CONS/1585:	34r1	Drg. P-0063/96	8/05/94	Add valves
	35	Drg. N-0090	8/09/94	Inst mount
	36	Hydro Proc	8/17/94	Delete C/O
	37	VOID		
	38	16051	8/31/94	Elec Mat'l
	39	13410	9/07/94	Lower set pts
	40	13400	9/07/94	Flange gasket
	41	13410/15160	9/13/94	Press. sensor
	42	16051	9/14/94	Cont'l wire test
	43	Drg. P-0063/64	9/15/94	Dip tube length
	44r3	Drg. P-0058/63	11/10/94	Tie-in mod.
	45	15060	10/17/94	Bolt spec.
	46	15060	10/17/94	Trac'g test
	47	RCI	10/19/94	Provide spec
	48	Drg. P-0063	10/20/94	Not apprvd
	49	15060	10/27/94	Not apprvd
	50	Drg. P-0063	11/02/94	Clarify details
	51	Drg. P-0059-63	11/02/94	Add valves
	52	Drg. P-0063	11/07/94	Relocate piping
	53	Drg. P-0063	11/10/94	Modify piping
	54	Drg. P-0063	11/10/94	Modify piping
	55	Drg. P-0063/96/106	11/15/94	Red-lines
	56	Drg. P-0065	11/19/94	Relocate piping
	57	15060	11/23/94	Valve Mat'l
	58	15060	11/23/94	Label req.
	59	15160, Drg. P-0096		
		Drg. P-0060-65	11/30/94	Skid modif.
	60	Drg. P-0096	12/02/94	Modify piping
	61	Drg. P-0096	12/02/94	Modify piping
	62	Drg. P-0059-63	12/06/94	Add siphon brk
	63	Drg. P-0065	12/06/94	Add DC piping
	64	Drg. N-0089/91	12/11/94	Chg elec contact
	65	Drg. E-0080	12/11/94	Add D/O relay
	66	Sketch 101794	12/12/94	Bypass switch
	67	Sketch 101794	12/12/94	Modify schematic

ATTACHMENT B
DOCUMENT REVIEW TYPES

Design Documents

Field Changes (cont.)

No.	Document	Date	Change
CONS/1585:			
68	Drg. E-0080	12/12/94	Move indicator
69	Drg. E-0078	12/13/94	Modify stop circ't
70	Drg. E-0078	12/13/94	Modify pan'l pwr
71		12/19/94	Add pipe supports
72	Drg. P-0065	12/20/94	Mod. level xmtr
73		12/20/94	Mod. cycle speed
74	15060	12/22/94	Chg valve spec
75	13400	12/31/94	Mod. test spec
76	15060	12/31/94	Mod. test spec
77	Drg. P-0065	12/31/94	Mod. piping dia.
78	Drg. P-0096	12/31/94	Add test port

ENG-IDR-101
February 1, 1995

ATTACHMENT C
TEAM CHECKLISTS

UNH Neutralization Project Design Review

ATTACHMENT E

DESIGN REVIEW RECORD

REVIEWING ORGANIZATION: FEMCO - Eng	DATE: 1/23/95
DESIGN NO. AND TITLE: UNH DESIGN REVIEW	COMMENTS DUE BY:

ITEM NO.	REVIEWER NAME	PAGE NO./ STEP	COMMENT	COMMENT RESOLUTION
1A	WEK		design criteria for pump change out was not found	
1A1	WEK		(couldn't find where was used) -	
1B2	WEK		Valve operators were not readily accessible adjacent to T-26	
1B6	WEK		Carrying 50# bags of mag O into process area - up to staging and is cumbersome.	
1K1	WEK	—	Document/Initial Procedure /process was not found (See facility assessment)	Part 7.4 7.5
III A4	WEK	—	I&C Equipment was designed/specified for another type of pump than that installed.	
III C1	WEK	—	Support for Pump is in question / ~~verified~~	
III C-4	WEK	—	"deadleg" was identified in Item 1003 (field walk down)	
1K-1	WEK	—	weld failure mechanism is unknown	
III B-4	WEK			
1E-2				
1E-3				
1D-4	WEK	-	materials as specified acceptable	
1J-5	WEK	—	Design Package content (consistent) SAF is questioned	

6587

General scope identified in Theising letter Jan 4, 1995

Attachment D - Sample of Independent Review Checklist

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

	YES	NO
I. GENERAL		
A. HAVE FUNCTIONAL AND OPERATIONAL REQUIREMENTS AND DESIGN CRITERIA BEEN SPECIFIED FOR THIS DESIGN?	☐	☒
1. Were they used in design process?	☐	☒
2. Were all areas adequately covered in design?	☒	☐
3. Are design assumptions reasonable and adequately identified and described?	☐	☐
4. Are the applicable codes, standards, and regulatory drivers, including issue and addends, properly identified?	☒	☐
5. Have they been met?	☐	☐
6. Was the design method appropriate?	☒	☐
7. Is the output reasonable compared to inputs?	☒	☐
B. HAVE HUMAN FACTORS BEEN CONSIDERED IN THE DESIGN?	☐	☐
1. Are controls well organized?	☐	☐
2. Are controls located for efficient operation?	☒	☐
3. Can monitoring devices be easily and accurately read?	☐	☐
4. Can all operations be performed safely without danger to user or facility?	☐	☐
5. Have Human Services requirements been considered? (Change rooms, offices, communications, etc.)	☐	☐
6. Can maintenance be performed easily?	☒	☐
7. Have operations requiring special skills or special attention been minimized?	☐	☐
8. Does the design adequately consider remote operability or maintainability requirements?	☐	☐
9. Does the design minimize potential for human error? *(Unique fittings to preclude inadvertent error in making routine connections, clear labeling and logical layouts to preclude mistakes in valve operations, minimum reliance on irregular manual operations, etc.)*	☐	☐
C. COST ESTIMATING		
1. Have cost-benefit studies been made? Are they realistic?	☐	☐
2. Are cost estimates realistic?	☐	☐
3. Are costs minimized?	☐	☐
D. CONSTRUCTION		
1. Are critical parameters to be controlled during construction clearly identified?	☐	☐
2. Has constructibility been considered?	☐	☐
3. Is equipment (commercial and other) available?	☐	☐
4. Are specified materials appropriate based on availability, cost and application?	☒	☐
5. Has previous construction experience been considered?	☐	☐
E. FAILURE MODES		
1. Have redundance, diversity, and separation requirements for structures, systems, and items been considered?	☐	☐
2. Have failure modes of critical elements been analyzed?	☐	☒
3. Have failure effects, requirements related to structures, systems, and items (including definition of events and accidents which they must withstand) been considered?	☐	☒
F. HAS THE PLANT ENVIRONMENT'S EFFECT ON THE DESIGN BEEN CONSIDERED?	☐	☐
G. HAS THE DESIGN'S EFFECT ON PLANT AND OFFSITE ENVIRONMENT BEEN CONSIDERED?	☐	☐
H. HAVE TRANSPORTABILITY REQUIREMENTS BEEN CONSIDERED?	☐	☐
I. HAVE NATURAL PHENOMENA DESIGN CRITERIA BEEN PROPERLY ESTABLISHED?	☐	☐

Not included in review

not included in review

Not included in review

Not included in review

Attachment D - Sample of Independent Review Checklist (cont'd) 6587

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

	YES	NO
J. DOCUMENT CONTROL		
1. Are drawings, equipment, valve and instrument numbering systems consistent with plant standards?	☒	☐
2. Has completeness of drawings and specifications been verified?	☒	☐
3. Are acceptance criteria specified in design documents sufficient to allow verification that design requirements have been adequately accomplished?	☒	☐
4. Are design details complete and accurate? Are tolerances properly called out?	☒	☐
5. Have obvious errors and omissions been corrected?	☒	☒
6. Are adequate SSC identification requirements specified?	☒	☐
K. RECORDS CONTROL		
1. Are requirements for record preparation, review, approval, retention, and storage adequately specified?	☐	☒
L. INTERFACE CONTROL		
1. Have the basic functions of each structure, system, and item been defined?	☐	☐
2. Have interface requirements including definition of functional and physical interfaces involving structures and items been considered?	☐	☐
3. Have layout and arrangement requirements (including ventilation criteria) been met?	☐	☐
4. Have interdisciplinary checks been completed?	☐	☐
5. Has the simplicity of the design been optimized?	☐	☐
6. Have energy conservation design features been incorporated to minimize the consumption of energy?	☐	☐
7. Have underground utilities been appropriately considered?	☐	☐
8. Have plant as-builts been fully considered in interface review?	☐	☐
II. NUCLEAR AND INDUSTRIAL SAFETY		
A. GENERAL		
1. Have requirements been provided to prevent undue risk to the health and safety of plant personnel and the public and to assure protection of the environment?	☒	☐
2. Has the need for safety studies/reports been identified and planned for?	☐	☐
B. SAFEGUARDS AND SECURITY		
1. Have access and administrative control requirements for plant safeguards and security been provided?	☒	☐
C. ENVIRONMENTAL SAFETY AND HEALTH		
1. Have permissible personnel radiation exposures or specified areas and conditions been considered?	☒	☐
2. Has the design properly considered the control of radiation contamination and exposure to plant personnel and the public?	☒	☐
3. Does the design comply with the As Low As Reasonably Achievable (ALARA) criteria?	☒	☐
4. Have safety requirements dealing with source containment for preventing personnel injury been considered?	☒	☐
5. Have notches, cracks, crevices and rough surfaces that might retain radioactivity been minimized in the design?	☐	☐
6. Does the design provide for control of gaseous, liquid and solid waste output?	☒	☐
D. INDUSTRIAL SAFETY		
1. Have fire protection and fire resistance requirements been provided?	☒	☐
2. Have the following safety requirements been provided?	☒	☐
a. Restricting use of dangerous materials?	☒	☐
b. Escape provision from enclosures?	☒	☐
c. Grounding of electrical systems?	☒	☐
d. Barriers and railings?	☒	☐
e. Emergency and first aid equipment?	☒	☐
f. Evacuation provisions?	☒	☐

Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

	YES	NO
E. CRITICALITY SAFETY		
1. Has a criticality safety evaluation been done?	☒	☐
2. If changes in operation or equipment are made, would this change the conclusions of the evaluation?	☒	☐
3. Are the proposed controls adequate to assure criticality safety (e.g., administrative, configuration, process)?	☒	☐
III. TECHNICAL/PLANT ENGINEERING		
A. GENERAL		
1. Are materials process, parts, and equipment suitable for required application?	☐	☒
2. Have performance requirements been considered?	☒	☐
a. Capacity?	☐	☐
b. Rating?	☐	☐
c. System output?	☐	☐
d. Reliability?	☒	☐
3. Have calculations been performed and provided to support design output?	☒	☐
4. Are control devices of proper type and adequate for purpose?	☐	☒
5. Have previous operating and maintenance experience been considered?	☒	☐
6. Has the use of mechanical equipment in radioactive areas been minimized?	☒	☐
7. Has technical risk assessment been considered (i.e., state-of-the-art versus proved design)?	☒	☐
8. Have all necessary codes and standards been identified and a compliance evaluation considered?	☒	☐
9. Has testing been properly addressed? not evaluated	☐	☐
10. Has application of automatic data processing been appropriately considered? not evaluated	☐	☐
B. PROCESS DEVELOPMENT		
1. Have design conditions been considered?	☒	☐
a. Pressure?	☐	☐
b. Temperature?	☐	☐
c. Fluid chemistry?	☒	☐
2. Have chemistry requirements such as provisions for sampling limitations of fluid chemistry been provided for?	☒	☐
3. Is pilot plant or development required and planned?	☐	☒
4. Are key process control points identified?	☒	☒
C. MECHANICAL		
1. Have mechanical requirements been considered?	☐	☒
a. Vibration?	☐	☒
b. Stress?	☐	☒
c. Shock?	☐	☒
d. Reaction forces?	☐	☒
2. Have structural requirements for equipment foundations and pipe supports been provided?	☒	☐
3. Have hydraulic requirements been considered?	☒	☐
a. Pump net positive suction heads?	☒	☐
b. Allowable pressure drops?	☒	☐
c. Allowable fluid velocities?	☒	☐
d. Anti-siphoning provisions?	☒	☐
e. Elimination of inadvertent transfer routs?	☒	☐
f. Overflow provisions?	☒	☐
g. The design pressures are such that they perform the required function and are minimally in excess of the resistance at the static head?	☒	☐
h. Dynamic pressure addressed, where applicable?	☒	☐
4. Have breakpoints been properly identified for system isolation or for line and valve classes?	☐	☒

Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

D. ELECTRICAL		
1. Have electrical requirements been met?	☑	☐
a. Source of power?	☐	☐
b. Voltage?	☐	☐
c. Raceway requirements?	☐	☐
d. Electrical insulation requirements?	☐	☐
e. Motor requirements?	☐	☐
f. Proper function and routing?	☐	☐
g. Have cable and conduit schedules been prepared by the designer?	☐	☐
E. CIVIL		
1. Have design loads been provided for the following?	☑	☐
a. Seismic?	☑	☐
b. Wind?	☐	☐
c. Thermal?	☐	☐
d. Dynamic?	☐	☐
2. Have anticipated environmental conditions during storage, constructions, and operation been considered?	☐	☐
3. Have utility systems interface requirements been considered and established?	☐	☐
4. Have requirements for concrete been properly identified?	☐	☐
F. MATERIALS		
1. Concrete finishes for protective coatings?	☐	☐
2. Proper additives, release agents, or curing compounds?	☐	☐
a. Compatibility with existing plant equipment and processes?	☐	☐
b. Electrical insulation properties?	☐	☐
c. Protective coatings?	☐	☐
d. Corrosion resistance?	☐	☐
e. Radiation resistance?	☐	☐
f. Physical and chemical properties?	☐	☐
g. Welding materials?	☐	☐
h. Special processes?	☐	☐
i. Cathodic protection?	☐	☐
3. Are the specified materials compatible with each other and the environmental conditions to which they will be exposed?	☐	☐
IV. QUALITY ASSURANCE		
A. ARE APPROPRIATE QUALITY ASSURANCE REQUIREMENTS SPECIFIED?	☐	☐
B. HAS ADEQUATE ACCESSIBILITY BEEN PROVIDED TO PERFORM THE IN-SERVICE INSPECTION REQUIRED DURING PLANT LIFE?	☐	☐
C. HAVE QC INSPECTION REQUIREMENTS BEEN PROPERLY IDENTIFIED?	☐	☐
D. ARE ACCEPTANCE CRITERIA INCORPORATED INTO THE DESIGN DOCUMENTS TO ALLOW VERIFICATION OF DESIGN REQUIREMENTS?	☐	☐
V. PRODUCTION		
A. GENERAL		
1. Are accessibility, maintenance, repair, and in-service inspection and the conditions under which they will be performed considered (Overlay drawings should be provided if requested by the Project Manager)?	☐	☐
2. Are operation and maintenance features consistent with FERMCO policies and procedures?	☐	☐
3. Are adequate handling, storage, cleaning, and shipping requirements specified?	☐	☐
4. Have OSHA and DOE requirements for operation and maintenance activities been specified?	☐	☐
5. Have needs for bypasses or operating spares been established?	☐	☐
6. Have personnel requirements and limitations, including the qualifications and numbers of personnel available for plant operations and maintenance been considered?	☐	☐

Not reviewed

Not reviewed

Not reviewed

Attachment D - Sample of Independent Review Checklist (cont'd) 6587

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

B. STARTUP AND TESTING		
1. Have adequate pre-operational test requirements been adequately specified, including acceptance criteria?	☐	☐
2. If Qualification Testing will be used to verify design adequacy:		
a. Is the testing identified and documented?	☐	☐
b. Have written test procedures been developed?	☐	☐
c. Are acceptance criteria specified?	☐	☐
Not reviewed		
C. OPERATION		
1. Have operation requirements under various conditions been considered?	☐	☐
a. Plant start-up?	☐	☐
b. Normal process operation?	☐	☐
c. Process shutdown?	☐	☐
d. Plant emergency operation?	☐	☐
e. Special or infrequent operation?	☐	☐
f. System abnormal or emergency operation?	☐	☐
2. Are critical parameters to be controlled during operation clearly identified?	☐	☐
D. MAINTENANCE AND REPAIR		
1. Have prior maintenance and repair experience related to similar systems and items been considered?	☐	☐
2. Have adequate maintenance features and requirements been specified?	☐	☐
3. Are items requiring frequent maintenance easily accessible?	☐	☐
4. Has repairman safety been considered?	☐	☐
5. Are spare parts appropriately considered?	☐	☐
6. Are accessibility and other design provisions adequate for performance for required maintenance replacement and repair been considered?	☐	☐
7. Have opportunities and limitation of remote maintenance and operation been considered?	☐	☐
8. Have instrument calibration and preventive maintenance been considered?	☐	☐
9. Have decontamination and decommissioning been considered?	☐	☐

6587

ATTACHMENT E

DESIGN REVIEW RECORD

REVIEWING ORGANIZATION: FLUOR DANIEL POWER	DATE: 1/24/95
DESIGN NO. AND TITLE: UNH DESIGN REVIEW	COMMENTS DUE BY:

ITEM NO.	REVIEWER NAME	PAGE NO./ STEP	COMMENT	COMMENT RESOLUTION
I.A.2.	Ken Roberts		Inadequate access for operation of some valves	
I.A.5.	Ken Roberts		Seam welded carbon steel pipe used where seamless was specified.	
I.J.5.	Ken Roberts		Wall thickness for copper tubing incorrectly given on material spec sheet. (Performance Spec, Sect. 15060 pp 33 of 35)	
III.A.3.	Ken Roberts		Pipe stress calculations were not done; thermal expansion due to heat tracing not analyzed.	
III.C.1.b.	Ken Roberts		See previous comment (III.A.3.).	
III.C.1.d	Ken Roberts		Reactive forces of diaphram pump not considered prior to installation.	
V.B.1.	Ken Roberts		No field verification of pipe support adequacy including type of support and locations, resulted in improperly constrained piping.	

Attachment D - Sample of Independent Review Checklist

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review

	YES	NO
I. GENERAL		
A. HAVE FUNCTIONAL AND OPERATIONAL REQUIREMENTS AND DESIGN CRITERIA BEEN SPECIFIED FOR THIS DESIGN?	☑	☐
1. Were they used in design process?	☑	☐
2. Were all areas adequately covered in design?	☐	☑
3. Are design assumptions reasonable and adequately identified and described?	☐	☐
4. Are the applicable codes, standards, and regulatory drivers, including issue and addenda, properly identified?	☑	☐
5. Have they been met?	☐	☑
6. Was the design method appropriate?	☑	☐
7. Is the output reasonable compared to inputs?	☑	☐
B. HAVE HUMAN FACTORS BEEN CONSIDERED IN THE DESIGN?	☐	☐
1. Are controls well organized?	☐	☐
2. Are controls located for efficient operation?	☐	☐
3. Can monitoring devices be easily and accurately read?	☐	☐
4. Can all operations be performed safely without danger to user or facility?	☐	☐
5. Have Human Services requirements been considered? (Change rooms, offices, communications, etc.)	☐	☐
6. Can maintenance be performed easily?	☐	☐
7. Have operations requiring special skills or special attention been minimized?	☐	☐
8. Does the design adequately consider remote operability or maintainability requirements?	☐	☐
9. Does the design minimize potential for human error? *(Unique fittings to preclude inadvertent error in making routine connections, clear labeling and logical layouts to preclude mistakes in valve operations, minimum reliance on irregular manual operations, etc.)*	☐	☐
C. COST ESTIMATING		
1. Have cost-benefit studies been made? Are they realistic?	☐	☐
2. Are cost estimates realistic?	☐	☐
3. Are costs minimized?	☐	☐
D. CONSTRUCTION		
1. Are critical parameters to be controlled during construction clearly identified?	☑	☐
2. Has constructibility been considered?	☐	☐
3. Is equipment (commercial and other) available?	☐	☐
4. Are specified materials appropriate based on availability, cost and application?	☑	☐
5. Has previous construction experience been considered?	☐	☐
E. FAILURE MODES		
1. Have redundance, diversity, and separation requirements for structures, systems, and items been considered?	☐	☐
2. Have failure modes of critical elements been analyzed?	☐	☐
3. Have failure effects, requirements related to structures, systems, and items (including definition of events and accidents which they must withstand) been considered?	☐	☐
F. HAS THE PLANT ENVIRONMENT'S EFFECT ON THE DESIGN BEEN CONSIDERED?	☐	☐
G. HAS THE DESIGN'S EFFECT ON PLANT AND OFFSITE ENVIRONMENT BEEN CONSIDERED?	☐	☐
H. HAVE TRANSPORTABILITY REQUIREMENTS BEEN CONSIDERED?	☐	☐
I. HAVE NATURAL PHENOMENA DESIGN CRITERIA BEEN PROPERLY ESTABLISHED?	☐	☐

Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review

	YES	NO
J. DOCUMENT CONTROL		
1. Are drawings, equipment, valve and instrument numbering systems consistent with plant standards?	☐	☐
2. Has completeness of drawings and specifications been verified?	☐	☐
3. Are acceptance criteria specified in design documents sufficient to allow verification that design requirements have been adequately accomplished?	☑	☐
4. Are design details complete and accurate? Are tolerances properly called out?	☑	☐
5. Have obvious errors and omissions been corrected?	☐	☑
6. Are adequate SSC identification requirements specified?	☐	☐
K. RECORDS CONTROL		
1. Are requirements for record preparation, review, approval, retention, and storage adequately specified?	☐	☐
L. INTERFACE CONTROL		
1. Have the basic functions of each structure, system, and item been defined?	☐	☐
2. Have interface requirements including definition of functional and physical interfaces involving structures and items been considered?	☐	☐
3. Have layout and arrangement requirements (including ventilation criteria) been met?	☑	☐
4. Have interdisciplinary checks been completed?	☐	☐
5. Has the simplicity of the design been optimized?	☐	☐
6. Have energy conservation design features been incorporated to minimize the consumption of energy?	☐	☐
7. Have underground utilities been appropriately considered?	☐	☐
8. Have plant as-builts been fully considered in interface review?	☐	☐
II. NUCLEAR AND INDUSTRIAL SAFETY		
A. GENERAL		
1. Have requirements been provided to prevent undue risk to the health and safety of plant personnel and the public and to assure protection of the environment?	☐	☐
2. Has the need for safety studies/reports been identified and planned for?	☐	☐
B. SAFEGUARDS AND SECURITY		
1. Have access and administrative control requirements for plant safeguards and security been provided?	☐	☐
C. ENVIRONMENTAL SAFETY AND HEALTH		
1. Have permissible personnel radiation exposures or specified areas and conditions been considered?	☐	☐
2. Has the design properly considered the control of radiation contamination and exposure to plant personnel and the public?	☐	☐
3. Does the design comply with the As Low As Reasonably Achievable (ALARA) criteria?	☐	☐
4. Have safety requirements dealing with source containment for preventing personnel injury been considered?	☐	☐
5. Have notches, cracks, crevices and rough surfaces that might retain radioactivity been minimized in the design?	☑	☐
6. Does the design provide for control of gaseous, liquid and solid waste output?	☐	☐
D. INDUSTRIAL SAFETY		
1. Have fire protection and fire resistance requirements been provided?	☐	☐
2. Have the following safety requirements been provided?	☐	☐
a. Restricting use of dangerous materials?	☐	☐
b. Escape provision from enclosures?	☐	☐
c. Grounding of electrical systems?	☐	☐
d. Barriers and railings?	☐	☐
e. Emergency and first aid equipment?	☐	☐
f. Evacuation provisions?	☐	☐

6587

Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

	YES	NO
E. CRITICALITY SAFETY		
1. Has a criticality safety evaluation been done?	☐	☐
2. If changes in operation or equipment are made, would this change the conclusions of the evaluation?	☐	☐
3. Are the proposed controls adequate to assure criticality safety (e.g., administrative, configuration, process)?	☐	☐
III. TECHNICAL/PLANT ENGINEERING		
A. GENERAL		
1. Are materials process, parts, and equipment suitable for required application?	☑	☐
2. Have performance requirements been considered?	☐	☐
a. Capacity?	☐	☐
b. Rating?	☐	☐
c. System output?	☐	☐
d. Reliability?	☐	☐
3. Have calculations been performed and provided to support design output?	☐	☑
4. Are control devices of proper type and adequate for purpose?	☐	☐
5. Have previous operating and maintenance experience been considered?	☐	☐
6. Has the use of mechanical equipment in radioactive areas been minimized?	☐	☐
7. Has technical risk assessment been considered (i.e., state-of-the-art versus proved design)?	☐	☐
8. Have all necessary codes and standards been identified and a compliance evaluation considered? ?	☐	☐
9. Has testing been properly addressed?	☑	☐
10. Has application of automatic data processing been appropriately considered?	☐	☐
B. PROCESS DEVELOPMENT		
1. Have design conditions been considered?	☐	☐
a. Pressure?	☐	☐
b. Temperature?	☐	☐
c. Fluid chemistry?	☐	☐
2. Have chemistry requirements such as provisions for sampling limitations of fluid chemistry been provided for?	☐	☐
3. Is pilot plant or development required and planned?	☐	☐
4. Are key process control points identified?	☐	☐
C. MECHANICAL		
1. Have mechanical requirements been considered?	☐	☐
a. Vibration?	☐	☐
b. Stress?	☐	☑
c. Shock?	☐	☐
d. Reaction forces?	☐	☑
2. Have structural requirements for equipment foundations and pipe supports been provided?	☐	☐
3. Have hydraulic requirements been considered?	☐	☐
a. Pump net positive suction heads?	☐	☐
b. Allowable pressure drops?	☐	☐
c. Allowable fluid velocities?	☐	☐
d. Anti-siphoning provisions?	☐	☐
e. Elimination of inadvertent transfer routs?	☐	☐
f. Overflow provisions?	☐	☐
g. The design pressures are such that they perform the required function and are minimally in excess of the resistance at the static head?	☐	☐
h. Dynamic pressure addressed, where applicable?	☐	☐
4. Have breakpoints been properly identified for system isolation or for line and valve classes?	☐	☐

Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review

D. ELECTRICAL	☐	☐
1. Have electrical requirements been met?	☐	☐
a. Source of power?	☐	☐
b. Voltage?	☐	☐
c. Raceway requirements?	☐	☐
d. Electrical insulation requirements?	☐	☐
e. Motor requirements?	☐	☐
f. Proper function and routing?	☐	☐
g. Have cable and conduit schedules been prepared by the designer?	☐	☐
E. CIVIL	☐	☐
1. Have design loads been provided for the following?	☐	☐
a. Seismic?	☐	☐
b. Wind?	☐	☐
c. Thermal?	☐	☐
d. Dynamic?	☐	☐
2. Have anticipated environmental conditions during storage, constructions, and operation been considered?	☐	☐
3. Have utility systems interface requirements been considered and established?	☐	☐
4. Have requirements for concrete been properly identified?	☐	☐
F. MATERIALS	☐	☐
1. Concrete finishes for protective coatings?	☐	☐
2. Proper additives, release agents, or curing compounds?	☐	☐
a. Compatibility with existing plant equipment and processes?	☐	☐
b. Electrical insulation properties?	☐	☐
c. Protective coatings?	☐	☐
d. Corrosion resistance?	☐	☐
e. Radiation resistance?	☐	☐
f. Physical and chemical properties?	☐	☐
g. Welding materials?	☐	☐
h. Special processes?	☐	☐
i. Cathodic protection?	☐	☐
3. Are the specified materials compatible with each other and the environmental conditions to which they will be exposed?	☐	☐
IV. QUALITY ASSURANCE		
A. ARE APPROPRIATE QUALITY ASSURANCE REQUIREMENTS SPECIFIED?	☐	☐
B. HAS ADEQUATE ACCESSIBILITY BEEN PROVIDED TO PERFORM THE IN-SERVICE INSPECTION REQUIRED DURING PLANT LIFE?	☐	☐
C. HAVE QC INSPECTION REQUIREMENTS BEEN PROPERLY IDENTIFIED?	☐	☐
D. ARE ACCEPTANCE CRITERIA INCORPORATED INTO THE DESIGN DOCUMENTS TO ALLOW VERIFICATION OF DESIGN REQUIREMENTS?	☐	☐
V. PRODUCTION		
A. GENERAL		
1. Are accessibility, maintenance, repair, and in-service inspection and the conditions under which they will be performed considered (Overlay drawings should be provided if requested by the Project Manager)?	☐	☐
2. Are operation and maintenance features consistent with FERMCO policies and procedures?	☐	☐
3. Are adequate handling, storage, cleaning, and shipping requirements specified?	☐	☐
4. Have OSHA and DOE requirements for operation and maintenance activities been specified?	☐	☐
5. Have needs for bypasses or operating spares been established?	☐	☐
6. Have personnel requirements and limitations, including the qualifications and numbers of personnel available for plant operations and maintenance been considered?	☐	☐

Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review

B. STARTUP AND TESTING		
1. Have adequate pre-operational test requirements been adequately specified, including acceptance criteria?	☐	☑
2. If Qualification Testing will be used to verify design adequacy:		
a. Is the testing identified and documented?	☐	☐
b. Have written test procedures been developed?	☐	☐
c. Are acceptance criteria specified?	☐	☐
C. OPERATION		
1. Have operation requirements under various conditions been considered?	☐	☐
a. Plant start-up?	☐	☐
b. Normal process operation?	☐	☐
c. Process shutdown?	☐	☐
d. Plant emergency operation?	☐	☐
e. Special or infrequent operation?	☐	☐
f. System abnormal or emergency operation?	☐	☐
2. Are critical parameters to be controlled during operation clearly identified?	☐	☐
D. MAINTENANCE AND REPAIR		
1. Have prior maintenance and repair experience related to similar systems and items been considered?	☐	☐
2. Have adequate maintenance features and requirements been specified?	☐	☐
3. Are items requiring frequent maintenance easily accessible?	☐	☐
4. Has repairman safety been considered?	☐	☐
5. Are spare parts appropriately considered?	☐	☐
6. Are accessibility and other design provisions adequate for performance for required maintenance replacement and repair been considered?	☐	☐
7. Have opportunities and limitation of remote maintenance and operation been considered?	☐	☐
8. Have instrument calibration and preventive maintenance been considered?	☐	☐
9. Have decontamination and decommissioning been considered?	☐	☐

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ATTACHMENT E

DESIGN REVIEW RECORD

REVIEWING ORGANIZATION: FERMILO FACILITIES ENGINEERING

DATE: 1/24/95

COMMENTS DUE BY:

DESIGN NO. AND TITLE: UNH DESIGN REVIEW

ITEM NO.	REVIEWER NAME	PAGE NO./ STEP	COMMENT	COMMENT RESOLUTION
I J-3	Ron Wordy		Location of hangers and anchors left to field to locate stress analysis could not be performed.	
III A-9	Ron Wordy		Testing of systems not adequately discribed	
III B-3	Ron Wordy		Numerous changes in planned operation noted.	
III C-1	Ron Wordy		Dynamic conditions associated double diaphragm pumps, Thermal stresses not initially considered in the design.	
III C-3	Ron Wordy		Surge supression and pipe line flexibility not given full consideration in the substitution of air driven pump over progressive cavity pumps.	

UNH DESIGN REVIEW

RONALD C WORSLEY 19

1-24-95

NOTE: UNMARK CHECKLIST ITEMS WERE NOT CONSIDERED OR NOT APPLICABLE TO THIS REVIEW

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Attachment D - Sample of Independent Review Checklist

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

	YES	NO
I. GENERAL		
A. HAVE FUNCTIONAL AND OPERATIONAL REQUIREMENTS AND DESIGN CRITERIA BEEN SPECIFIED FOR THIS DESIGN?	■	□
1. Were they used in design process?	■	□
2. Were all areas adequately covered in design?	■	□
3. Are design assumptions reasonable and adequately identified and described?	■	□
4. Are the applicable codes, standards, and regulatory drivers, including issue and addenda, properly identified?	■	□
5. Have they been met?	■	□
6. Was the design method appropriate?	■	□
7. Is the output reasonable compared to inputs?	■	□
B. HAVE HUMAN FACTORS BEEN CONSIDERED IN THE DESIGN?	□	□
1. Are controls well organized?	□	□
2. Are controls located for efficient operation?	□	□
3. Can monitoring devices be easily and accurately read?	□	□
4. Can all operations be performed safely without danger to user or facility?	□	□
5. Have Human Services requirements been considered? (Change rooms, offices, communications, etc.)	□	□
6. Can maintenance be performed easily?	□	□
7. Have operations requiring special skills or special attention been minimized?	□	□
8. Does the design adequately consider remote operability or maintainability requirements?	□	□
9. Does the design minimize potential for human error? *(Unique fittings to preclude inadvertent error in making routine connections, clear labeling and logical layouts to preclude mistakes in valve operations, minimum reliance on irregular manual operations, etc.)*	□	□
C. COST ESTIMATING		
1. Have cost-benefit studies been made? Are they realistic?	□	□
2. Are cost estimates realistic?	□	□
3. Are costs minimized?	□	□
D. CONSTRUCTION		
1. Are critical parameters to be controlled during construction clearly identified?	■	□
2. Has constructibility been considered?	■	□
3. Is equipment (commercial and other) available?	■	□
4. Are specified materials appropriate based on availability, cost and application?	■	□
5. Has previous construction experience been considered?	■	□
E. FAILURE MODES		
1. Have redundance, diversity, and separation requirements for structures, systems, and items been considered?	□	□
2. Have failure modes of critical elements been analyzed?	□	□
3. Have failure effects, requirements related to structures, systems, and items (including definition of events and accidents which they must withstand) been considered?	□	□
F. HAS THE PLANT ENVIRONMENT'S EFFECT ON THE DESIGN BEEN CONSIDERED?	■	□
G. HAS THE DESIGN'S EFFECT ON PLANT AND OFFSITE ENVIRONMENT BEEN CONSIDERED?	■	□
H. HAVE TRANSPORTABILITY REQUIREMENTS BEEN CONSIDERED?	□	□
I. HAVE NATURAL PHENOMENA DESIGN CRITERIA BEEN PROPERLY ESTABLISHED?	□	□

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

	YES	NO
J. DOCUMENT CONTROL		
1. Are drawings, equipment, valve and instrument numbering systems consistent with plant standards?	☑	☐
2. Has completeness of drawings and specifications been verified?	☑	☐
3. Are acceptance criteria specified in design documents sufficient to allow verification that design requirements have been adequately accomplished?	☐	☑
4. Are design details complete and accurate? Are tolerances properly called out?	☑	☐
5. Have obvious errors and omissions been corrected?	☑	☐
6. Are adequate SSC identification requirements specified?	☑	☐
K. RECORDS CONTROL		
1. Are requirements for record preparation, review, approval, retention, and storage adequately specified?	☑	☐
L. INTERFACE CONTROL		
1. Have the basic functions of each structure, system, and item been defined?	☑	☐
2. Have interface requirements including definition of functional and physical interfaces involving structures and items been considered?	☑	☐
3. Have layout and arrangement requirements (including ventilation criteria) been met?	☑	☐
4. Have interdisciplinary checks been completed?	☑	☐
5. Has the simplicity of the design been optimized?	☑	☐
6. Have energy conservation design features been incorporated to minimize the consumption of energy?	☐	☐
7. Have underground utilities been appropriately considered?	☐	☐
8. Have plant as-builts been fully considered in interface review?	☑	☐
II. NUCLEAR AND INDUSTRIAL SAFETY		
A. GENERAL		
1. Have requirements been provided to prevent undue risk to the health and safety of plant personnel and the public and to assure protection of the environment?	☑	☐
2. Has the need for safety studies/reports been identified and planned for?	☑	☐
B. SAFEGUARDS AND SECURITY		
1. Have access and administrative control requirements for plant safeguards and security been provided?	☑	☐
C. ENVIRONMENTAL SAFETY AND HEALTH		
1. Have permissible personnel radiation exposures or specified areas and conditions been considered?	☑	☐
2. Has the design properly considered the control of radiation contamination and exposure to plant personnel and the public?	☑	☐
3. Does the design comply with the As Low As Reasonably Achievable (ALARA) criteria?	☑	☐
4. Have safety requirements dealing with source containment for preventing personnel injury been considered?	☑	☐
5. Have notches, cracks, crevices and rough surfaces that might retain radioactivity been minimized in the design?	☐	☐
6. Does the design provide for control of gaseous, liquid and solid waste output?	☑	☐
D. INDUSTRIAL SAFETY		
1. Have fire protection and fire resistance requirements been provided?	☐	☐
2. Have the following safety requirements been provided?	☐	☐
a. Restricting use of dangerous materials?	☐	☐
b. Escape provision from enclosures?	☐	☐
c. Grounding of electrical systems?	☐	☐
d. Barriers and railings?	☐	☐
e. Emergency and first aid equipment?	☐	☐
f. Evacuation provisions?	☐	☐

Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

	YES	NO
E. CRITICALITY SAFETY		
1. Has a criticality safety evaluation been done?	■	□
2. If changes in operation or equipment are made, would this change the conclusions of the evaluation?	■	□
3. Are the proposed controls adequate to assure criticality safety (e.g., administrative, configuration, process)?	■	□
III. TECHNICAL/PLANT ENGINEERING		
A. GENERAL		
1. Are materials process, parts, and equipment suitable for required application?	■	□
2. Have performance requirements been considered?	■	□
a. Capacity?	■	□
b. Rating?	■	□
c. System output?	■	□
d. Reliability?	■	□
3. Have calculations been performed and provided to support design output?	□	□
4. Are control devices of proper type and adequate for purpose?	□	□
5. Have previous operating and maintenance experience been considered?	□	□
6. Has the use of mechanical equipment in radioactive areas been minimized?	■	□
7. Has technical risk assessment been considered (i.e., state-of-the-art versus proved design)?	□	□
8. Have all necessary codes and standards been identified and a compliance evaluation considered?	■	□
9. Has testing been properly addressed?	□	■
10. Has application of automatic data processing been appropriately considered?	□	□
B. PROCESS DEVELOPMENT		
1. Have design conditions been considered?	□	□
a. Pressure?	■	□
b. Temperature?	□	□
c. Fluid chemistry?	■	□
2. Have chemistry requirements such as provisions for sampling limitations of fluid chemistry been provided for?	■	□
3. Is pilot plant or development required and planned?	□	■
4. Are key process control points identified?	■	□
C. MECHANICAL		
1. Have mechanical requirements been considered?	□	■
a. Vibration?	■	□
b. Stress?	□	■
c. Shock?	□	■
d. Reaction forces?	□	■
2. Have structural requirements for equipment foundations and pipe supports been provided?	■	□
3. Have hydraulic requirements been considered?	■	□
a. Pump net positive suction heads?	■	□
b. Allowable pressure drops?	■	□
c. Allowable fluid velocities?	■	□
d. Anti-siphoning provisions?	■	□
e. Elimination of inadvertent transfer routs?	■	□
f. Overflow provisions?	■	□
g. The design pressures are such that they perform the required function and are minimally in excess of the resistance of the static head?	■	□
h. Dynamic pressure addressed, where applicable?	■	□
4. Have breakpoints been properly identified for system isolation or for line and valve classes?	■	□

NOTE This is a generic sample only Checklist must be customized for the specific design under review

D. ELECTRICAL		
1 Have electrical requirements been met?	☐	☐
a. Source of power?	☐	☐
b. Voltage?	☐	☐
c. Raceway requirements?	☐	☐
d. Electrical insulation requirements?	☐	☐
e. Motor requirements?	☐	☐
f. Proper function and routing?	☐	☐
g. Have cable and conduit schedules been prepared by the designer?	☐	☐
E. CIVIL		
1. Have design loads been provided for the following?	☐	☐
a. Seismic?	☐	☐
b. Wind?	☐	☐
c. Thermal?	☐	☐
d. Dynamic?	☐	☐
2. Have anticipated environmental conditions during storage, constructions, and operation been considered?	■	☐
3. Have utility systems interface requirements been considered and established?	■	☐
4. Have requirements for concrete been properly identified?	☐	☐
F. MATERIALS		
1. Concrete finishes for protective coatings?	☐	☐
2. Proper additives, release agents, or curing compounds?	☐	☐
a. Compatibility with existing plant equipment and processes?	☐	☐
b. Electrical insulation properties?	☐	☐
c. Protective coatings?	☐	☐
d. Corrosion resistance?	☐	☐
e. Radiation resistance?	■	☐
f. Physical and chemical properties?	■	☐
g. Welding materials?	☐	☐
h. Special processes?		
i. Cathodic protection?		
3. Are the specified materials compatible with each other and the environmental conditions to which they will be exposed?	■	☐
IV. QUALITY ASSURANCE		
A. ARE APPROPRIATE QUALITY ASSURANCE REQUIREMENTS SPECIFIED?	■	☐
B. HAS ADEQUATE ACCESSIBILITY BEEN PROVIDED TO PERFORM THE IN-SERVICE INSPECTION REQUIRED DURING PLANT LIFE?	☐	☐
C. HAVE QC INSPECTION REQUIREMENTS BEEN PROPERLY IDENTIFIED?	■	☐
D. ARE ACCEPTANCE CRITERIA INCORPORATED INTO THE DESIGN DOCUMENTS TO ALLOW VERIFICATION OF DESIGN REQUIREMENTS?	■	☐
V. PRODUCTION		
A. GENERAL		
1. Are accessibility, maintenance, repair, and in-service inspection and the conditions under which they will be performed considered (Overlay drawings should be provided if requested by the Project Manager)?	☐	☐
2. Are operation and maintenance features consistent with FERMCO policies and procedures?	☐	☐
3. Are adequate handling, storage, cleaning, and shipping requirements specified?	■	☐
4. Have OSHA and DOE requirements for operation and maintenance activities been specified?	■	☐
5. Have needs for bypasses or operating spares been established?	■	☐
6. Have personnel requirements and limitations, including the qualifications and numbers of personnel available for plant operations and maintenance been considered?	☐	☐

Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

B. STARTUP AND TESTING		
1. Have adequate pre-operational test requirements been adequately specified, including acceptance criteria?	■	□
2. If Qualification Testing will be used to verify design adequacy:		
a. Is the testing identified and documented?	■	□
b. Have written test procedures been developed?	■	□
c. Are acceptance criteria specified?	■	□
C. OPERATION		
1. Have operation requirements under various conditions been considered?	■	□
a. Plant start-up?	■	□
b. Normal process operation?	■	□
c. Process shutdown?	■	□
d. Plant emergency operation?	■	□
e. Special or infrequent operation?	□	□
f. System abnormal or emergency operation?	■	□
2. Are critical parameters to be controlled during operation clearly identified?		
D. MAINTENANCE AND REPAIR		
1. Have prior maintenance and repair experience related to similar systems and items been considered?	□	□
2. Have adequate maintenance features and requirements been specified?	□	□
3. Are items requiring frequent maintenance easily accessible?	□	□
4. Has repairman safety been considered?	□	□
5. Are spare parts appropriately considered?	□	□
6. Are accessibility and other design provisions adequate for performance for required maintenance replacement and repair been considered?	□	□
7. Have opportunities and limitation of remote maintenance and operation been considered?	□	□
8. Have instrument calibration and preventive maintenance been considered?	■	□
9. Have decontamination and decommissioning been considered?	■	□

ATTACHMENT E

DESIGN REVIEW RECORD

REVIEWING ORGANIZATION: NUCLEAR ENGINEERING	DATE: 1-25-95
DESIGN NO. AND TITLE: UNH DESIGN REVIEW	COMMENTS DUE BY:

ITEM NO.	REVIEWER NAME	PAGE NO./ STEP	COMMENT	COMMENT RESOLUTION
I.A.3	C. Miller	15 OF 20	DESIGN ASSUMPTIONS	WOULD EXPECT PARSONS TO HAVE THIS AVAILABLE FOR REVIEW
J.5	C. Miller	16 OF 20	OBVIOUS ERRORS	SPECIFICATIONS HAVE NOT BEEN REVISED TO REFLECT DIAPHRAGM PUMPS AS DRAWING HAVE
V.B.2	C. Miller	19 OF 20	QUALIFICATION TESTING	NOT SPECIFIED AND NOT REQUIRED FOR THIS APPLICATION

N/A = NOT APLICABLE

Attachment D - Sample of Independent Review Checklist

UNABLE TO DETERMINE

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

GENERAL	YES	NO	✓
A. HAVE FUNCTIONAL AND OPERATIONAL REQUIREMENTS AND DESIGN CRITERIA BEEN SPECIFIED FOR THIS DESIGN?	X	☐	☐
1. Were they used in design process?	☐	☐	X
2. Were all areas adequately covered in design?	X	☐	☐
3. Are design assumptions reasonable (YES) and adequately identified and described? (NO)	X	X	☐
4. Are the applicable codes, standards, and regulatory drivers, including issue and addenda, properly identified?	X	☐	☐
5. Have they been met?	X	☐	☐
6. Was the design method appropriate?	☐	☐	X
7. Is the output reasonable compared to inputs?	X	☐	☐
B. HAVE HUMAN FACTORS BEEN CONSIDERED IN THE DESIGN?	X	☐	☐
1. Are controls well organized?	X	☐	☐
2. Are controls located for efficient operation?	X	☐	☐
3. Can monitoring devices be easily and accurately read?	X	☐	☐
4. Can all operations be performed safely without danger to user or facility?	X	☐	☐
5. Have Human Services requirements been considered? (Change rooms, offices, communications, etc.) N/A	☐	☐	X
6. Can maintenance be performed easily?	X	☐	☐
7. Have operations requiring special skills or special attention been minimized?	X	☐	☐
8. Does the design adequately consider remote operability or maintainability requirements? N/A	☐	☐	☐
9. Does the design minimize potential for human error? *(Unique fittings to preclude inadvertent error in making routine connections, clear labeling and logical layouts to preclude mistakes in valve operations, minimum reliance on irregular manual operations, etc.)*	X	☐	☐
C. COST ESTIMATING			
1. Have cost-benefit studies been made? Are they realistic?	☐	☐	X
2. Are cost estimates realistic?	☐	☐	X
3. Are costs minimized?	☐	☐	X
D. CONSTRUCTION			
1. Are critical parameters to be controlled during construction clearly identified?	☐	☐	X
2. Has constructibility been considered?	X	☐	☐
3. Is equipment (commercial and other) available?	X	☐	☐
4. Are specified materials appropriate based on availability, cost and application?	X	☐	☐
5. Has previous construction experience been considered?	☐	☐	X
FAILURE MODES			
1. Have redundance, diversity, and separation requirements for structures, systems, and items been considered? STAND ALONE SYSTEM	X	☐	☐
2. Have failure modes of critical elements been analyzed?	☐	☐	X
3. Have failure effects, requirements related to structures, systems, and items (including definition of events and accidents which they must withstand) been considered?	☐	☐	X
HAS THE PLANT ENVIRONMENT'S EFFECT ON THE DESIGN BEEN CONSIDERED?	☐	☐	X
HAS THE DESIGN'S EFFECT ON PLANT AND OFFSITE ENVIRONMENT BEEN CONSIDERED?	☐	☐	X
HAVE TRANSPORTABILITY REQUIREMENTS BEEN CONSIDERED?	X	☐	☐
HAVE NATURAL PHENOMENA DESIGN CRITERIA BEEN PROPERLY ESTABLISHED?	☐	☐	X

Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

	YES	NO	UNABLE TO DETERMINE
J. DOCUMENT CONTROL			
1. Are drawings, equipment, valve and instrument numbering systems consistent with plant standards?	☐	☐	☒
2. Has completeness of drawings and specifications been verified?	☐	☐	☒
3. Are acceptance criteria specified in design documents sufficient to allow verification that design requirements have been adequately accomplished?	☒	☐	☐
4. Are design details complete and accurate? Are tolerances properly called out?	☐	☐	☒
5. Have obvious errors and omissions been corrected? REVISE SPECS TO DIA. PUMPS	☐	☒	☐
6. Are adequate SSC identification requirements specified?	☐	☐	☒
K. RECORDS CONTROL			
1. Are requirements for record preparation, review, approval, retention, and storage adequately specified?	☐	☐	☒
L. INTERFACE CONTROL			
1. Have the basic functions of each structure, system, and item been defined?	☒	☐	☐
2. Have interface requirements including definition of functional and physical interfaces involving structures and items been considered?	☒	☐	☐
3. Have layout and arrangement requirements (including ventilation criteria) been met?	☒	☐	☐
4. Have interdisciplinary checks been completed?	☐	☐	☒
5. Has the simplicity of the design been optimized?	☐	☐	☒
6. Have energy conservation design features been incorporated to minimize the consumption of energy? N/A	☐	☐	☐
7. Have underground utilities been appropriately considered? N/A	☐	☐	☐
8. Have plant as-builts been fully considered in interface review?	☐	☐	☒
II. NUCLEAR AND INDUSTRIAL SAFETY			
A. GENERAL			
1. Have requirements been provided to prevent undue risk to the health and safety of plant personnel and the public and to assure protection of the environment?	☒	☐	☐
2. Has the need for safety studies/reports been identified and planned for? N/A	☐	☐	☐
B. SAFEGUARDS AND SECURITY			
1. Have access and administrative control requirements for plant safeguards and security been provided?	☒	☐	☐
C. ENVIRONMENTAL SAFETY AND HEALTH			
1. Have permissible personnel radiation exposures or specified areas and conditions been considered? N/A	☐	☐	☐
2. Has the design properly considered the control of radiation contamination and exposure to plant personnel and the public? N/A	☐	☐	☐
3. Does the design comply with the As Low As Reasonably Achievable (ALARA) criteria? N/A	☐	☐	☐
4. Have safety requirements dealing with source containment for preventing personnel injury been considered?	☒	☐	☐
5. Have notches, cracks, crevices and rough surfaces that might retain radioactivity been minimized in the design? N/A	☐	☐	☐
6. Does the design provide for control of gaseous, liquid and solid waste output?	☒	☐	☐
D. INDUSTRIAL SAFETY			
1. Have fire protection and fire resistance requirements been provided?	☐	☐	☒
2. Have the following safety requirements been provided?	☐	☐	☐
a. Restricting use of dangerous materials?	☐	☐	☒
b. Escape provision from enclosures?	☐	☐	☒
c. Grounding of electrical systems?	☐	☐	☒
d. Barriers and railings?	☐	☐	☒
e. Emergency and first aid equipment?	☐	☐	☒
f. Evacuation provisions?	☐	☐	☒

Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

	YES	NO	UNABLE TO DETERMINE
E. CRITICALITY SAFETY			
1. Has a criticality safety evaluation been done? N/A	☐	☐	☐
2. If changes in operation or equipment are made, would this change the conclusions of the evaluation? N/A	☐	☐	☐
3. Are the proposed controls adequate to assure criticality safety (e.g., administrative, configuration, process)? N/A	☐	☐	☐
III. TECHNICAL/PLANT ENGINEERING			
A. GENERAL			
1. Are materials process, parts, and equipment suitable for required application?	☒	☐	☐
2. Have performance requirements been considered?	☒	☐	☐
a. Capacity?	☒	☐	☐
b. Rating?	☒	☐	☐
c. System output?	☒	☐	☐
d. Reliability?	☒	☐	☐
3. Have calculations been performed and provided to support design output?	☐	☐	☒
4. Are control devices of proper type and adequate for purpose? WITH CHANGES FOR PUMPS	☒	☐	☐
5. Have previous operating and maintenance experience been considered?	☐	☐	☒
6. Has the use of mechanical equipment in radioactive areas been minimized?	☒	☐	☐
7. Has technical risk assessment been considered (i.e., state-of-the-art versus proved design)?	☒	☐	☐
8. Have all necessary codes and standards been identified and a compliance evaluation considered?	☒	☐	☐
9. Has testing been properly addressed? YES, BUT NOT FOLLOWED	☒	☐	☐
10. Has application of automatic data processing been appropriately considered?	☐	☐	☒
B. PROCESS DEVELOPMENT			
1. Have design conditions been considered?	☒	☐	☐
a. Pressure?	☒	☐	☐
b. Temperature?	☒	☐	☐
c. Fluid chemistry?	☒	☐	☐
2. Have chemistry requirements such as provisions for sampling limitations of fluid chemistry been provided for?	☐	☐	☒
3. Is pilot plant or development required and planned? N/A	☐	☐	☐
4. Are key process control points identified? N/A	☐	☐	☒
C. MECHANICAL			
1. Have mechanical requirements been considered?	☒	☐	☐
a. Vibration?	☒	☐	☐
b. Stress?	☒	☐	☐
c. Shock?	☒	☐	☐
d. Reaction forces?	☒	☐	☐
2. Have structural requirements for equipment foundations and pipe supports been provided?	☒	☐	☐
3. Have hydraulic requirements been considered?	☒	☐	☐
a. Pump net positive suction heads?	☒	☐	☐
b. Allowable pressure drops?	☒	☐	☐
c. Allowable fluid velocities?	☒	☐	☐
d. Anti-siphoning provisions?	☒	☐	☐
e. Elimination of inadvertent transfer routs?	☒	☐	☐
f. Overflow provisions?	☒	☐	☐
g. The design pressures are such that they perform the required function and are minimally in excess of the resistance at the static head?	☒	☐	☐
h. Dynamic pressure addressed, where applicable?	☒	☐	☐
4. Have breakpoints been properly identified for system isolation or for line and valve classes?	☒	☐	☐

Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

	YES	NO	UNABLE TO DETERMINE
D. ELECTRICAL			
1. Have electrical requirements been met?	X		
a. Source of power?	X		
b. Voltage?	X		
c. Raceway requirements?			X
d. Electrical insulation requirements?			X
e. Motor requirements? — AIR OPERATED			X
f. Proper function and routing?			X
g. Have cable and conduit schedules been prepared by the designer?			X
E. CIVIL			
1. Have design loads been provided for the following?			
a. Seismic?			X
b. Wind?			X
c. Thermal?	X		
d. Dynamic?			X
2. Have anticipated environmental conditions during storage, constructions, and operation been considered?			X
3. Have utility systems interface requirements been considered and established?			X
4. Have requirements for concrete been properly identified?			X
F. MATERIALS			
1. Concrete finishes for protective coatings? N/A			X
2. Proper additives, release agents, or curing compounds? N/A			
a. Compatibility with existing plant equipment and processes?	X		
b. Electrical insulation properties?	X		
c. Protective coatings?	X		
d. Corrosion resistance?	X		
e. Radiation resistance? — N/A	X		
f. Physical and chemical properties?	X		
g. Welding materials?			X
h. Special processes?			X
i. Cathodic protection?			X
3. Are the specified materials compatible with each other and the environmental conditions to which they will be exposed?	X		
IV. QUALITY ASSURANCE			
A. ARE APPROPRIATE QUALITY ASSURANCE REQUIREMENTS SPECIFIED?	X		
B. HAS ADEQUATE ACCESSIBILITY BEEN PROVIDED TO PERFORM THE IN-SERVICE INSPECTION REQUIRED DURING PLANT LIFE? N/A			
C. HAVE QC INSPECTION REQUIREMENTS BEEN PROPERLY IDENTIFIED?	X		
D. ARE ACCEPTANCE CRITERIA INCORPORATED INTO THE DESIGN DOCUMENTS TO ALLOW VERIFICATION OF DESIGN REQUIREMENTS?	X		
V. PRODUCTION			
A. GENERAL			
1. Are accessibility, maintenance, repair, and in-service inspection and the conditions under which they will be performed considered (Overlay drawings should be provided if requested by the Project Manager)?			X
2. Are operation and maintenance features consistent with FERMCO policies and procedures?			X
3. Are adequate handling, storage, cleaning, and shipping requirements specified?	X		
4. Have OSHA and DOE requirements for operation and maintenance activities been specified?			X
5. Have needs for bypasses or operating spares been established?	X		
6. Have personnel requirements and limitations, including the qualifications and numbers of personnel available for plant operations and maintenance been considered?			X

Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

	YES	NO	UNABLE TO DETERMINE
B. STARTUP AND TESTING			
1. Have adequate pre-operational test requirements been adequately specified, including acceptance criteria?	☒	☐	☐
2. If Qualification Testing will be used to verify design adequacy:		☒	
a. Is the testing identified and documented?	☐	☐	☐
b. Have written test procedures been developed?	☐	☐	☐
c. Are acceptance criteria specified?	☐	☐	☐
C. OPERATION			
1. Have operation requirements under various conditions been considered?	☒	☐	☐
a. Plant start-up?	☒	☐	☐
b. Normal process operation?	☐	☐	☐
c. Process shutdown?	☐	☐	☒
d. Plant emergency operation?	☐	☐	☒
e. Special or infrequent operation?	☐	☐	☒
f. System abnormal or emergency operation?	☐	☐	☒
2. Are critical parameters to be controlled during operation clearly identified?			
D. MAINTENANCE AND REPAIR			
1. Have prior maintenance and repair experience related to similar systems and items been considered?	☐	☐	☒
2. Have adequate maintenance features and requirements been specified?	☒	☐	☐
3. Are items requiring frequent maintenance easily accessible?	☒	☐	☐
4. Has repairman safety been considered?	☒	☐	☐
5. Are spare parts appropriately considered?	☒	☐	☐
6. Are accessibility and other design provisions adequate for performance for required maintenance replacement and repair been considered?	☐	☐	☒
7. Have opportunities and limitation of remote maintenance and operation been considered? ~ N/A	☐	☐	☐
8. Have instrument calibration and preventive maintenance been considered?	☒	☐	☐
9. Have decontamination and decommissioning been considered?	☐	☐	☒

ATTACHMENT E

DESIGN REVIEW RECORD

REVIEWING ORGANIZATION: FLUOR DANIEL - IRVINE	DATE: 1/24/95
DESIGN NO. AND TITLE: UNH PROJECT - Independent Review Checklist	COMMENTS DUE BY: 1/25/95

ITEM NO.	REVIEWER NAME	PAGE NO./ STEP	COMMENT	COMMENT RESOLUTION
1	H. Kortnicki	P.1, I.D	Construction - Field routing of piping and supports did not permit constructability to be reviewed during. Not apparent how constructability was reviewed as construction proceeded.	
2	H. Kortnicki	P.1, I.E.	Failure Modes - No evidence of failure modes analysis or redundancy. Please clarify	

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ATTACHMENT E

DESIGN REVIEW RECORD

REVIEWING ORGANIZATION: FLUOR DANIEL - IRVINE				DATE: 1/24/95
DESIGN NO. AND TITLE: UWH Project - Independent Review Checklist				COMMENTS DUE BY: 1/25/95
ITEM NO.	REVIEWER NAME	PAGE NO./ STEP	COMMENT	COMMENT RESOLUTION
3	H. Kortnick	P. 2, #II.B.	Process Development - Pilot plant development is not required due to proven technology used.	
4	H. Kortnick	P. 5, #V.B.	Startup and Testing - Pre-operational test requirements are not adequate. Hydro-test of progressive cavity pump at vendor was not performed, resulting in failure of initial operational testing.	

Gary Hartwig
1/25/95

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Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

	YES	NO	Not Observed
I. DOCUMENT CONTROL			
1. Are drawings, equipment, valve and instrument numbering systems consistent with plant standards?	☐	☐	X
2. Has completeness of drawings and specifications been verified?	X	☐	
3. Are acceptance criteria specified in design documents sufficient to allow verification that design requirements have been adequately accomplished?	X	☐	
4. Are design details complete and accurate? Are tolerances properly called out?	X	☐	
5. Have obvious errors and omissions been corrected?	X	☐	
6. Are adequate SSC identification requirements specified?	X	☐	
K. RECORDS CONTROL			
1. Are requirements for record preparation, review, approval, retention, and storage adequately specified?	☐	☐	X
L. INTERFACE CONTROL			
1. Have the basic functions of each structure, system, and item been defined?	X	☐	
2. Have interface requirements including definition of functional and physical interfaces involving structures and items been considered?	X	☐	
3. Have layout and arrangement requirements (including ventilation criteria) been met?	☐	☐	X
4. Have interdisciplinary checks been completed?	☐	☐	X
5. Has the simplicity of the design been optimized?	X	☐	
6. Have energy conservation design features been incorporated to minimize the consumption of energy? NA	☐	☐	
7. Have underground utilities been appropriately considered? NA	☐	☐	
8. Have plant as-builts been fully considered in interface review?	X	☐	
II. NUCLEAR AND INDUSTRIAL SAFETY			
A. GENERAL			
1. Have requirements been provided to prevent undue risk to the health and safety of plant personnel and the public and to assure protection of the environment?	X	☐	
2. Has the need for safety studies/reports been identified and planned for?	X	☐	
B. SAFEGUARDS AND SECURITY			
1. Have access and administrative control requirements for plant safeguards and security been provided?	X	☐	
C. ENVIRONMENTAL SAFETY AND HEALTH			
1. Have permissible personnel radiation exposures or specified areas and conditions been considered?	☐	☐	X
2. Has the design properly considered the control of radioactive contamination and exposure to plant personnel and the public?	☐	☐	X
3. Does the design comply with the As Low As Reasonably Achievable (ALARA) criteria?	☐	☐	X
4. Have safety requirements dealing with source containment for preventing personnel injury been considered?	X	☐	
5. Have notches, cracks, crevices and rough surfaces that might retain radioactivity been minimized in the design?	☐	☐	X
6. Does the design provide for control of gaseous, liquid and solid waste output?	X	☐	
D. INDUSTRIAL SAFETY			
1. Have fire protection and fire resistance requirements been provided?	☐	☐	X
2. Have the following safety requirements been provided:	☐	☐	
a. Restricting use of dangerous materials?	X	☐	
b. Escape provision from enclosures?	X	☐	
c. Grounding of electrical systems?	☐	☐	X
d. Barriers and railings?	☐	☐	X
e. Emergency and first aid equipment?	☐	☐	X
f. Evacuation provisions?	☐	☐	X

Henry Jo Tuck
1/24/95

Attachment D - Sample Independent Review Checklist

Not Observed

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

	YES	NO	
I. GENERAL			
A. HAVE FUNCTIONAL AND OPERATIONAL REQUIREMENTS AND DESIGN CRITERIA BEEN SPECIFIED FOR THIS DESIGN?	☒	☐	
1. Were they used in design process?	☒	☐	
2. Were all areas adequately covered in design?	☐	☐	X
3. Are design assumptions reasonable and adequately identified and described?	☒	☐	
4. Are the applicable codes, standards, and regulatory directives, including issue and addenda, properly identified?	☒	☐	
5. Have they been met?	☐	☐	
6. Was the design method appropriate?	☒	☐	
7. Is the output reasonable compared to inputs?	☐	☐	X
B. HAVE HUMAN FACTORS BEEN CONSIDERED IN THE DESIGN?	☒	☐	
1. Are controls well organized?	☒	☐	
2. Are controls located for efficient operation?	☒	☐	
3. Can monitoring devices be easily and accurately read?	☒	☐	
4. Can all operations be performed safely without danger to the user or facility?	☒	☐	
5. Have Human Services requirements been considered? (Storage rooms, offices, communications, etc.)	☐	☐	
6. Can maintenance be performed easily?	☒	☐	
7. Have operations requiring special skills or special attention been minimized?	☒	☐	
8. Does the design adequately consider remote operability and maintainability requirements?	☒	☐	
9. Does the design minimize potential for human error? (*Pipe fittings to preclude inadvertent error in making routine connections, clear labeling and logical layouts to preclude mistakes in valve operations, minimum reliance on irregular manual operations, etc.*)	☐	☐	
C. COST ESTIMATING (Not Applicable)			
1. Have cost-benefit studies been made? Are they realistic?	☐	☐	
2. Are cost estimates realistic?	☐	☐	
3. Are costs minimized?	☐	☐	
D. CONSTRUCTION			
1. Are critical parameters to be controlled during construction clearly identified? (Field Routing)	☐	☒	
2. Has constructibility been considered? (Field Routing)	☐	☒	
3. Is equipment (commercial and other) available?	☒	☐	
4. Are specified materials appropriate based on availability, cost and application?	☒	☐	
5. Has previous construction experience been considered?	☒	☐	
E. FAILURE MODES			
1. Have redundance, diversity, and separation requirements for structures, systems, and items been considered?	☐	☒	
2. Have failure modes of critical elements been analyzed?	☐	☒	
3. Have failure effects, requirements related to structures, systems, and items (including definition of events and accidents which they must withstand) been considered?	☐	☒	
F. HAS THE PLANT ENVIRONMENT'S EFFECT ON THE DESIGN BEEN CONSIDERED?	☒	☐	
G. HAS THE DESIGN'S EFFECT ON PLANT AND OFFSITE ENVIRONMENT BEEN CONSIDERED?	☒	☐	
H. HAVE TRANSPORTABILITY REQUIREMENTS BEEN CONSIDERED?	☒	☐	
I. HAVE NATURAL PHENOMENA DESIGN CRITERIA BEEN PROPERLY ESTABLISHED?	☒	☐	

Gary Fortenberry 1/24/95

Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Checklist must be customized for the specific design under review.

	YES	NO	Not Observed
E. CRITICALITY SAFETY			
1. Has a criticality safety evaluation been done?	☐	☐	X
2. If changes in operation or equipment are made, would they change the conclusions of the evaluation?	☐	☐	X
3. Are the proposed controls adequate to assure criticality safety (e.g., administrative, configuration, process)?	☐	☐	X
III. TECHNICAL/PLANT ENGINEERING			
A. GENERAL			
1. Are materials process, parts, and equipment suitable for intended application?	X	☐	
2. Have performance requirements been considered?	X	☐	
a. Capacity?	X	☐	
b. Rating?	X	☐	
c. System output?	X	☐	
d. Reliability?	X	☐	
3. Have calculations been performed and provided to support design output?	☐	☐	X
4. Are control devices of proper type and adequate for purpose?	X	☐	
5. Have previous operating and maintenance experience been considered?	☐	☐	X
6. Has the use of mechanical equipment in radioactive areas been minimized?	X	☐	
7. Has technical risk assessment been considered (i.e., state-of-the-art versus proved design)?	☐	☐	X
8. Have all necessary codes and standards been identified and a compliance evaluation considered?	☐	☐	X
9. Has testing been properly addressed?	X	☐	
10. Has application of automatic data processing been appropriately considered? Not Applicable	☐	☐	
B. PROCESS DEVELOPMENT			
1. Have design conditions been considered?	X	☐	
a. Pressure?	X	☐	
b. Temperature?	X	☐	
c. Fluid chemistry?	☐	☐	X
2. Have chemistry requirements such as provisions for some limitations of fluid chemistry been provided for?	X	☐	
3. Is pilot plant or development required and planned?	☐	X	
4. Are key process control points identified?	X	☐	
C. MECHANICAL			
1. Have mechanical requirements been considered?	X	☐	
a. Vibration?	X	☐	
b. Stress?	X	☐	
c. Shock?	X	☐	
d. Reaction forces?	X	☐	
2. Have structural requirements for equipment foundations and pipe supports been provided?	X	☐	
3. Have hydraulic requirements been considered?	☐	☐	X
a. Pump net positive suction heads?	☐	☐	X
b. Allowable pressure drops?	☐	☐	X
c. Allowable fluid velocities?	☐	☐	X
d. Anti-siphoning provisions?	☐	☐	X
e. Elimination of inadvertent transfer routs?	X	☐	
f. Overflow provisions?	X	☐	
g. The design pressures are such that they perform the required function and are minimally in excess of the resistance at the static head?	X	☐	
h. Dynamic pressure addressed, where applicable?	☐	☐	X
4. Have breakpoints been properly identified for system limits or for line and valve classes?	X	☐	

Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Checklists must be customized for the specific design under review.

D. ELECTRICAL			
1. Have electrical requirements been met?	☒	☐	
a. Source of power?	☒	☐	
b. Voltage?	☒	☐	
c. Raceway requirements?	☐	☐	
d. Electrical insulation requirements?	☐	☐	
e. Motor requirements?	☐	☐	
f. Proper function and routing?	☒	☐	
g. Have cable and conduit schedules been prepared [illegible] designer?	☒	☐	
E. CIVIL			
1. Have design loads been provided for the following? Not Applicable	☐	☐	
a. Seismic?	☐	☐	
b. Wind?	☐	☐	
c. Thermal?	☐	☐	
d. Dynamic?	☐	☐	
2. Have anticipated environmental conditions during storage, construction, and operation been considered?	☐	☐	X
3. Have utility systems interface requirements been considered and established?	☒	☐	
4. Have requirements for concrete been properly identified? Not Applicable	☐	☐	
F. MATERIALS			
1. Concrete finishes for protective coatings? Not Applicable	☐	☐	
2. Proper additives, release agents, or curing compounds?	☐	☐	
a. Compatibility with existing plant equipment and materials? Not Applicable	☐	☐	
b. Electrical insulation properties?	☐	☐	
c. Protective coatings?	☐	☐	
d. Corrosion resistance?	☐	☐	
e. Radiation resistance?	☐	☐	
f. Physical and chemical properties?	☐	☐	
g. Welding materials?	☐	☐	
h. Special processes?	☐	☐	
i. Cathodic protection?	☐	☐	
3. Are the specified materials compatible with each other and the environmental conditions to which they will be exposed?	☐	☐	X
IV. QUALITY ASSURANCE			
A. ARE APPROPRIATE QUALITY ASSURANCE REQUIREMENTS SPECIFIED?	☐	☐	
B. HAS ADEQUATE ACCESSIBILITY BEEN PROVIDED TO PERFORM THE IN-SERVICE INSPECTION REQUIRED DURING PLANT LIFE?	☐	☐	
C. HAVE QC INSPECTION REQUIREMENTS BEEN PROPERLY IDENTIFIED?	☐	☐	
D. ARE ACCEPTANCE CRITERIA INCORPORATED INTO THE DESIGN DOCUMENTS TO ALLOW VERIFICATION OF DESIGN REQUIREMENTS?	☐	☐	
V. PRODUCTION			
A. GENERAL			
1. Are accessibility, maintenance, repair, and in-service inspection and the conditions under which they will be performed considered (Overlay drawings should be provided if requested by the Project Manager)?	☐	☐	
2. Are operation and maintenance features consistent with SMCO policies and procedures?	☐	☐	
3. Are adequate handling, storage, cleaning, and shipping requirements specified?	☐	☐	
4. Have OSHA and DOE requirements for operation and maintenance activities been specified?	☐	☐	
5. Have needs for bypasses or operating spares been established?	☐	☐	
6. Have personnel requirements and limitations, including qualifications and numbers of personnel available for plant operations and maintenance been considered?	☐	☐	

Not Observed

Hung Vietuell
11/ /95

6587

Attachment D - Sample of Independent Review Checklist (cont'd)

NOTE: This is a generic sample only. Check list must be customized for the specific design under review.

B. STARTUP AND TESTING (Problems with progressive cavity pumps)			
1. Have adequate pre-operational test requirements been clearly specified, including acceptance criteria?	☐	☒	Not observed
2. If Qualification Testing will be used to verify design adequacy:			
a. Is the testing identified and documented?	☐	☒	
b. Have written test procedures been developed?	☐	☒	
c. Are acceptance criteria specified?	☐	☒	
C. OPERATION			
1. Have operation requirements under various conditions been considered?	☒	☐	
a. Plant start-up?	☒	☐	
b. Normal process operation?	☒	☐	
c. Process shutdown?	☐	☐	X
d. Plant emergency operation?	☐	☐	X
e. Special or infrequent operation?	☐	☐	X
f. System abnormal or emergency operation?	☒	☐	
2. Are critical parameters to be controlled during operation clearly identified?			
D. MAINTENANCE AND REPAIR			
1. Have prior maintenance and repair experience related to similar systems and items been considered?	☐	☐	X
2. Have adequate maintenance features and requirements been specified?	☒	☐	
3. Are items requiring frequent maintenance easily accessible?	☒	☐	
4. Has repairman safety been considered?	☒	☐	
5. Are spare parts appropriately considered?	☐	☐	X
6. Are accessibility and other design provisions adequate for performance for required maintenance replacement and repair been considered?	☒	☐	
7. Have opportunities and limitation of remote maintenance and operation been considered?	☒	☐	
8. Have instrument calibration and preventive maintenance been considered?	☒	☐	
9. Have decontamination and decommissioning been considered?	☒	☐	

TOTAL P.06

ENG-IDR-101
February 1, 1995

ATTACHMENT D
PLAN OF THE DAY

UNH Neutralization Project Design Review

This section contains:

Plan of the Day with notes

Supplemental Information

Attendance Sheets

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Name	Organization	Phone
Bill Kortner	FERMCO Eng.	648-6121
CECIL BECKETT	" "	648-6211
JOHNNY REISING	DOE-FN	648-3137
Chris White	DOE-FN	648-3172
Al Beasley	DOE/RI Tech	
Garner Powell	MTC / DOE	738-8915
THURLE MOSS	FERMCO ENG	648-6152
RON WORSLEY	ENGRG.	648-6155
Steve Reuteke	ENG	648-6165
Bob Heck	ENG	648-6103
⇒ Harry Kortnicki	Fluor Daniel-Irvine	714-975-5601
⇒ CRAIG MILLER	FLUOR DANIEL IRVINE	714-975-5428
⇒ Kenneth Roberts	Fluor Daniel Chicago	312 368 3913
TONY PYRZ	PARSONS FAIRFIELD	513-870-8275
HAROLD L. THOMPSON	FERMCO-WCC	513-738-6187
David R. Spence	DOE / RI-Tech	
STAN FRANK	FERMCO	738-6650
DAVID ~~SCHETTSCHNEIDER~~	FERMCO	738-6101

Briefing 738-6116 — Tom Crawford

Joe Waters - 648-7344 called 11:15

KEY ISSUES	RESPONSIBILITIES	TARGET TQD	COMPLETE
• SAR - Authorization Basis - Consistent with Design (USQ's)	Ubbes		
• Heat Tracing	Worsley		
• Documenting for Vendor Deliverables/ Specs Changed by Construction	Reutcke		
• Valve Leaks / Didn't Get Valves Specified	Reutcke		
• Flow to Totalizer Doesn't Work	Pyrz		
• Valve Location Not Specified / Construction Location Poor for Maintenance	Pyrz		
• Design Basis for Diaphragm Pump / Update Drawings / RCR / Support.	Pyrz/Worsley/Kortier		
• Weld Failure / Pipestress / Weld Inspection / Hangers	Roberts/Worsley/Kortier/MAORCR.		
• Remediation Pressure Instruments / High Trip Pump, High Trip Pressure	Pyrz		
• Secondary Containment Adequate	Roberts/Worsley/Kortier x SAR Panel Bill Rainer 738-6911		
• Plan/Procedure for Technical Review GOAL	Beckett x input from all parties to Cecil - cecil assembles. -		
• Hydrostatic static testing?	Pyrz		
• ~~Distinct Comm Form~~			
• ~~Pump Change~~			

— Parsons / Hydro

— Rich. - Weld Analysis

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6582

1-11-95

Bill Rortier	FERMCO Eng	648-6121
Dennis Anderson	DOE-FN	648-3103
David R. Spence	DOE/RI-Tech	
Al Beasley	DOE/RI Tech	
THURLE MOSS	FERMCO ENG	648-6152
Harry Kortnicki	Fluor Daniel - Irvine	(714)975-5601
CRAIG MILLER	FD-Irvine	714-975-5428
Richard C. MAUREN	FERMCO Const	738 6564
RON WORSLEY	ENGRG	648-6155
CECIL BECKETT	FERMCO ENG	648-6211
TONY PYRZ	PARSONS	870-8275
BOB HUCK	ENG'G	648-6103
Kenneth Roberts	Fluor Daniel	(312) 368 3013
Steve Reutcke	Fermco Eng	648-6165
DAVID BRETTSCHNEIDER	FERMCO R&D	738-6101

UNH 7:30 AM MEETINGS SCHEDULE

1/11/95	3RD FL. CENTRAL
1/12/95	4TH FL. CENTRAL
1/13/95	BOB HECK'S OFFICE
1/16/95	3RD FL. CENTRAL
1/17/95	4TH FL. CENTRAL
1/18/95	4TH FL. CENTRAL
1/19/95	4TH FL. CENTRAL
1/20/95	~~4TH~~ 2nd FL. CENTRAL

THESE WILL BE ONE HOUR SESSIONS.

PLAN OF THE DAY - JANUARY ~~11~~, 1995

KEY ISSUES		RESPONSIBILITIES	TARGET ~~TRB~~	COMMENTS
1)	SAR - Authorization Basis - Consistent Design (USQ's)	Ubbes	TBD	Pyrz advised to get current version of SAR circa 1/11/95 and list of USQ's. SAR plus USQ list ~~with~~ to authorization basis.
2)	Heat Tracing	Worsley		TBD
3)	Documenting for Vendor Deliverables/ Specs Changed by Construction	Reutcke	Ongoing	Since 200 actions are involved, the team will report only important issues. Issues per 1/11/95 reported; seamless vs. seam pipe, hoses.
4)	Valve Leaks / Didn't Get Valves Specified	Reutcke		No change.
5)	Flow to Totalizer Doesn't Work	Pyrz	1/17/95	Item will be resolved with preparation of Design ~~basis information~~ Criteria Package -- see item #7; pump change redefines instrumentation requirements. ~~Design criteria package~~
6)	Valve Location Not Specified / Construction Location Poor for Maintenance	Pyrz		~~No change~~. Stan Frank / McCall to identify ~~start~~ location
7)	Design Basis for Diaphragm Pump / Update Drawings	Pyrz/Worsley/Kortier	~~1/11/95~~ 1/17/95	Draft response due by 1/11/95 per DOE-0374-95, 12/30/94.
8)	Weld Failure / Pipestress / Weld Inspection / Hangers	Roberts/Worsley/Kortier	1/13/95	Modelling in process.
9)	Remediation Pressure Instruments / High Trip Pump, High Trip Pressure	Pyrz	1/17/95	Same date and comment as item #5.
10)	Secondary Containment Adequate	Roberts/Worsley/Kortier	1/17/95	Waiver process as required by GDC will be followed.

1/12

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ernald
nvironmental Restoration
lanagement Corporation
) Box 398704
ncinnati, Ohio 45239-8704
131 738 6200

ENGINEERING CALCULATION

PROJECT NUMBER:	6587
BY:	
DATE:	
PAGE:	OF
REVISED:	

UBJECT:

TONY PIRE	PARSONS	870-8225
Dave Spence	DOE/RI-Tech	-3163
Al Beasley	DOE/RI Tech	64E 3163
Richard L. Mauer	FEMCO Const	738-6564
Dennis Anderson	DOE-FN	648-3103
Harry Kortnicki	FDI-Irvine	(714)975-5601
CRAIG MILLER	FDI-IRVINE	714-975-5428
Bill Kortier	FERMO Eng	648-4121
Steve Reuteke	Fermco Eng	648-[illegible]
Kenneth Roberts	Fluor Daniel	(312) 368-3913
THURLE MOSS	FLUOR DANIEL	648-6152

PLAN OF THE DAY - JANUARY 12, 1995

KEY ISSUES		RESPONSIBILITIES	TARGET TRB	COMMENTS
1)	SAR - Authorization Basis - Consistent Design (USQ's)	Ubbes	TBD	Pyrz advised to get current version of SAR circa 1/11/95 and list of USQ's. SAR plus USQ list is authorization basis.
2)	Heat Tracing	Worsley	TBD	
3)	Documenting for Vendor Deliverables/ Specs Changed by Construction	Reutcke	Ongoing	Since 200 actions are involved, the team will report only important issues. Issues per 1/11/95 reported; seamless vs. seam pipe, hoses.
4)	Valve Leaks / Didn't Get Valves Specified	Reutcke		No change. Why bought two sets that [illegible]
5)	Flow to Totalizer Doesn't Work	Pyrz	1/17/95	Item will be resolved with preparation of Design Criteria Package -- see item #7; pump change redefines instrumentation requirements.
6)	Valve Location Not Specified / Construction Location Poor for Maintenance	Pyrz		Stan Frank/McCall to identify location. 1:00 p.m. at site Pyrz
7)	Design Basis for Diaphragm Pump / Update Drawings	Pyrz/Worsley/Kortier	1/17/95	Draft response due by 1/11/95 per DOE-0374-95, 12/30/94.
8)	Weld Failure / Pipestress / Weld Inspection / Hangers	Roberts/Worsley/Kortier	1/13/95	Modelling in process.
9)	Remediation Pressure Instruments / High Trip Pump, High Trip Pressure	Pyrz	1/17/95	Same date and comment as item #5.
10)	Secondary Containment Adequate	Roberts/Worsley/Kortier	1/17/95	Waiver process as required by GDC will be followed.

1/13

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KEY ISSUES	RESPONSIBILITIES	TARGET TRB	COMMENTS
1) Plan/Procedure for Technical Review	Beckett	1/13/95	Inputs from team participants to Beckett 1/13/95 a.m. per Engineering procedure 12-4008.
2) Develop Verification Test (Hydro)	Pyrz	1/18/95	Parsons to identify hydro procedures and stand ready to issue new hydro procedure.
3) Dead Leg in UNH Transfer Line	Roberts/Huey/Pyrz		Line is deadended; may not flush/drain. - Hxud - change
4) Batches Exceed FSAR Limits	Pyrz		See Item #1. — Enrichment/Scw Portion - dilution

TECHNICAL MEETINGS	RESPONSIBILITIES	TARGET TRB	COMMENTS
1) Weld Failure Analysis	Maurer	1/12/95	Vendor report due to Maurer 1/11/95. - 3 cc lock mtg
2) Develope Verification Test (Hydro)	Pyrz	1/17/95	Proposed rehydro to prove piping system integrity.

3/95

6587

Bill Kortier	FERMCO-ENG	648-6121
Craig Miller	FD Irvine	714-9755428
Herb Clark	FD Greeville	803-281-5928
Harry Kortnicki	FD Irvine	714-975-5601
George Pelc	RSO Support	313 738-9061
Richard L. Mauer	FERMCO Const	738 6564
Tony Pyrz	PARSONS	870-8275
THURLE MOSS	FERMCO-ENG	648-6152
Kenneth Roberts	Fluor Daniel	(312) 368 3913
Ronald C. Worsley	ENGRG	648-6155
Bob Hulic	ENGRG	648-6103
Al Beasley	DOE/RI Tech	
Dennis Anderson	DOE-FN	648-3103
David R. Spence	DOE/RI-Tech	
Mike Yates	FERMCO-CP	648-3035
Steve Reutcke	Fermco-ENG	648-6165
Richard E Kline	ORR-UNH	648 6504
Paul Breitschneider	Fermco-RSO	738-6101

Independence

PLAN OF THE DAY - JANUARY 13, 1995

KEY ISSUES		RESPONSIBILITIES	TARGET	COMMENTS
1)	SAR - Authorization Basis - Consistent Design (USQ's)	~~Ubbes~~ Kortier	TBD	Pyrz advised to get current version of SAR circa 1/11/95 and list of USQ's. SAR plus USQ list is authorization basis. Chang Butch [illegible]
2)	Heat Tracing	Worsley	TBD	
3)	Documenting for Vendor Deliverables/ Specs Changed by Construction	Reutcke	Ongoing	Since 200 actions are involved, the team will report only important issues. Issues per 1/11/95 reported; seamless vs. seam pipe, ~~hoses~~. ~ 20-25 [illegible]
4)	Valve Leaks/Didn't Get Valves Specified	Reutcke		Why were two sets purchased and one set used. - [illegible]
5)	Flow to Totalizer Doesn't Work	Pyrz / [illegible]	1/17/95	Item will be resolved with preparation of Design Criteria Package -- see item #7; pump change redefines instrumentation requirements. - contact [illegible]
6)	Valve Location Not Specified/ Construction Location Poor for Maintenance	~~Pyrz~~ Worsley/		Frank/McCall to identify location. Pyrz to meet with ~~Frank 1/13/95, 1:00~~ pm.
7)	Design Basis for Diaphragm Pump/ Update Drawings	Pyrz/Worsley/Kortier	1/17/95	Draft response due by 1/11/95 per DOE-0374-95, 12/30/94.
8)	Weld Failure/Pipestress/Weld Inspection/Hangers	Roberts/Worsley/Kortier	1/13/95	~~Modelling in process~~. modelling complete - / Analysis -
9)	Remediation Pressure Instruments/ High Trip Pump, High Trip Pressure	Pyrz / [illegible]	1/17/95	Same date and comment as item #5.
10)	Secondary Containment Adequate	Roberts/Worsley/Kortier	1/17/95	Waiver process as required by GDC will be followed.
11)	Plan/Procedure for Technical Review	Beckett	1/13/95	Inputs from team participants to Beckett 1/13/95 a.m. per Engineering procedure 12-4008. Beckett to assemble inputs for review 1/16/95.

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PLAN OF THE DAY

~ 1:00 Parsons

12)	Develop Verification Test (Hydro)	Pyrz	1/18/95	Parsons to identify hydro procedures and stand ready to issue new hydro procedure.
13)	Dead Leg in UNH Transfer Line	Roberts/Huey/Pyrz		Line is deadended; may not flush/drain. Partial explanation; line is to be flanged, need for hydro was questioned. – Industrial Prod.
14)	Batches Exceed FSAR Limits	Pyrz		See Item #1. Concern is based on enrichment limits/grams specified in SAR. ~ One Bottom - Trinitiles Contact.
15)	Logic for Schedule Development Responsibility	Kortier/Brettschneider/ Kortnicki	1/16/95	Work activities and their interelationships are to be identified. Lapse times will be assigned later.

TECHNICAL MEETINGS		RESPONSIBILITIES	TARGET	COMMENTS
1)	Weld Failure Analysis	Maurer	1/12/95	Vendor report due to Maurer 1/11/95. Technical meeting scheduled for 1/13/95, 3:00 p.m. at Springdale.
2)	Develop Verification Test (Hydro)	Pyrz	1/17/95	Proposed rehydro to prove piping system integrity.

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TECHNICAL REVIEW

NUCLEAR MATERIAL LIQUID HANDLING

DESIGN

Available design data was reviewed for technical adequacy and operability. This data included performance and procurement specifications, design drawings, relevant meeting notes, Project Order Plan, Scope of Work and Field Change Requests. Due to the relatively short operating life of this project and followint Docu;;ment No. 12-4008, Rev.0, dated 9-16-94, Independent Design reviews, Attachment C, page 13 of 20, number 4 under General Comments, states that "Common sense should be used when making all comments." This is the approach taken.
The drawings and specifications are sufficiently clear, adequate and unambiguous to provide what is required. The specifications refer to codes and standards that meet the requirements for transferring and processing the UN solutions safely. Documentation of the change from progressive cavity to air diaphragm pumps was found only on the design drawings. Additional writted documentation should be prepared and filed accordingly, stating the rationale for the change from the procurement specifications. The diaphragm pumps are a good choice for transferring this liquid with suspended solids and met "fit for purpose" guidelines. The progressive cavity pumps are a better fit for more viscous materials at higher operating pressures. The diaphragm pumps meet all of the design requirements and have the advantages of simplicity of design and controls, able to run dry without damage, can be used in all electrical classifications, no rotating parts to balance, ease of maintenance, flow control achieved by simply controlling the inlet air pressure, mechanical seals not required and high pressure relief or bypass not required.

IMPLEMENTATION / INSTALLATION

A site visit to review the installation found the conversion of the pump skids in progess. Additional bracing had been attached to the ;pump outlets to reduce transmitted vibration to the piping system. It is recommended that the pump manufacturer be consulted for this and also the recommended length of flexible outlet piping necessary to reduce vibrations transmitted to the system. Some vibration is considered normal for these type of pumps due to their design and construction. Overall construction, fabrication and installation appeared to meet good engineering practices. The phusical locations of the pump skids are restricted to spaces available in each area. This is not the best arrangement but considering the relatively short operating life of the system from the Scope of Work document, it is workable and should not restrict operations unduly. The piping installation and routing appeared adequate for this service, considering the interferences with existing piping and equipment. Pipe supports should be reviewed for each location to verify that pipe expansion is considered for the system and undue stresses are not possible due to misapplication of hanger types.

Secondary containment was evident around all ofthe UN storage tanks. There have been some leaks identified, from as low as one drop per day to several drops per hour. Most of the leaks appear to be from nozzle locations with blind flanges. At least one blind flange was carbon steel and not stainless as the rest of the tank materials. This is an obvious source of a leak due to the corrosiveness of the UN solution. Leaks due to tank integrity were not able to be determined because of access restrictions and tank insulation. The impact on leakage rates should be considered when each tank is emptied. As mixers are put into operation and tank contents recirculated prior to transfer, the possibility of increased leakage exists from velocity (circulation) effects in each tank. As the tank level is reduced, this effect along with hydrostatic head reduction will reduce the leakage rates to zero when the tank is empty. Pump suction through a dipleg inserted in each manway necessitates some simple vapor cover to reduce any emissions and for personnel safety also.

PROCUREMENT / INSPECTION

Purchase orders were not available for review, so no comments can be made concerning this. The purchase specifications require testing prior to delivery along with certificates verifying the type of quality assurance performned on the equipment. No reports were found that verified the equipment conformed to the specification requirements. It is recommended that all testing and inspection requirements be performed where and when required and waivers from shop testing not be considered. The level of detail requirements in the specifications and data sheets provide for a wide range of responses from bidders that will meet the requirements listed but are not suitable for the intended service. This makes it very difficult to disqualify any bidder for technical non-compliance. Vendors should provide proof of successful operation in similar service and conditions with the same materials of construction as specified with their bid package. This will remove prototype equipment and inexperienced vendors from even being considered.

PRE-OPERATIONAL TESTING / VERIFICATION

At mechanical completion, prior to any testing, a complete walkdown of the system should be performed to verify installation agreement with the flow sheets. Tag numbers need to be confirmed on all equipment, valves, panels, etc., to verify that implementation agrees with the design. A functional check-out should be performed on control and power logic to verify agreement with design. A full system hydro test should be performed to prove system integrity against leaks. Additional hydro tests should be performed each time the transfer pump skid is moved or any connections broken. These hydro tests should be limited to the components affected by the use of isolation valves. Worker washdown stations should be provided in the vicinity of the tanks and pump skids to meet OSHA. The permanent washdown stations have had the water turned off and the hazard posed by the UN solutions will require some worker safety features.

START-UP AND TRAINING

Operator understanding and familiarity with the intended operation is mandatory for successful completion and also to insure personnel safety. A training program for all operators in a classroom setting would provide operating instructions and sequencing events to help insure their safety. After completion classroom training, dry-run training should show the location of pump skids, valves which need to be operated and washdown facilities. This training should be documented to verify that adequate steps have been taken to meet restoration requirements. After completion of training and proper documentation, it is recommended that water be used for start-up to further familiarize the operators with the system. Now the operators should be ready to introduce the UN solutions for transfer and processing.

RECOMMENDATIONS

Specific recommendations are discussed in each section above and are summarized below:

1) Document the design change from progressive cavity to diaphragm type pumps

2) Consult pump manufacturer for agreement with additional bracing that has been installed and also need for pulsation dampener on pump outlet

3) Consult pump manufacturer for recommendation of length of flexible outlet connection necessary to reduce transmitted vibration (may be combined with need for dampener above)

4) Review pipe supports for proper type at each location

5) Impact of starting mixers and circulating contents on any existing leaks

6) Verify that all sludge has been fluidized and tank contents are uniform before transferring contents. This may be more difficult with the 4 large horizontal tanks.

7) Verify testing at point of manufacture for all equipment per P.O. requirements.

8) Check installation against flow sheets upon mechanical completion.

9) Provide portable washdown stations.

10) Provide detailed training for operators.

11) Heat tracing temperature; use minimum available or restrict operation to ambient conditions not requiring tracing.

12) Existing lines that were shutdown and blocked in may have UNH solution, need to determine this and develop plan for processing.

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7:30 Plan of the DAY

1/16/95

tive Rentche	Fermco Eng	648-6165
M PERZ	PARSONS	870-8275
RAIG MILLER	FD-IRVINE	714-975-5428
RRY KORTNICKI	FD - IRVINE	714-975-5601
Al Beasley	DOE/RI Tech	648-3163
enneth Roberts	Fluor Daniel	312-368-3913
hris White -	DOE	648-3172
ill Kovtner	FERMCO-Eng	648-6121
ECIL BECKETT	FERMCO	648-6211
ON WORSLEY	FERMCO-ENGRG.	648-6155
ichard L. Mauer	FERMCO Const	738-6564
URLE MOSS	FERMCO-ENG	648-6152

PLAN OF THE DAY - JANUARY ~~16~~ 17, 1995

KEY ISSUES		RESPONSIBILITIES	TARGET	COMMENTS
1)	SAR - Authorization Basis - Consistent Design (USQ's)	Kortier/Hiles	TBD	Pyrz advised to get current version of SAR circa 1/11/95 and list of USQ's. SAR plus USQ list is authorization basis. Concern over batches exceeding SAR limits -- see item #14 below; is ongoing and can't find reference in SAR. - (Worsley - [illegible] SAR)
2)	Heat Tracing	Worsley	TBD	
3)	Documenting for Vendor Deliverables/ Specs Changed by Construction	Reutcke	Ongoing	Since 200 actions are involved, the team will report only important issues. Issues per 1/11/95 reported; seamless vs. seam pipe. Hoses are a non-issue. Approx. 25 procurements by other than construction are being reviewed 1/16/95. -
4)	Valve Leaks/Didn't Get Valves Specified	Reutcke		Why were two sets purchased and one set used. Leakers were 3 inch ball valves from local vendor.
5)	Flow to Totalizer Doesn't Work	Miller/Pyrz	1/17/95	Item will be resolved with preparation of Design Criteria Package -- see item #7; pump change redefines instrumentation requirements.
6)	Valve Location Not Specified/ Construction Location Poor for Maintenance	~~Pyrz~~ Worsley		Frank/McCall to identify location. Pyrz to meet with Frank 1/13/95, 1:00 pm. / Worsley given assignment -/ fix under review
7)	Design Basis for Diaphragm Pump/ Update Drawings	Pyrz/Worsley/Kortier	1/17/95	Draft response due by 1/11/95 per DOE-0374-95, 12/30/94. Parsons contact is Scott Vaaler.
8)	Weld Failure/Pipestress/Weld Inspection/Hangers	Roberts/Worsley/Kortier	1/13/95	Modelling is complete. Analysis runs are being made as needed. — Crack Propagation question for Herb.
9)	Remediation Pressure Instruments/ High Trip Pump, High Trip Pressure	Miller/Pyrz	1/17/95	Same date and comment as item #5.
10)	Secondary Containment Adequate	Roberts/Worsley/Kortier	1/17/95	Waiver process as required by GDC will be followed. Consultant (Sirine) needs [illegible]

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11)	Plan/Procedure for Technical Review	Beckett	1/13/95	Inputs from team participants to Beckett 1/13/95 a.m. per Engineering procedure 12-4008. Beckett to assemble inputs for review 1/16/95.
12)	Develop Verification Test (Hydro)	Pyrz	1/18/95	Meeting scheduled 1:00 pm, 1/17/95, at Parsons to confirm results of design review and establish redesign/path forward.
13)	Dead Leg in UNH Transfer Line	Roberts/Huey/Pyrz		Line is deadended; may not flush/drain. Partial explanation; line is to be flanged, need for hydro was questioned. Item open
14)	Batches Exceed FSAR Limits	Kortier/Hiles		See Item #1. Concern is based on enrichment limits/grams specified in SAR. - Pattern - Batch sheets
15)	Logic for Schedule Development Responsibility	Beckett/Kortnicki	1/16/95	Work activities and their interelationships are to be identified. Lapse times will be assigned later.

TECHNICAL MEETINGS		RESPONSIBILITIES	TARGET	COMMENTS
1)	Weld Failure Analysis	Maurer	1/12/95	Vendor report due to Maurer 1/11/95. Technical meeting scheduled for 1/13/95, 3:00 p.m. at Springdale.
2)	Develop Verification Test (Hydro)	Pyrz	1/17/95	Proposed rehydro to prove piping system integrity.

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UNH Plan of the DAY 6587
1/17/95

Steve Reutche	Fermco Eng 648-6165
CECIL BECKETT	FERMCO pg 844-3010 648-6211
CRAIG MILLER	FD IRVINE 714-975-5428
HARRY KORTNICKI	FD-IRVINE 714-975-5601
THURLE MOSS	FERMCO-ENG 648-6152
TONY PEREZ	PARSONS 870-8275
Kenneth Roberts	Fluor Daniel (512) 569 5913
Bill Kortier	FERMCO Eng 648-6121
Ron Woesley	Fermco Energy 648-6155
Dave Spence	DOE/RI-Tech 3163
Al Beasley	DOE/RI-Tech 3163

PLAN OF THE DAY - JANUARY ~~17~~ 18, 1995

KEY ISSUES		RESPONSIBILITIES	TARGET	COMMENTS
1)	SAR - Authorization Basis - Consistent Design (USQ's)	Kortier/Hiles	TBD	Pyrz advised to get current version of SAR circa 1/11/95 and list of USQ's. SAR plus USQ list is authorization basis. Concern over batches exceeding SAR limits -- see item #14 below; is ongoing and can't find reference in SAR. A reminder: the SAR is controlled by configuration management rules, i.e., discussions about 'what-ifs' are N/A.
2)	Heat Tracing	Worsley	TBD	
3)	Documenting for Vendor Deliverables/ Specs Changed by Construction	Reutcke	Ongoing	Since 200 actions are involved, the team will report only important issues. Issues per 1/11/95 reported; seamless vs. seam pipe. Hoses are a non-issue. Approx. 25 procurements by other than construction are being reviewed 1/16/95.
4)	Valve Leaks/Didn't Get Valves Specified	Reutcke		Why were two sets purchased and one set used. Leakers were 3 inch ball valves from local vendor.
5)	Flow to Totalizer Doesn't Work	Miller/Pyrz	1/17/95	Item will be resolved with preparation of Design Criteria Package -- see item #7; pump change redefines instrumentation requirements.
6)	Valve Location Not Specified/ Construction Location Poor for Maintenance	Worsley		Frank/McCall to identify location. Pyrz to meet with Frank 1/13/95, 1:00 pm. Assignment reassigned to Ron Worsley as RSO ENG. Worsley is in touch with Safety.
7)	Design Basis for Diaphragm Pump/ Update Drawings	Pyrz/Worsley/Kortier	1/17/95	Draft response due by 1/11/95 per DOE-0374-95, 12/30/94. Parsons contact is Scott Vaaler.
8)	Weld Failure/Pipestress/Weld Inspection/Hangers	Roberts/Worsley/Kortier	1/13/95	Modelling is complete. Analysis runs are being made as needed. Special note: crack propogation question - Herb Clar to have discussion w/ Dave Spence.

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KEY ISSUES	RESPONSIBILITIES	TARGET	COMMENTS
9) Remediation Pressure Instruments/ High Trip Pump, High Trip Pressure	Miller/Pyrz	1/17/95	Same date and comment as item #5.
10) Secondary Containment Adequate	Roberts/Worsley/Kortier	1/17/95	Waiver process as required by GDC will be followed. Copy of waiver to be supplied to Dave Spence. / discover that waiver not approved
11) Plan/Procedure for Technical Review	Beckett	1/13/95	Inputs from team participants to Beckett 1/13/95 a.m. per Engineering procedure 12-4008. Beckett to assemble inputs for review 1/16/95.
12) Develop Verification Test (Hydro)	Pyrz	1/18/95	Meeting scheduled 1:00 pm, 1/17/95, at Parsons to confirm results of design review and establish redesign/path forward. (Integrated w/ #10)
13) Dead Leg in UNH Transfer Line	Roberts/Huey/Pyrz		Line is deadended; may not flush/drain. Partial explanation; line is to be flanged, need for hydro was questioned.
14) Batches Exceed FSAR Limits	Kortier/Hiles		See Item #1. Concern is based on enrichment limits/grams specified in SAR. Enrichment limits cannot be found in SAR.
15) Logic for Schedule Development Responsibility	Beckett/Kortnicki	1/16/95	Work activities and their interelationships are to be identified. Lapse times will be assigned later.

TECHNICAL MEETINGS	RESPONSIBILITIES	TARGET	COMMENTS
1) Weld Failure Analysis	Maurer	1/12/95	Vendor report due to Maurer 1/11/95. Technical meeting scheduled for 1/13/95, 3:00 p.m. at Springdale.
2) Develop Verification Test (Hydro)	Pyrz	1/17/95	Proposed rehydro to prove piping system integrity.

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DESIGN VERIFICATION REPORT
ACTION ITEMS
1/18/95

PIPING STRESS ANALYSIS - Action: Ken Roberts

Provide a report detailing the piping stress analysis of all UNH piping and hanger systems. The analysis shall be based on the present configuration of piping as obtained through field observations of piping runs, piping material identifications provided by FERMCO, and location and configuration of piping supports. Assumed fixed supports shall be clearly identified. The report shall be performed for operating temperatures of 50, 150, and 250 deg F. The report shall identify stress levels at fixed supports. Any stress levels exceeding material limits shall be clearly identified. Isometrics of each piping run shall be included. Recommendations for modification or loosening of pipe supports to reduce piping stress levels shall also be included.

WELDING ANALYSIS - Action: Herb Clark/Ron Worsley

Provide a report detailing the analysis of the failed UNH carbon steel pipe weld. The report shall contain a complete summary of tests performed, observations made, and indicated failure mechanism and cause(s). A recommendation for inspection of any other suspect carbon steel pipe welds shall also be provided. The inspection procedure shall identify method to be used and criteria for acceptance of pipe welds.

SAR - VALIDATION AGAINST UNH SYSTEM - Action: Tony Pyrz/Tim Hiles (Parsons)

Assure that design matches authorization basis in SAR. Verify by walk-thru. Report on items that were changed and red-line or as-build changes. NOTE: SAR is a document controlled under Configuration Management and requires Engineering signature for change in addition to normally required signatures. Clarify Joe Patton comment on concern for a potential batch that may have enrichment higher than acceptable.

OPERABILITY/MAINTENANCE - Action: Ron Worsley

Review location and access instruments, controls, valves to promote safety in operation by providing reasonable accessibility to operators. Also review UNH system design against potential OSHA concerns. Make recommendations for design changes.

Evaluate dead leg in UNH transfer line for operational and safety basis. Line is deadended and may not drain. Provide analysis with a recommendation for correcting.

HEAT TRACING - Action: Ron Worsley

Provide memo addressing heat tracing on the UNH system. Heat tracing is only required for freeze protection, not for process requirements. Specifications call for 80 psig steam; plant has 150 psig steam available. Based on the results of the pipe stress analysis, the maximum temperature that does not overstress the pipe support system will determine what level of steam can be used. The design specifications and drawings will need to be revised to reflect any change from present status. Heat tracing is an option based on

ambient conditions at the time of UNH operations.

DIAPHRAGM PUMP - Action: Tony Pyrz

Provide record of vendor concurrence on support modifications and nozzle loadings. Pump vendor must agree on additional supports installed for vibration reduction. Further discussion and design checks will determine if this is advisable or even necessary with the current system design.

INSTRUMENTATION FOR DIAPHRAGM PUMP - Action: Tony Pyrz

Determine controls necessary for diaphragm pumps. The replacement of the progressive cavity pumps with air operated diaphragm types requires a significant change in the method of instrumentation necessary for control purposes. Minimum/maximum flow requirements need verification for the UNH transfer, neutralization, and Magnesium Hydroxide transfer pumps.

MATERIAL CONFORMANCE - Action: Steve Reutcke

Review receiving/inspection records to assure that procured material meets the design requirements. Make recommendation(s) on actions necessary to ensure integrity of the UNH system.

PLAN OF THE DAY - JANUARY 18, 1995

KEY ISSUES		RESPONSIBILITIES	TARGET	COMMENTS
1)	SAR - Authorization Basis - Consistent Design (USQ's)	Kortier/Hiles	TBD	Pyrz advised to get current version of SAR circa 1/11/95 and list of USQ's. SAR plus USQ list is authorization basis. Concern over batches exceeding SAR limits -- see item #14 below; is ongoing and can't find reference in SAR. A reminder: the SAR is controlled by configuration management rules, i.e., discussions about 'what-ifs' are N/A. Worsley - [illegible] Butcher table - [illegible] PXIO
2)	Heat Tracing	Worsley	TBD	
3)	Documenting for Vendor Deliverables/ Specs Changed by Construction	Reutcke	Ongoing	Since 200 actions are involved, the team will report only important issues. Issues per 1/11/95 reported; seamless vs. seam pipe. Hoses are a non-issue. Approx. 25 procurements by other than construction are being reviewed 1/16/95.
4)	Valve Leaks/Didn't Get Valves Specified	Reutcke		Why were two sets purchased and one set used. Leakers were 3 inch ball valves from local vendor.
5)	Flow to Totalizer Doesn't Work	Miller/Pyrz	1/17/95	Item will be resolved with preparation of Design Criteria Package -- see item #7; pump change redefines instrumentation requirements.
6)	Valve Location Not Specified/ Construction Location Poor for Maintenance	Worsley		Frank/McCall to identify location. Pyrz to meet with Frank 1/13/95, 1:00 pm. Assignment reassigned to Ron Worsley as RSO ENG. Worsley is in touch with Safety.
7)	Design Basis for Diaphragm Pump/ Update Drawings	Pyrz/Worsley/Kortier	1/17/95	Draft response due by 1/11/95 per DOE-0374-95, 12/30/94. Parsons contact is Scott Vaaler.
8)	Weld Failure/Pipestress/Weld Inspection/Hangers	Roberts/Worsley/Kortier	1/13/95	Modelling is complete. Analysis runs are being made as needed. Special note: crack propogation question - Herb Clark to have discussion w/ Dave Spence.

→ System is constructed in places where shouldn't be but there are [illegible]

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6581

KEY ISSUES		RESPONSIBILITIES	TARGET	COMMENTS
9)	Remediation Pressure Instruments/ High Trip Pump, High Trip Pressure	Miller/Pyrz	1/17/95	Same date and comment as item #5.
10)	Secondary Containment Adequate	Roberts/Worsley/Kortier	1/17/95	Waiver process as required by GDC will be followed. Copy of waiver to be supplied to Dave Spence. Discovered that waiver was never prepared. Also, for design review purposes, identification of absence of waiver should be the focus.
11)	Plan/Procedure for Technical Review	Beckett	1/13/95	Inputs from team participants to Beckett 1/13/95 a.m. per Engineering procedure 12-4008. Beckett to assemble inputs for review 1/16/95.
12)	Develop Verification Test (Hydro)	Pyrz	1/18/95	Meeting scheduled 1:00 pm, 1/17/95, at Parsons to confirm results of design review and establish redesign/path forward. Integrate with item #10.
13)	Dead Leg in UNH Transfer Line	Roberts/Huey/Pyrz		Line is deadended; may not flush/drain. Partial explanation; line is to be flanged, need for hydro was questioned.
14)	Batches Exceed FSAR Limits	Kortier/Hiles		See Item #1. Concern is based on enrichment limits/grams specified in SAR. Enrichment limits cannot be found in SAR.
15)	Logic for Schedule Development Responsibility	Beckett/Kortnicki	1/16/95	Work activities and their interelationships are to be identified. Lapse times will be assigned later.

TECHNICAL MEETINGS		RESPONSIBILITIES	TARGET	COMMENTS
1)	Weld Failure Analysis	Maurer	1/12/95	Vendor report due to Maurer 1/11/95. Technical meeting scheduled for 1/13/95, 3:00 p.m. at Springdale.
2)	Develop Verification Test (Hydro)	Pyrz	1/17/95	Proposed rehydro to prove piping system integrity.

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PLAN OF DAY MEETING ROSTER 1/19/95

CECIL BECKETT	FERMCO ENG	648-6211
TONY PYRE	PARSONS	820-8225
Richard L. Maurer	Fermco	738 6564
ED HOPSON	FERMCO	648 6247
Al Beasley	DOE/RI Tech	648 3163
Dave Spence	DOE/RI Tech	" "
RON WORSLEY	FERMCO ENGRG	648-6155
Dennis Anderson	DOE-FN	648-3103
Kenneth Roberts	Fluor Daniel	(312) 368 3913
Bill Kortier	FERMCO-Eng.	648-6121

ENG-IDR-101
February 1, 1995

ATTACHMENT E
REVIEW DISCUSSION

UNH Neutralization Project Design Review

Attachment E-1 **SAR Analysis**

SAR Section	Section Title	Quote	Actual Condition
2.5.1.3.1	UNH Solution Transfer Pumps	"...skids will have a 12-inch tall stainless steel pan..."	The portable skids have a 2-inch tall lip pan which drains through a 2-inch drain into the skid basin which has 11.88-inch walls which subsequently drains through a 2-inch drain line.
2.5.2.6	Drumming Station	"No significant modifications were made."	New dust collector and associated ducting was installed.
2.5.2.2	Filter Feed Tank F43-203	"...nominal capacity of 10,000 gallons."	The Plant 8 outage charts lists 10,080 gallons.
2.5.2.3	Filter Feed Tank F43-203A	"...nominal capacity of 5,000 gallons."	The Plant 8 outage charts lists 5,278 gallons.
2.5.2.4	Filtrate Hold Tank 25A	"...nominal capacity of 25,000 gallons."	The Plant 8 outage charts lists 19,800 gallons.
2.5.2.5	Precoat Tank	"...nominal capacity of 6,000 gallons."	Unable to verify this number. Plant 8 outage chart does not list this tank.
2.6.1	Storage Tank Connection	"...portable skid...anchored and connected..."	The portable skid will not be anchored at each location.
2.6.1	Storage Tank Connection	"The new assembly will be hydrostatically tested prior..."	Current plans are to leak test not hydro the pumps after each fitup.

SAR Section	Section Title	Quote	Actual Condition
2.6.7	Receiving High Nitrate Slurry at Plant 8	"The total capacity of the Tanks is 15,000 gallons."	Plant 8 outage charts list capacity as 15,358 gallons.
2.8.1	NOx Scrubber/Process Tank Ventilation	"Inlet fume conditions will be a flow rate of 100 acfm and a temperature of 100 degrees F."	The SOT was unable to achieve a 100 acfm condition. Also there is no means for inlet temperature measurement and not all inlet fumes will be 100 degrees F.
2.8.1	NOx Scrubber/Process Tank Ventilation	"The scrubber will remove 90% of the inlet vapor contaminants."	There is no way to verify this statement during the SOT.
2.8.1	NOx Scrubber/Process Tank Ventilation	"Scrubber exhaust fan is capable of pulling 100 acfm through the scrubber packing with 2-inch water gauge external static pressure."	SOT was not able to achieve this criteria.

2.8.3	Plant 2/3 Secondary Containment/Spill Control	"All dikes in the Plant 2/3 area are configured to pump to tank 25A....with the exception of the OK Liquor dike and the Hot Raffinate Building which pump to Tank F2E-601..."	Containment within the NFS Storage Area, CD Blend Area and Digestion Area of Plant 2/3 will automatically pump to either F1-25A or F1-26A. The Denitration Area of Plant 2/3 will automatically pump to F2E-601 or F1-608. The OK Liquor Area will manually pump to either F1-25A, F1-26A, F2E-601, or F1-608. The Hot Raffinate Area will manually pump to F2E-601 or F1-608,
SAR Section	Section Title	Quote	Actual Condition
2.8.3	Plant 2/3 Secondary Containment/Spill Control	"...the secondary containment and sumps are visually inspected daily and leak tested monthly..."	UNH operations have not been leak testing the containment and sumps monthly. This testing was performed during operations but was suspended upon shutdown.

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To: Bill Kortier

From: D.J. Brettschneider

Subject: SAR CHANGES

This is the list of items which exist in the field which differ from the SAR. Please review for engineering basis/operability standpoint. Can we operate safely without these items? Justification?

cc: Heck
Frank
Cranford

Worsley

USQ ISSUES FOR THE UNH NEUTRALIZATION PROJECT FSAR

No.	SAR REQUIREMENT	LOCATION	NON-COMPLIANCE	REQUIRED ACTION
1	Transfer piping will connect to only one tank at a time	2.5.1.1	Piping may be connected to more than one tank	Requires clarification in the SAR. The system is designed with a second pump that can be connected to a second storage tank to recirculate the UNH solution, supplementing the agitator.
2	Drain valves will be installed on either side of the block valves (to be used for flushing)	2.5.1.1	Drain valves were not installed.	An engineering evaluation addresses the deletion of the drain valves from the design. They were not required to drain the lines.
3	SAR specifies stainless steel braided hose	2.5.1.1	The stainless steel braid is on the outside of UHMWP hose. The SAR is misleading and it was intended to reference the UHMWP.	Requires clarification in the SAR. The hose identified in the SAR is ultra high molecular weight polyethelylene (UHMWP) hose protected reinforced by stainless steel sheathing. This hose is commonly referenced as braided stainless steel hose and that reference was inappropriately included in the SAR.
4	The pump skids have a 12 inch tall stainless steel pan built around the skid.	2.5.1.3.1	The pumps have a 2 inch wall and the skid has a built-in reservoir to contain any released material.	The design is adequate to contain and direct leakage from the pumps. In place of a high cumbersome wall, a well was built into the pump skid to collect and direct a leak.

No.	SAR REQUIREMENT	LOCATION	NON-COMPLIANCE	REQUIRED ACTION
5	UNH solution will be removed from the top of the storage tanks	2.6.1	The connection to tank F1-2 will be through the bottom discharge. This discharge was upgraded prior to the transfer of the contents of Tank F1-26 and is acceptable for transfer from the bottom discharge.	Tank F1-2's bottom discharge was refurbished, tested, and accepted prior to the transfer of the UNH solution from F1-26 to F1-2 under ASR 94-0024. The bottom discharge would be preferable for all storage tanks becasue it would permit complete draining of tank contents. Only F1-2 has a refurbished bottom (a safety enhancement as a result of the preparation for the F1-26 transfer) and it will be used to ensure complete draining of the tank.
6	The assembly connecting to the UNH Tanks will be hydrostatically tested prior to use.	2.6.1	The assembly will be leak tested, not hydrostatically tested prior to use.	This is acceptable because the connection is on the suction side of the pump and would be subject to pressurization under normal operations.
7	The pump skid will be anchored.	2.6.1	The pump skid will not be anchored.	There is an engineering evaluation addressing the pumps skids not requiring anchoring. The weight of the pump skid is adequate to keep it in place.

All components have been

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No.	SAR REQUIREMENT	LOCATION	NON-COMPLIANCE	REQUIRED ACTION
8	NOx Scrubber will remove 90% of the vapor contaminants and pull 100 acpm.	2.8.1	The scrubber will not perform as stated in the SAR. The scrubber is not needed and there is no requirement for it to operate as specified in the SAR.	There is an engineering evaluation addressing the scrubber data. The scrubber is capable of producing 42 cfm. 17 cfm is required for adequate exhaust ventilation of the tanks. Adequate exhaust ventilation is all that is required for the protection of the facility worker and there are no NOx discharge limits to the environment applicable. Therefore, the efficiency of the scrubber is not an issue for safety and removal rates should not be considered operation.
9	All dikes in the Plant 2/3 area are configured to pump to Tank 25A.	2.8.3	They are configured to pump to F1-25A or F1-26A.	Requires SAR clarification. Additional capacity is provided by Tank F1-26A. The designations in the SAR of "25A" should be changed to F1-25A to include the complete citation.
10	Tank F2E-601 located in the O.K. Liquor diked area	2.8.3	Actually located in the Refinery Sump area.	Requires clarification in the SAR. The location of the tank was inaccurately cited as in the O.K. Liquor area when the correct location is in the Refinery area.

No.	SAR REQUIREMENT	LOCATION	NON-COMPLIANCE	REQUIRED ACTION
11	The use of compressed air to clear lines has been eliminated reducing the potential of over-pressurizing process components.	3.3.2.3.1	The use of compressed air to clear lines has not been eliminated.	Compressed air is used to clear lines and prevent freezing. Compressed air is not used to verify valve line-ups, the root of the Type B Investigation finding related to this topic. The concern in the Type B Investigation was that using compressed air as the verification of a correct line-up did not guarantee that there were no other valves in an incorrect position that would also allow transfer to an undesired location.
12	Internal dosimetry requirements for visitors described in the SAR does not reflect recent changes in the program	7.9	The dosimeter requirements were updated in the site program and the SAR is no longer accurate.	There were changes to the site procedure for visitor dosimetry since the submittal of the SAR that now renders the SAR description inaccurate. The SAR description should be updated to reflect these changes. There is no affect on the safety of visitors.
13	Control points	7.16	SAR description of the location of the control points is not accurate.	Trailers will be installed as function as the control point in Plant 2/3. The SAR should be updated to reflect the movement of the control point to the trainlers. The movement of the control point provides more working space for operations, enhancing the safety of the facility workers.

No.	SAR REQUIREMENT	LOCATION	NON-COMPLIANCE	REQUIRED ACTION
14	SOT for scrubber to include effectiveness	10.3 Table 10.3-1	The SAR was changed per a general DOE SAR review comment resolution, but is included in this list until specifically accepted.	The scrubber effectiveness is not important to safety because there are no discharge limits for NOx. The safety of the facility is assured by exhaust ventilation that prevents migration of NOx to the work area from the tanks. To test scrubber efficiency a NOx source and sensitive monitoring equipment would be required. This would unnecessarily introduce a hazard and cost to a system that is not required. The scrubber is excess equipment that was installed as a "good practice."
15	Simulation of operations to take place at 5 tank locations	10.3.1	The simulation will not take place at 5 locations.	The simulation of operations will not be accomplished as described in the SAR and the SAR discussion should be revised.
16	Screens were added to the suction of the pumps	Appx-B, 6.5	The screens were not added to the substituted pumps.	The addition of the screens was recommended by the HAZOP team to protect the progressive cavity pumps. The double diapragm pump design does not include screens. This is addressed in an engineering evaluation.

No.	SAR REQUIREMENT	LOCATION	NON-COMPLIANCE	REQUIRED ACTION
17	Throughout the SAR reference is made to high nitrate slurry	Throughout	The high nitrate slurry is identified as MDU slurry throughout the operating procedures.	The SAR was changed to high nitrate slurry as a result of comments prior to the final procedures. The final procedures reference Magnesium Diuranate (MDU) slurry, a more common tern for operations. The SAR reference should be updated to MDU, the generally accepted reference.

E-2 Piping Stress

The "as-built" piping for UNH was modelled using field sketches for routing, dimensions, support locations, support configurations, fitting, equipment, and weld locations.

Stress calculations were generated using the CAESAR II computer program. CAESAR II is a PC-based computer program developed, marketed and sold by COADE Engineering Software. This software package is an engineering tool used in the mechanical design and analysis of piping systems. The CAESAR II user creates a model of the piping system using simple beam elements and defines the loading conditions imposed on the system. With this input, CAESAR II will produce results in the form of deflections, loads, and stresses throughout the system. Additionally, CAESAR II will compare these results to their allowed limits.

CAESAR II is most often used for the mechanical design of new piping systems. Hot piping systems present a unique problem to the mechanical engineer--these irregular structures experience great thermal strain which must be stiff enough to support their own weight and also flexible enough to accept thermal growth. These loads, deflections, and stresses can be estimated through analysis of the piping model in CAESAR II. To aid in this design by analysis, CAESAR II incorporates many of the limitations placed on these systems and their attached equipment. These limits are typically specified be engineering bodies (such as the ASME B31 committees, ASME Section VIII, and the Welding Research Council) or by manufacturers of piping-related equipment (API, NEMA, or EJMA).

The program is not limited to thermal analysis of piping systems. CAESAR II also has the capability of modelling and analyzing the full range of static and dynamic loads which may be imposed on the system. There, CAESAR II is not only a tool for new design but it is also valuable in troubleshooting or redesigning existing systems. Here, one can determine the cause of failure or evaluate the severity of unanticipated operating conditions such as fluid/piping interaction or mechanical vibration caused by rotating equipment.

CAESAR II is a program which closely fits the requirements of the pipe stress industry. Data entry is simple and straight forward through annotated input screens and/or spreadsheets. CAESAR II provides a wide range of modelling and analysis capabilities without becoming too complicated for simple system analysis. Users may tailor their CAESAR II installation through default setting and customized data bases. Comprehensive input graphics confirms the model construction before the analysis is made. The program's interactive output processor presents results on the monitor for quick review or sends complete reports to a file or printer. CAESAR II is an up-to-date

package in that it not only utilizes standard analysis guidelines but also provides the latest recognized options for these analyses.

The CAESAR II program calculates the stresses resulting from the combined effects of pipe (and contents) weight, line lengths (and configuration), temperature, and internal pressure. The displacements and stresses (axial, bending, torsion, hoop, and resultant or combined) are shown for three temperatures (50, 150, and 250° F)[1] in Cases 1, 2, and 3, respectively, of the Stress Reports in Attachment E-8, Volume 2.

The program also calculates the stresses resulting from just pipe (and contents) weight and internal pressure for comparison with the Code allowable stress. These stresses are shown in Case 4 of the attached Stress Reports.

The program then calculates the thermal expansion Code stresses for comparison to the Code allowable stress. The Code allowable stress for thermal expansion consists of a thermal stress allowable at 1.5 times the Code allowable weight plus pressure stress which can be exceeded by the amount of stress that the weight plus pressure stress is less than its Code allowable.

> For example, the thermal expansion stress allowable for carbon steel is 25,500 psi (1.5 X 17,000 psi) and the weight and pressure stress allowable is 17,000 psi for a maximum allowable combined stress of 42,500 psi. The actual thermal expansion allowable stress for a specific analysis node would be the 42,500 psi minus the weight and pressure stress value at that node. The thermal expansion Code stresses and thermal expansion Code allowable stresses are shown for the same three temperatures (50, 150, and 250° F) in Cases 5, 6, and 7, respectively, of the attached Stress Reports.

The program also calculates the force and moment loads on the system supports or restraints. These values are tabulated on the last pages of the Stress Reports.

One important factor to keep in mind during a review of these reports is how the U-bolts were modelled in the program. They have been treated as three way restraints with no allowance for deflection or slippage. This is more restrictive than what would physically occurs at high loads, so it produces unrealistically high stresses due to high loads.

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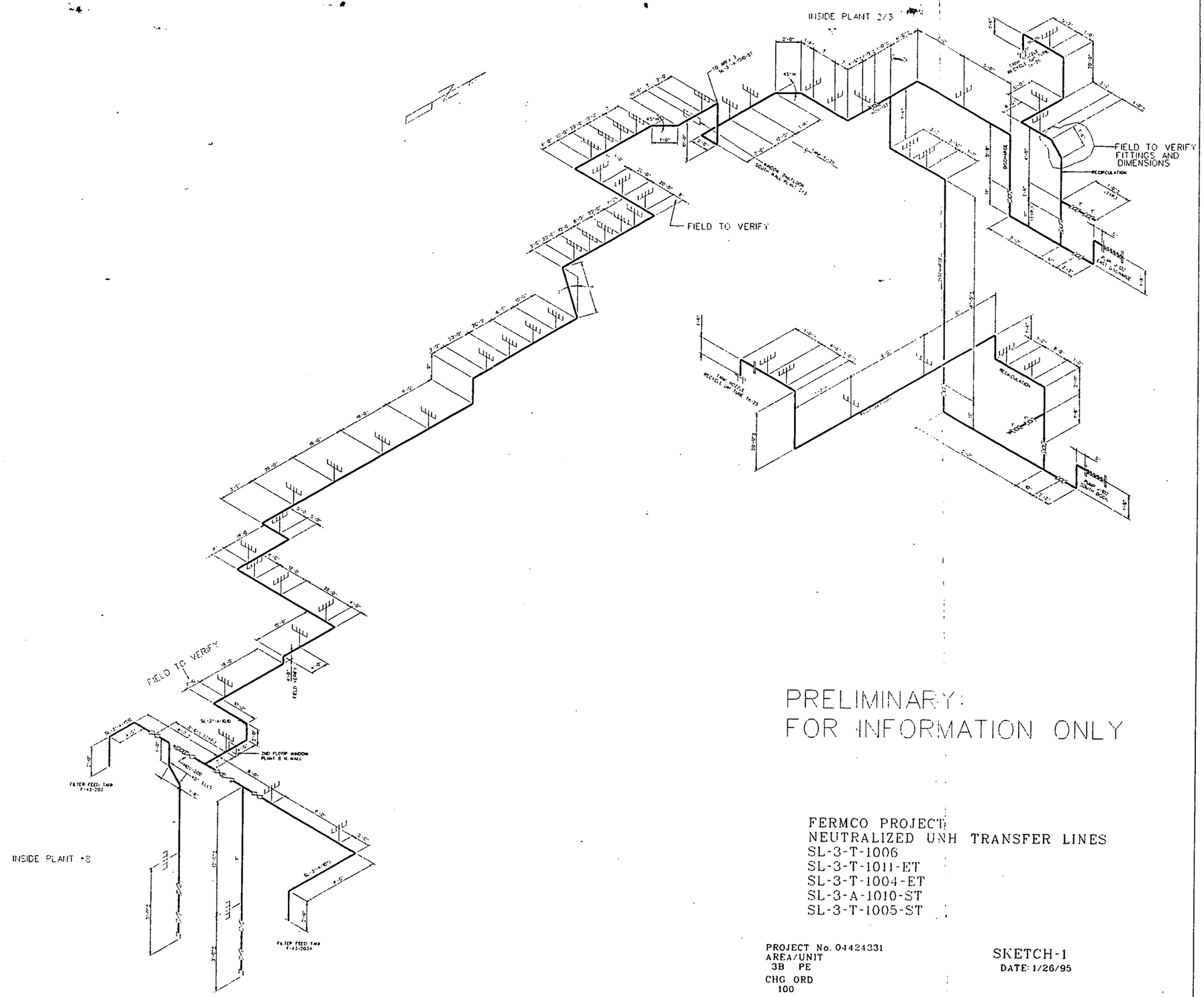
[1] For the system with the failed weld (Stress Report PS-2), stresses were also calculated at 350, 450, and 550° F in an attempt to find a temperature that would produce enough stress to break the weld.



PRELIMINARY:
FOR INFORMATION ONLY

FERMCO PROJECT
NEUTRALIZED UNH TRANSFER LINES
SL-3-T-1006
SL-3-T-1011-ET
SL-3-T-1004-ET
SL-3-A-1010-ST
SL-3-T-1005-ST

PROJECT No. 04424331
AREA/UNIT
3B PE
CHG ORD
100

SKETCH-1
DATE: 1/26/95

F:\MPTF.24331\SK1.DGN

sk1.m(778.ws16) jerry@ws16. Fri Jan 27 12:55:08 CST 1995

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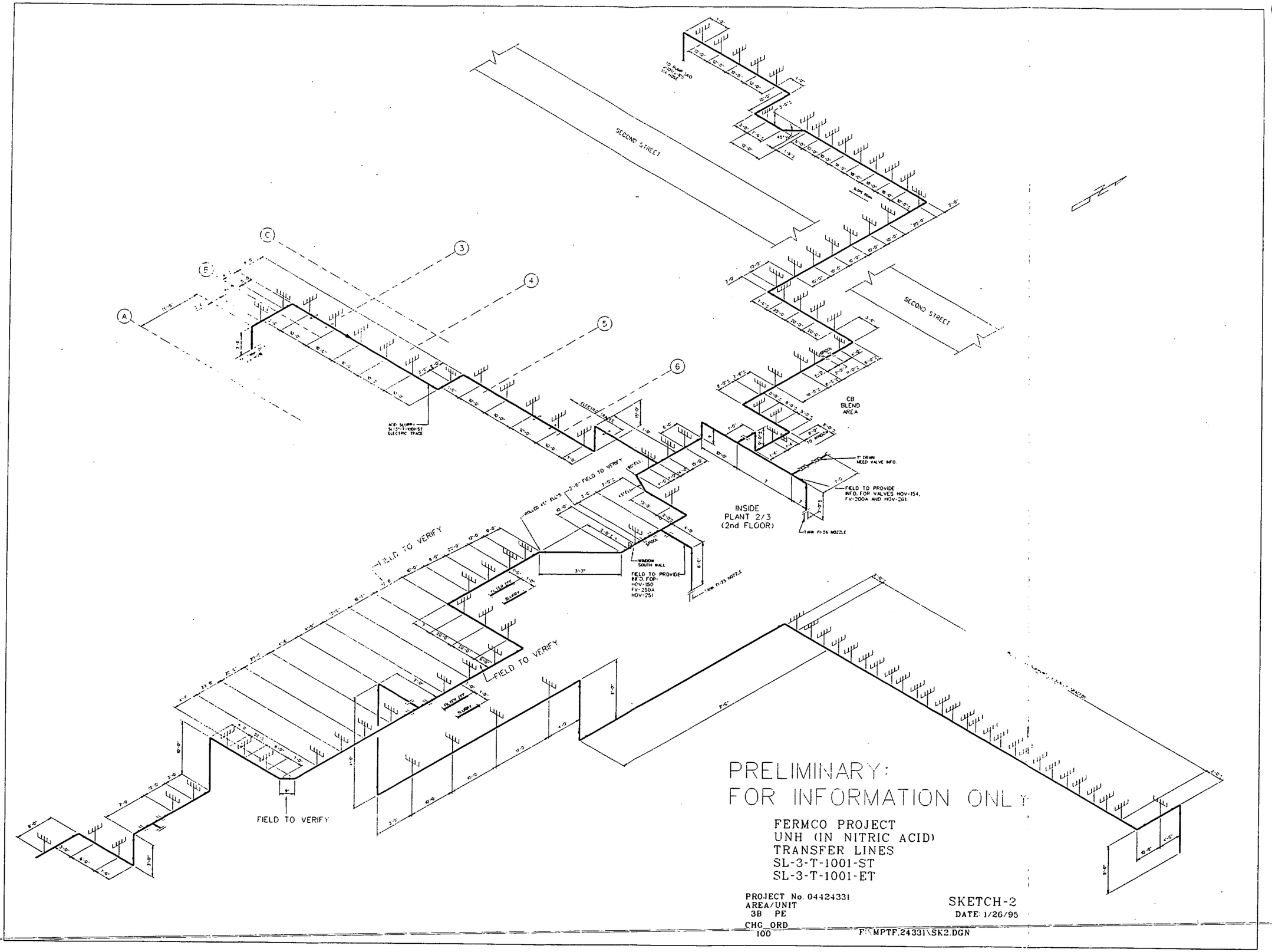

FERMCO PROJECT
UNH (IN NITRIC ACID)
TRANSFER LINES
SL-3-T-1001-ST
SL-3-T-1001-ET

PROJECT No. 04424331
AREA/UNIT
3B PE
CHG ORD
100

SKETCH-2
DATE: 1/26/95

F:\MPTF.24331\SK2.DGN

sk2.m(779.ws16) jerry@ws16. Fri Jan 27 12:55:58 CST 1995

000121

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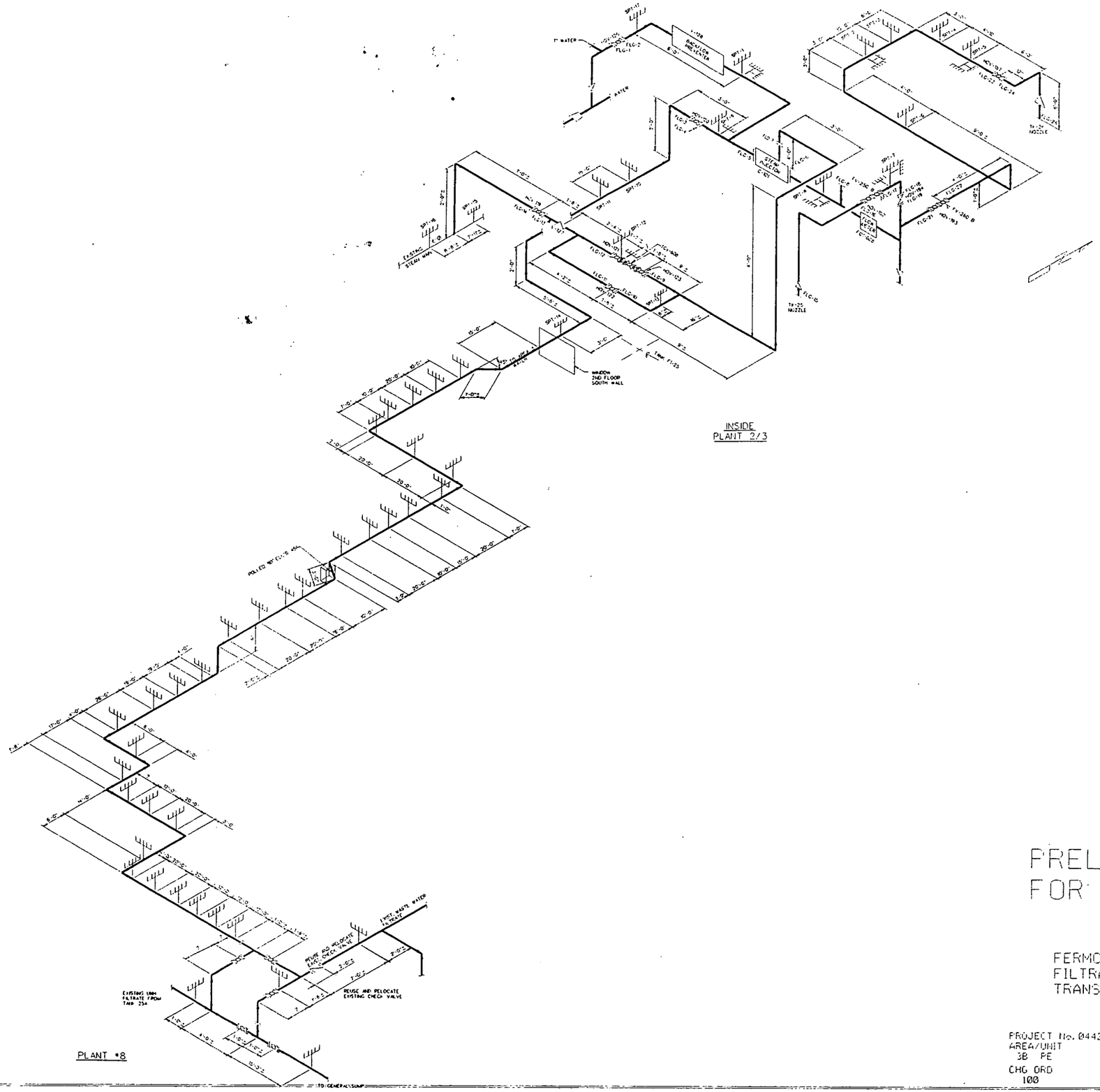


PRELIMINARY:
FOR INFORMATION ONLY

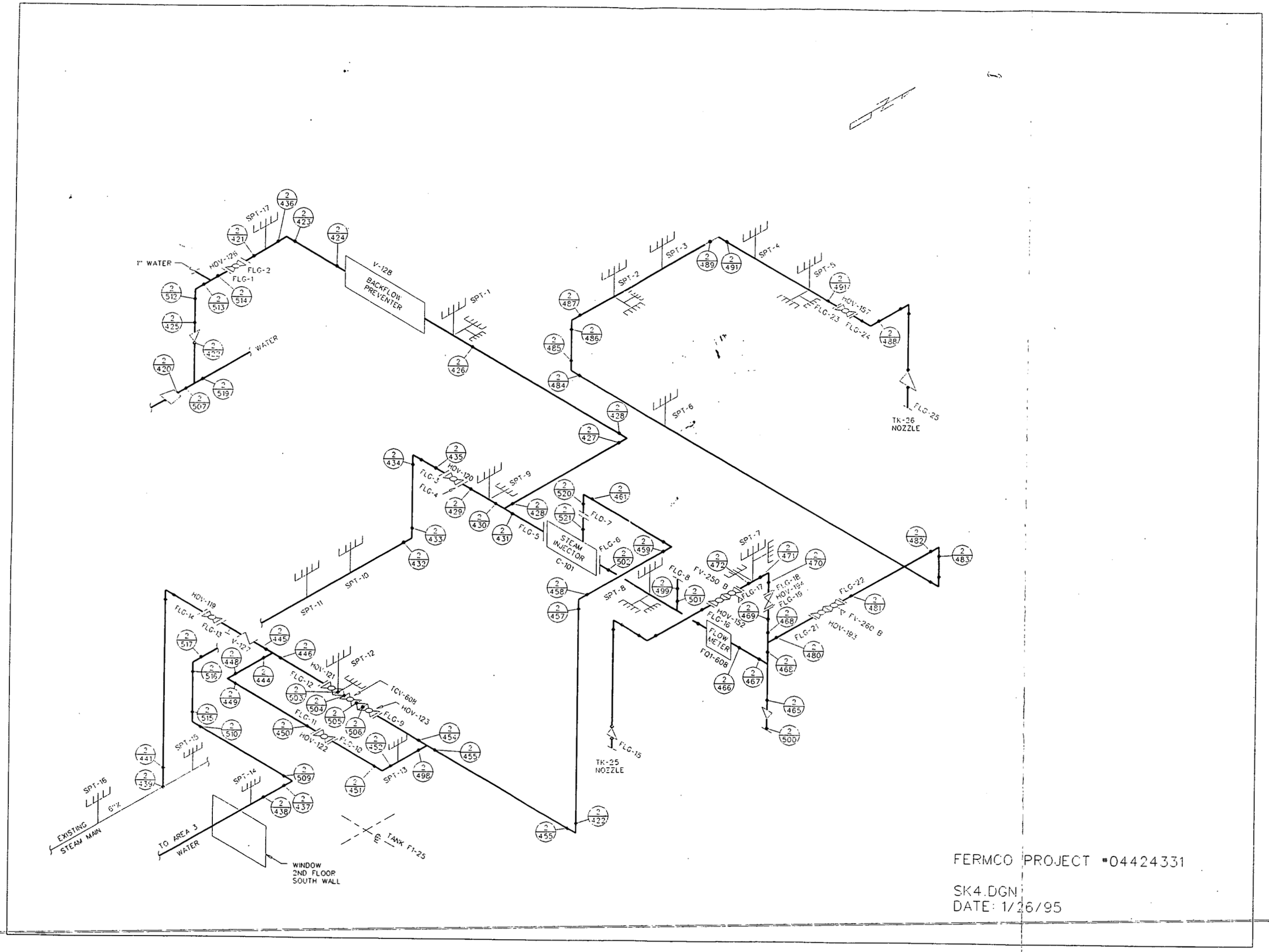
FERMCO PROJECT
FILTRATE (WATER)
TRANSFER LINE

PROJECT No. 04424331
AREA/UNIT
3B PE
CHG ORD
100

SKETCH-3
DATE: 1/27/95

F:\MPTF.24331\SK3.DGN

sk3.m(780.ws16) jerry@ws16. Fri Jan 27 12:57:03 CST 1995



FERMCO PROJECT #04424331

SK4.DGN
DATE: 1/26/95

E-3 Secondary Containment

1300-7 CONFINEMENT SYSTEMS

1300-7.1 Objectives

Confinement systems shall accomplish the following:

- Minimize the spread of radioactive and other hazardous materials within the unoccupied process areas
- Prevent, if possible, or else minimize the spread of radioactive and other hazardous materials to occupied areas
- Minimize the release of radioactive and other hazardous materials in facility effluents during normal operation and anticipated operational occurrences
- Limit the release of radioactive and other hazardous materials resulting from DBAs including severe natural phenomena and man-made events in compliance with the guidelines contained in Section 1300-1.4.2, Accidental Releases.

1300-7.2 General

Confinement capabilities, including confinement barriers and associated ventilation systems, shall maintain a controlled, continuous airflow pattern from the environment into the confinement building, and then from noncontaminated areas of the building to potentially contaminated areas, and then to normally contaminated areas.

For a specific nuclear facility, the number and arrangement of confinement barriers and their required design features and characteristics shall be determined on a case-by-case basis. Typical factors that affect confinement system design are the type, quantity, form, and conditions for dispersing the hazardous material, including the type and severity of DBAs. In addition, alternative process and facility designs may reduce the potential hazards and the requirements for confinement system design. Engineering evaluations, trade-offs, and experience shall be used to develop a practical design that achieves confinement system objectives.

The number of confinement systems required in different locations of a facility may vary depending on the potential consequences from hazards during normal operation, anticipated operational occurrences, and DBAs. Although individual confinement systems are not required to withstand the effects of every accident, they shall effectively perform their required functions for the DBAs they are required to withstand. Sufficient redundancy shall be provided in the unlikely event of a confinement system failure. At least one of the confinement systems shall be designed to ensure that it can withstand the effects of severe natural phenomena and man-made events (see Section 0111-99.0, Nonreactor Nuclear Facilities—General), including the postulated DBAs and DBF initiated by these events, and remain functional to the extent that the guidelines of Section 1300-1.4.2, Accidental Releases, are not violated. The adequacy of the design of these confinement systems to effectively perform their required functions shall be demonstrated by the safety analysis. To

the extent practical, the ALARA concept shall be applied to the design of all confinement systems to minimize exposures to hazardous materials.

Because the number and arrangement of confinement systems that shall be required for a specific nuclear facility design cannot be predicted, these general criteria describe a conservative confinement design that uses three principal confinement systems. In general, the primary confinement system consists of the process enclosures and their ventilation system. In special cases where the processes require the use of corrosive or noxious materials, the process system shall be totally enclosed (i.e., pipes and vessels) and provided with its own ventilation and off-gas cleanup system. In such cases, the process system shall be treated as the primary confinement system. The secondary confinement system consists of the barriers that enclose the areas that house the primary confinement and the system that ventilates those areas. These areas may be referred to as operating areas or operating area compartments. The tertiary or final confinement system is the building structure and its ventilation system.

The secondary and tertiary barriers may exist in common such as a single structural envelope (e.g., walls, roof slab, floor slab), provided the barrier can withstand the effects of man-made events and DBAs including the DBE, and does not contain access ways that allow the routine transfer of personnel, equipment, or materials directly from the exterior of the facility. Access ways into the interior of the single structural envelope are allowed, provided that entrance into the access way is gained from another level of confinement.

The confinement system requirements specified for the various types of nuclear facilities in the facility-specific sections that follow are typical for that type of nuclear facility. The actual confinement system design requirements shall be determined as described in this section.

Design of confinement areas shall provide adequate means for decontamination of the areas prior to entry or breaching for maintenance and repair purposes.

Confinement system ventilation and off-gas system requirements are provided in Section 1550-99, Special Facilities. For enclosure of radioactive and other hazardous materials, see Section 1161, Enclosures.

1300-7.3 Access Ways

Special features (e.g., air locks, enclosed vestibules) shall be considered for access through confinement barriers to minimize the impact of facility access requirements on the ventilation system and to prevent the release of radioactive airborne materials. Provision for normal and emergency equipment shall be provided in or adjacent to the access ways. Consideration shall be given to emergency lighting, paging systems, automatic access door switches, hand and foot monitors, storage for clothing and emergency equipment, warning lights, air sampling, and breathing air outlets.

1300-7.4 Transfer Pipes and Encasements

Double-walled pipes or pipes within a secondary confinement structure encasement shall be used in all areas where the primary pipe leaves the facility. In areas within the facility, the use of double-walled pipe shall be considered. Leakage monitoring shall be provided to

detect leakage into the space between the primary pipe and the secondary confinement barrier.

1300-8 WASTE MANAGEMENT

1300-8.1 General

Wastes from special facilities may include both radioactive and nonradioactive materials and may be in the form of liquid or airborne effluents, or solids. For SNM declared to be waste, the term "wastes" shall be defined in accordance with the DOE 5632 series. The process systems shall minimize the production of wastes at the sources and minimize the mixing of radioactive and nonradioactive hazardous wastes. The waste management systems shall provide facilities and equipment (or incorporate existing facilities and equipment) to handle those wastes safely and effectively. Volume reduction equipment for both liquid and solid wastes shall be required where feasible and shall be designed for process capability and capacity commensurate with the types and quantities of wastes expected. Waste handling areas shall comply with the standards of confinement and ventilation requirements commensurate with the potential for spreading contamination by the waste packages/forms handled. Specific DOE design and operating requirements for radioactive wastes (HLW, LLW, and TRU) appear in DOE 5820.2A.

See also Section 0273, Water Pollution Controls; Section 0275, Industrial Wastewater Treatment; Section 0285, Solid Waste Systems; Section 1540, Plumbing and Service Piping; and Section 1589, Air Pollution Control.

1300-8.2 Hazardous Waste Requirements

Hazardous waste requirements appear in the directive in DOE 5480.1B, Chapter 2. Additionally, the RCRA, as amended, 40 CFR 264 and 40 CFR 265, contain specific design and operating requirements and standards for owners and operators of hazardous waste TSD facilities. Part 267 of RCRA contains interim standards for owners and operators of new hazardous waste land disposal facilities. Part 268 of RCRA contains land disposal restrictions and treatment standards for hazardous waste.

1300-8.3 Mixed Waste

Radioactive mixed waste, i.e., waste containing radioactive materials and other hazardous waste, shall be avoided where practicable. Mixed waste that cannot be avoided shall be identified and considered in the design at the earliest possible time. Mixed waste shall be segregated and handled separately from other types of waste in accordance with DOE 5400.3.

1300-8.4 Waste Segregation

Facility design shall provide for the segregation of hazardous wastes into compatible groups for storage in accordance with the DOE 5400 series and DOE 5480 series. Suggested compatibility groups are acids, caustics, flammable materials, and organic materials.

E-4 Welding Verification

This section contains:

Weld Analysis

Most Probable Cause of Weld Failure

ENG-IDR-101
February 1, 1995

WELD ANALYSIS

BACKGROUND

A 3" schedule 40 A53 grade B carbon steel filtrate line (FT-3A-2500-ST) installed in accordance with reference b) experienced a weld failure in a circumferential pipe to elbow field weld (I.D. No. 2/510) during pre-operational checks. The line was heated by steam tracer lines and had been heated for over seven weeks in a filled with water, zero flow condition. System fluid was water with less than 15 ppm chlorine.

Weld 2/510 and the adjacent 2/515 weld (other end of the same elbow) and an additional set of elbow welds (2/516 and 2/517) were removed and sent to MQS Inspection, Inc. for analysis. All welds were stated to have been made by the same welder. Only weld 2/510 exhibited through circumferential cracking; reported to be a continuous 7" in length.

REQUIREMENTS

1. The carbon steel piping was required to be fabricated to ASME B31.3 - 1993 edition, category "D" per reference b), paragraph 3.3.A.2. B31.3 Category "D" visual acceptance criteria extent is normally per paragraph 341.4.2 which states in part: "...visually examined...to the extent necessary to satisfy the examiner that...workmanship conforms to the requirements..." For welds, each welder's and welding operator's work shall be represented. However UNH specification 15060 (Ref. b) requires 20% to be visually examined (paragraph 3.1.C).

   In addition, Paragraph 3.3.A.2 requires stainless steel to be Category "M" which requires 20% of the welds to be randomly (by welder) volumetrically examined (RT or UT). FCR 002 was approved modifying the inspection criteria (see attached).

2. B31.3 Category "D" requirements for examination are specified in B31.3, Chapter VI, Table 341.3.2A which states:

   1) No radiographic examination required.
   2) No magnetic particle examination required.
   3) No liquid penetrant examination required.
   4) Concave Root - Weld thickness to meet or exceed nominal pipe wall.
   5) Visual examination to meet the following:

a) Undercut not to exceed nominal wall divided by four (i.e. 0.054").
b) Reinforcement or internal protrusion not to exceed 1/8".
c) Crack not permitted.
d) Lack of fusion/incomplete penetration - depth not to exceed 20% of the nominal pipe wall thickness, cumulative length not to exceed 1.5 inches in any 6 inches of weld length provided there are no tightly butted unfused root faces.
e) Additionally, allowed mismatch (hi-lo) is specified in ASME B31.3, Chapter V, Figure 328.4.3 as "per the Welding Procedure Specification". A review of Welding Procedure Specification CC3.0, Rev. 0, dated 7/28/86) did not indicate a limit on mismatch, but does give a root gap of 1/16" - 1/8" and a root face of 1/16" - 1".

3. All weld procedures and welders are required to be qualified in accordance with ASME Section IX (reference d) per reference e) chapter V, paragraph 328. The weld procedure (reference e) met this requirement.

TECHNICAL REVIEW

1. Summary

a) All four welds met O.D. final visual criteria as well as could be determined from remains.

b) A visual inspection of the I.D. reveals lack of penetration, lack of fusion, offset[1] and poor fit up on all four welds inspected. Visual Examination based on acceptance criteria of reference c) of the weld remains available and weld photographs in reference a) is as follows:

Weld Number	2/510	2/515	2/516	2/517
Lack of Penetration (Length)	Reject	Accept	Accept	Accept
Lack of Penetration (Depth)	Reject	Unknown	Unknown	Accept
Tight Butted Root Faces	Reject	Reject	Reject	Accept
Undercut	Accept	Accept	Accept	Accept
Reinforcement	Accept	Accept	Accept	Accept
Mismatch (1)	Reject	Accept	Reject	Accept
Cracks	Reject	Accept	Accept	Accept
Root Concavity	Accept	Accept	Accept	Accept

1 Industry practice is 1/16" maximum. Above 1/16" shall be tapered per reference c), Chapter V, Figure 328.4.4

2 Some lack of penetration is permitted by the Code (reference c)

c) Three of the four pipes submitted were seam welded pipes and the fourth was seamless. The use of seam welded pipe does not appear to be a causal factor in the failure. However, an approved FCR should document acceptability of the use of seam welded pipe.

d) The proximate cause of cracking at weld 2/510 is attributed to improper weldments with significantly reduced cross sections and the presence of concentrated stresses from tight butted root faces.

2. Results

a) Visual inspection of the O.D. of the weldments does not reveal any nonconformances excepting a large crack in weld 2/510. The crack was predominately confined to the weld deposit and exhibited brittle characteristics. The crack extended about 270 degrees and measured approximately 7" in length.

The I.D. of the welds showed evidence of improper fit-up prior to welding. The cracked weldment had virtually no weld gap and also showed offset. Only about 90 degree of the cracked weld had full weld penetration. All welds revealed areas with a lack of penetration, and insufficient weld gap.

All four of these welds revealed a lack of penetration. Only the cracked weld is rejectable based on O.D. characteristics. Note that two of the welds are marginal.

b) The elbow, the pipe, and the weld deposit associated with weld 2/510 met the requirements for type of material in reference b).

c) Hardness tests were performed on the welds. The hardness levels indicate a weld strength of 72,000 PSI which is well over the required 60,000 PSI.

d) Specifics of visual examination of weld 2/510:

1) Factory ends used, i.e., no field grinding to facilitate fit-up. Ends not cleaned back from weld prep. I.D. or O.D.).

2) Fit-up gaps less than 1/16" (recognizing the joint does shrink).

3) Mismatch in places as high as 3/32", root face up to 3/32" thickness.

4) Lack of penetration approximately 75% of I.D. Welder would know that he was not getting penetration. Could not ascertain depth of lack of penetration due to tightly butted root faces, but depth probably averages 50% of joint thickness including weld crown thickness.

5) External appearance acceptable.

e) Conclusions:

The primary cause of weld failure is attributed to poor weld quality due to improper fit-up resulting in extensive lack of penetration (270° approximately), lack of weld thickness, and tightly butted root faces. Stress mode is presumed to be thermally generated as pressure stress is negligible.

REFERENCES

a) MQS Inspection Inc., Weld Test Analysis Report 0595-6001 dated 1/9/95.

b) Uranyl Nitrate Neutralization Project Performance Specification - Piping; 15060 dated 3/21/94, Rev. 1.

c) ASME B31.3-1993 edition - Chemical Plant and Petroleum Refinery Piping.

d) FMPC Welding Procedure Specification CC3.0, Rev. 0, dated 7/28/86.

e) ASME Boiler and Pressure Vessel Code, Section IX; Welding and Brazing Qualifications.

)04:03/08/93)

ENTERED 05/09/94

6587

FERMCO FIELD CHANGE REQUEST (FCR)

PAGE OF

FCR NO.: CONS/1585:002

REVISION NO.

W.O. NO.:	S/C NO.:	S/C TITLE:
1585		Uranyl Nitrate Project

OCUMENTS AFFECTED	DOCUMENT(S) NO.	REV.	OTHER
15 Mechanical cification # 15060	15060 para. 3.1-a,b,c Titled Examination	E	CONTROLLED

EASON FOR CHANGE: Eliminate unnecessary inspection quirements will still assuring system operability.

ISTING CONDITION: Specification requires: ① Visual examination of piping the Construction Mgr. ② In process examination aid by dye etrant performed by the Construction Mgr. ③ Visual examination ormed by a certified inspector in accordance with ASME B313 a 3.44.2

SCRIPTION OF CHANGE: Change inspection reqts to the following piping welds on slurry (SL), magnesium hydroxide (MH) d nitric acid (AN) shall be visually inspected by Fermco . Visual examination shall be in accordance with ME B31 3 paragraph 344.2 In addition 20 per cent all remaining pipe welds shall be visually examined the requirements above.

EPARER: David Fannin	DATE: 4/19/94	DEPARTMENT/CRU:

ED	FERMCO REVIEW		APPROVAL	
	QUALITY ASSURANCE: Vern Turner	4-20-94	DESIGN ORGANIZATION: X GP Page APPRZ	5/5/94
	ES&H:			
	REGULATORY COMPLIANCE:		FERMCO CONSTRUCTION: X David Fannin	4/20/94

CHANGE APPROVED? YES ☒ NO ☐

000133

Most Probable Cause of Weld Failure

Line FT 3" A 2500-ST experienced a leak on December 27, 1995 emanating from a crack in a weld at an elbow inside Plant 2/3. This pipeline was hydrostatically tested on August 30, 1994 at 150 psi with potable water at approximately 60° F. The hydrostatic test was deemed to be successful as the pressure was maintained for twenty-five minutes without any indication of leakage. This line was drained after the initial hydrostatic test. The installation of steam tracing, insulation and lagging was completed on October 5, 1994. The steam tracing was believed to have been turned on around the October 5, 1994 date. The line was first used to transfer water on October 31, 1994 and subsequently on November 1, 1994 and again on November 7, 1994 without incident. The line was not drained after the initial use and was believed to have remained essentially full of water up to the discovery of the leak. The leak was discovered during a pumping operation to the General Sump when a valve, intended to block flow to the line, was left slightly open permitting a small flow to enter the line.

A section of the pipe containing the failed weld (#510) and three other welds was removed and sent to an independent testing laboratory for a weld analysis. The following is a summary of the key findings:

Visual inspection of the outside diameter of the weldments did not reveal any nonconformances excepting a large crack in weld #510. The crack was predominantly confined to the weld deposit and exhibited brittle characteristics. The crack extended about 270° and measured approximately 7" in length.

The inside diameter of the welds showed evidence of improper fit-up prior to welding. The cracked weldment had virtually no weld gap and also showed misalignment. Only about 90° of the cracked weld had full weld penetration. All welds revealed areas with a lack of fusion, lack of penetration and insufficient weld gap. Improper joint fit up was the major reason for the lack of penetration at the weld root which resulted in under-bead cracking of the weld. There was no evidence of a root pass in the portion of weld #510 that cracked and started leaking. There is no evidence of any weld tacks having been made to maintain a proper root gap during welding.

All four of these welds revealed a lack of penetration. Only the cracked weld is rejectable based on O.D. characteristics. Two of the welds are marginal. Weld 2/517 is acceptable based on the acceptance criteria with no lack of fusion noted.

Most Probable Cause of Weld Failure (cont.)

The stresses which eventually caused a crack to breech the cap pass of weld #510 are believed to have been created by a succession of events which started with the formation of the weld itself. Without a root gap of at least 1/16 of an inch wide around the circumference of the joint, a full depth root pass could not be formed creating a significant stress riser or multiplier. The lack of weld throat and the irregular, uneven circumferential weld thickness undoubtedly built up residual stresses within the weld metal itself. The cracking most likely began as the weld cooled initially after formation as a result of shrinkage. While the joint withstood a 150 psig hydrostatic test, the resulting tensile and hoop stresses may have further propagated the initial crack. After the hydrostatic test was completed, the filtrate line was left empty with the steam tracing activated for more than three weeks. The resultant thermal stresses caused by the expansion of the heated pipe would have been below 10,000 psi in a full thickness joint at 250° F assuming the line was unrestrained. The allowable design stress for three inch Schedule 40 pipe is approximately 17,000 psi. The improperly installed hangers located in close proximity to the failed weld acted like anchors and reduced the thermal stress in the joint metal to around 6000 psi. It should be noted that the failed weld was, on the average, approximately one-half of the normal pipe wall thickness due to the lack of penetration thereby doubling the unit stress in the weld area.

The steam temperature in the nominal 150 pound steam main was measured to be 358° F, by RSO maintenance on February 3, 1995, at a point midway between Plant 2/3 and Plant 8. The tracers for the Filtrate Return Line originate at Plant 8 and run towards Plant 2/3 where the condensate passes through a thermodynamic trap at approximately 190° F. The average steam tracing temperature was estimated to be approximately 270° F to 280° F. (Eighty-four percent (84%) of the available heat from the condensation of the steam and sixteen percent (16%) from the temperature differential of the condensate.) Heat is transferred between the tracer and the pipeline by a combination of radiation and convection. The air gap between the three inch steel line and the steam tracers does not permit heat transfer by conduction. Assuming a coefficient of heat transfer around 0.8 and allowing for the radiant and conductive heat transfer through the significantly larger surface area of the insulating jacket, a temperature gradient of 60° F to 70° F (Roughly 80 percent (80%) of the higher temperature) appears reasonable. The rate of heat transfer diminishes as the cooler surface heats up due to the decreasing temperature differential. A near steady state condition is eventually reached when the heat input to the envelope equals the radiant heat loss. (Note: Variations in the ambient temperature and wind velocity will cause this point to fluctuate.)

Most Probable Cause of Weld Failure (cont.)

The period of sustained heating of the empty pipe line ended with the abrupt introduction of 50° F to 60°F water as the line was used to transfer water to a tank in Plant 2/3. The roughly 200° F temperature gradient would produce a significant thermal shock which could only further damage the already compromised weld. The approximately five hundred and twelve feet of three inch pipe between the pump and the failed weld would fill in approximately fifty-five to sixty seconds based on the 200 gpm capacity of the transfer pump. The water being transferred would have had little chance to heat up more than a couple of degrees before reaching weld #510.

The line was not drained after the initial transfer and was reused two and eight days later in a similar manner. The water remained stagnant in the line for two and six days between uses could have been heated to a temperature estimated to be around 240° F to 260° F. This would significantly reduce the resultant shock resulting from the initial resumption of flow but a significant thermal gradient would have reached the weakened joint in less than a minute after the start of flow in the line. Each of these stress inducing cycles would continue to propagate the crack weakening the unsound weld which may or may not have been breached by a hair line crack to the outside at this point.

The filtrate line had been sitting essentially full of water for seven weeks with the steam tracers on when the leak was noticed in Plant 2/3 during a subsequent transfer of water to the General Sump on December 27, 1994. On this occasion, the introduction of cold water to the filtrate line came about because of a valve inadvertently being left slightly open. It was estimated that the roughly 40°F water was being introduced into the filtrate line at a rate of five to six gpm based on an approximation of the amount of water collected in the Plant 2/3 sump divided by an estimation of the elapsed time in minutes between the initiation of pumping and the subsequent discovery of the leak and the shut down of the system.

The filtrate line increases in elevation along its route to the elbow with the failed weld joint located just prior to another shut-off valve in the line inside of Plant 2/3. It may be assumed that a small portion of the filtrate line may have drained towards Plant 8. The partially water filled line would have had ample opportunity to become heated above the flash point during the previous seven weeks while it lay dormant. With the steam tracers heating the water over the flashpoint, a vapor column could have been created at a nominal pressure of ten pounds per square inch or less. The introduction of cold water (estimated temperature of 40° F) at a relatively slow rate (5 to 6 gpm) would cool the liquid in the

Most Probable Cause of Weld Failure (cont.)

line sufficiently after five to ten minutes to cause the vapor pocket to suddenly condense creating a void. The water contained in the three inch line would surge forward possibly creating a condensation induced water hammer of significant magnitude along with a mild thermal shock in the area of the weld failure.

The combined effect of the chain of probable stress inducing events eventually led to the brittle fracture of the poorly formed weld. While the impact of the likely events that caused the weld to fail after passing the initial hydrostatic test are speculative, the physical evidence available to us, such as the circumferential crack in the center of the weld, supports the conclusions presented.

The important factor to be gleaned from this analysis is the need to keep the piping systems from being subjected to unnecessary stress cycles, especially if the condition of the welds might be impaired. Controlling or eliminating freeze up protection is a key element in reducing the potential for joint fatigue by reducing the magnitude of the thermal gradients experienced by the piping system. Avoiding the conditions that could cause liquids contained within the piping to flash to the vapor phase and suddenly condense creating a severe shock or "hammer" is most important in maintaining the soundness of a fluid transfer system. After an initial post-construction hydrostatic test at 150 percent of design pressure to verify the integrity of a piping system, periodic or extended hydrostatic testing appears to be of little value in maintaining the soundness of the pipe lines and may actually have a deleterious effect.

E-5 UNH Pump Change

Fernald Environmental
ERMCO
ration Management Corporation P.O. Box 398704 Cincinnati, Ohio 45239-8704 (513) 738-6200

6587

October 21, 1994

U. S. Department of Energy
Fernald Environmental Management Project
Letter No. C:RSO:(FP):94-0002

Mr. Tony Pyrz
6120 South Gilmore Road
Fairfield Executive Center
Fairfield, OH 45014

Dear Mr. Pyrz:

SUBJECT: UNH REPLACEMENT PUMPS

The pumps that were specified for the UNH Neutralization Project and received from Fisher Pump and Valve have been found to be defective. The pumps have been returned to Fisher for replacement. Tarby Pumps, who is the manufacturer of the pumps, is recasting the suction casting with new molds. The schedule for the return and installation of the pumps will not allow the UNH Project to meet it's schedule for commencing operations on January 16, 1995.

Several double-diaphragm pumps have been located on site that are suitable for use in the UNH Project. The pumps will be mounted on the pump skids that will be returned by Fisher. Minor modifications to the suction and discharge piping will be required to install the pumps.

Parsons is directed to redesign any piping and instrumentation changes required for this modification. The drawings are to be revised to show the new pumps and any change in the design. Additionally, the design criteria and control philosophy documents also require updating.

In order to meet the schedule commitment to Ohio EPA, three weeks have been allocated to install the new pumps on the pump skids and two additional weeks to install the pumps in the field. The new pipeline and pumps are required to be completed by November 21, 1994. A schedule is attached that shows the critical path to meet the January 16, 1995 commitment.

In addition to the equipment changes, several of the documents already issued for the UNH Project will require modification. These include the SAR, Operating Procedures, Plan of Action and Lesson Plans.

Fernald Environmental
FERMCO
Restoration Management Corporation

Thank you for your support to the UNH Neutralization Project. Please contact me with any questions at 738-6650.

Sincerely,

Stan Frank, Manager
UNH Neutralization Project

SWF:njw

c:
File Record Storage Copy 102.1
UNH File Copy 106.48

REV 1 11/4/94

INSTRUMENTATION FOR INTERIM AIR OPERATED PUMPS

PRESSURE SWITCHES (one per pump to be modified):

A. Fluid: air

B. 3 to 30 psi range (min.), adjustable

C. 2 psi deadband (max.)

D. 1/4" NPT(F) process connection

E. Withstand up to 75 psig without deformation or damage.

F. Contact charecteristics: SPDT, Dry contact, 120VAC, 60HZ, 1 Amp,

G. Enclosure: NEMA 4

H. Manufacturers and Models:
   1. SOR, 4NN-K5-N4-B1A
   2. Square D, Class 9012 GWD-2
   3. Allen-Bradley, 836T-T-251J
   4. Or Approved Equal

SOLENOID VALVE (one per pump to be modified):

A. 2-Way, Normaly closed

B. Fluid: air

C. Operating Pressure: 110 psi (max.)

D. Process Connection: 1" NPT

E. Body Material: class 300 SST (exception: solenoid valves for the Maghydroxide Feed System or the Filter Feed System can be made of brass or class 300 SST)

F. Seals and Disks, Materials: Buna-N

G. Power: 120 VAC, 60 Hz

H. Enclosure: NEMA 4

I. Coil Insulation: Class F or H

J. Maufacturers and Models
   1. ASCO, 8210D89
   2. MAC, 57C-13-11 0 CA
   3. Skinner, 703N9 G 1A
   4. Or Approved Equal

CABLE:

A. #16 Twisted, shielded, 2 conductor

B. Insulation: 300V (min)

LEAK DETECTION SWITCHES:

A. Manufacturer and Model
   1. Wilden, WIL-GARD I, 65-8100-99

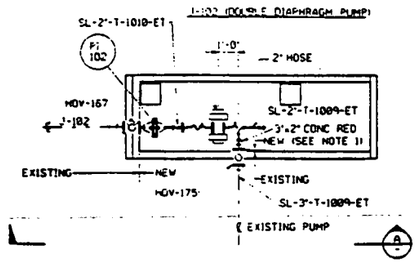
CONFIGURATION OF DYNAPAR FLOW METERS

A. Record positions of DIP swtches in back and step through the program and record the parameters. This will allow it to be returned to it's original configuration.

B. Interim DIP switch configuration:
   1. A.O.C and B.O.C switches are in the up position
   2. AMAG and BMAG switches are in the down position.

C. Programming:
   1. Input operation for A-B
   2. Inputs A and B for low Speed
   3. 0.7 Gallons/pulse
   4. Other parameters should be correct

skp0134(6.in(6323.ws422) po110@ws422. Tue Nov 1 10:11:31 EST 1994



PLAN J-102
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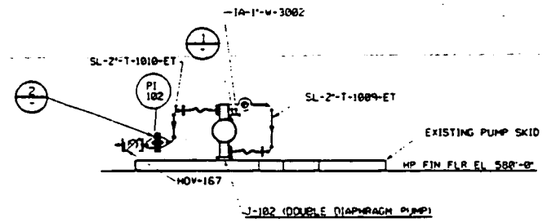

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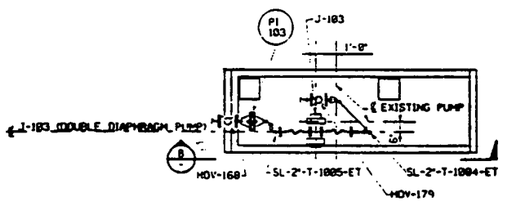

PLAN J-103
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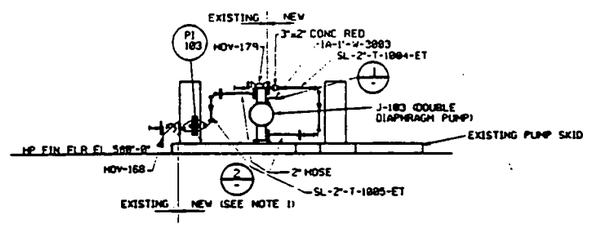

SECTION B
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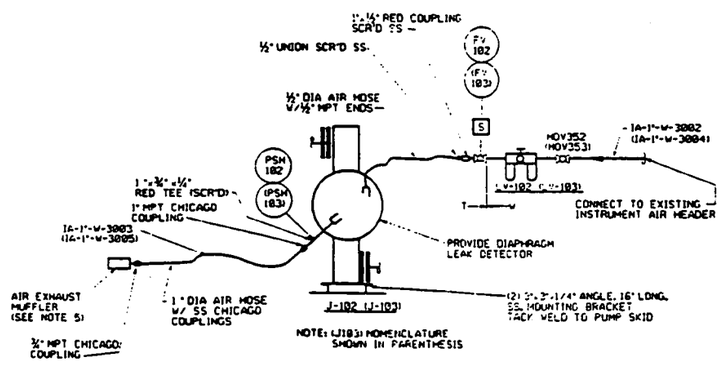
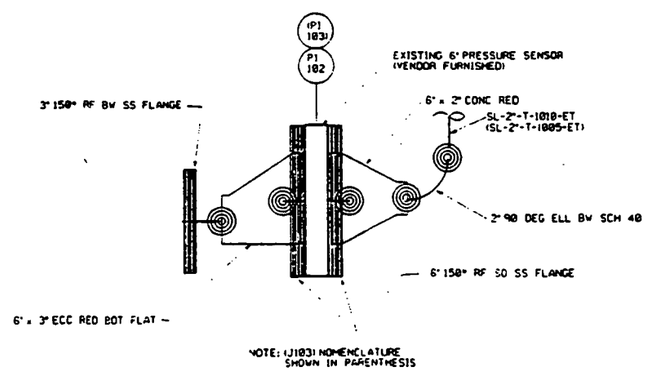


DETAIL 1
NTS



DETAIL 2
NTS

NOTES

1. FIELD TO REMOVE EXISTING PIPING AND RELIEF VALVE ASSEMBLY BETWEEN EXISTING 3" BALL VALVES. STORE THIS ASSEMBLY FOR FUTURE PROGRESSIVE CAVITY PUMP INSTALLATION.
2. FOR LOCATIONS AND ORIENTATIONS OF PUMPS J-102 AND J-103 SEE DRAWING 92X-5900-P-00063.
3. FOR MECHANICAL PROCESS P&ID SEE DRAWING SK-M-03408.
4. LEGEND:
   NEW PIPING= ————————
   EXISTING PIPING= — — — — .
5. DISCONNECT MUFFLER FROM PUMP AND RELOCATE AT NEAREST CONTAINMENT SUMP.
6. PUMPS J-102 AND J-103 SHALL BE INSULATED AND ELECTRIC TRACED.
7. FIELD TO SUPPORT EXISTING PIPING AS NECESSARY.

MATERIAL LIST-J-102 & J-103
QUANTITIES SHOWN ARE FOR TWO PUMPS

1) 1" AIR REGULATOR/FILTER/LUBRICATOR (2 REQ'D)
2) 1" BALL VALVE CARBON STEEL (TY) (2 REQ'D)
3) 1"x3/4"x1/4" RED TEE STAINLESS STEEL (TY) (2 REQ'D)
4) 1/2" DIA AIR HOSE 4'-0" LONG, W/1/2" STAINLESS STEEL MPT FITTING EA END (TY) (2 REQ'D)
5) 1"x1/2" RED COUPLING STAINLESS STEEL (TY) (2 REQ'D)
6) 1" PIPE CARBON STEEL (TY) (60 LF)
7) 3" FLANGE 150# RF SS WN (TY) (4 REQ'D)
8) 6" 150# RF SO FLANGE SS (TY) (4 REQ'D)
9) 2" 90 DEG ELL SS BW (TY) (9 REQ'D)
10) 3"x2" CONC RED SS BW (TY) (2 REQ'D)
11) 2" ID HOSE, TEFLON LINED, 1'-6" LONG, LAP JOINT STUB END RF SS FLANGES (T) (4 REQ'D)
12) 2" 45 DEG ELL SS BW (TY) (2 REQ'D)
13) 2" PIPE SCH 40 SS (TY) 10'-0" LONG
14) 6"x3" ECC RED BW SCH 40 SS (T) (2 REQ'D)
15) 2" FLANGE 150# RF SS WN (TY) (4REQ'D)
16) 1" DIA AIR HOSE 10'-0" LONG, W/ SS CHICAGO COUPLING EA END (TY) (2 REQ'D)
17) CHICAGO COUPLING (TY) SS MPT (4 REQ'D)(2-1" MPT; 2-3/4" MPT)
18) 1/2" UNION SCR'D SS (TY) (2 REQ'D)
19) 1/2" PIPE NIPPLE TBE 3" LONG SS (TY) (2 REQ'D)
20) 6"x2" CONC RED BW SCH 40 SS (TY) (2 REQ'D)
21) 6" BOLT-UPS (TY) (2 REQ'D) (INCLUDES 4 GASKETS AND 2 PI BOLT-THRUS)
22) 3" BOLT-UPS (TY) (4 REQ'D)
23) 2" BOLT-UPS (TY) (8 REQ'D)

REF DWG NO.	DRAWING TITLE
92X-5900-P-00063	PIPING PLAN AND SECTIONS DILUTION-NEUTRALIZATION PLANT 2/3
SK-M-03408	MECHANICAL PROCESS P&ID FOR UNH TRANSFER

REV. NO.	REASON FOR REVISION - DESCRIPTION	BY	CHKD	DATE
A	ISSUED PER FERMCO LETTER: CARSON(FP) 94-0002			

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
URANYL NITRATE NEUTRALIZATION PROJECT

DRAWING TITLE
PIPING/PLANT DESIGN
PIPING PLANS, SECTIONS AND DETAILS
UNH PUMPS SHEET 1 OF 3

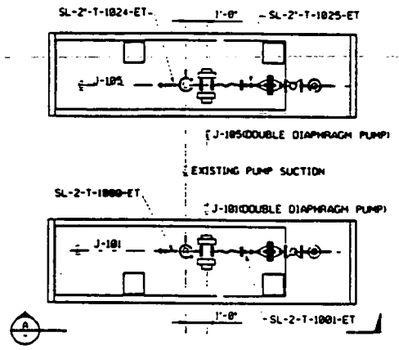
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
D. ROSENE	10-24-94	D. ROSENE	10-31-94	D. CARLSON	10-31-94

PLANT/BLDG. NO. | TURBO | SCALE: AS NOTED | CLASS

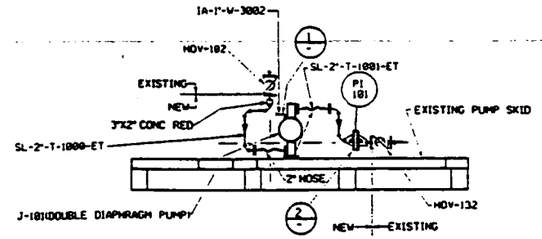
SUBMITTED FOR APPROVAL | FERMCO DRG APPROVAL

PARSONS DRAFT PARSONS PROJECT/DRAFT NUMBER	DOE PROJECT NO.	FTLP PROJECT NO.	DRAWING DRAFT CODE NO.	SHEET NO.	REV. NO.
=CRU2/P0110		1V85 00-90701	SK-P-03406	P0001	A

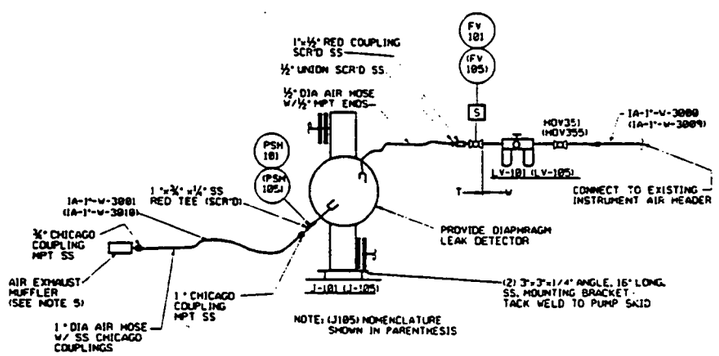
skp(13407.m)(6324.ws422) po110@ws422. Tue Nov 1 10:12:53 EST 1994



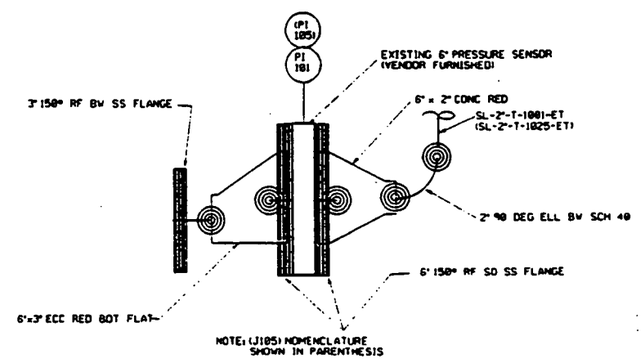
PIPING PLAN
SCALE ⅜"=1'-0



SECTION A
⅜"=1'-0"
J-101 SHOWN
J-105 SIMILAR



DETAIL 1
NTS



DETAIL 2
NTS

NOTES

1. FIELD TO REMOVE EXISTING PIPING AND RELIEF VALVE ASSEMBLY BETWEEN EXISTING 3" BALL VALVES. STORE THIS ASSEMBLY FOR FUTURE PROGRESSIVE CAVITY PUMP INSTALLATION.
2. FOR LOCATIONS AND ORIENTATIONS OF PUMPS J-101 AND J-105 SEE DRAWINGS 92X-5900-P-00059, 92X-5900-P-00060, 92X-5900-P-00061, 92X-5900-P-00062 AND 92X-5900-P-00063.
3. FOR MECHANICAL PROCESS P&ID SEE DRAWING SK-N-03408.
4. LEGEND:
   NEW PIPING: ————————
   EXISTING PIPING: — - - — -
5. DISCONNECT MUFFLER FROM PUMP AND RELOCATE AT NEAREST CONTAINMENT SUMP.
6. PUMPS J-101 AND J-105 SHALL BE INSULATED AND ELECTRIC TRACED.
7. FIELD TO SUPPORT EXISTING PIPING AS NECESSARY.

MATERIAL LIST: J-101 & J-105
QUANTITIES SHOWN ARE FOR TWO PUMPS

1) 1" AIR REGULATOR/FILTER/LUBRICATOR (2 REQ'D)
2) 1" BALL VALVE CARBON STEEL (WH) (2 REQ'D)
3) 1"x¾"x¼" RED TEE STAINLESS STEEL (TH) (2 REQ'D)
4) ½" DIA AIR HOSE 4'-0" LONG W/½" STAINLESS STEEL MPT FITTING EA END (TH) (2 REQ'D)
5) 1"x½" RED COUPLING STAINLESS STEEL (TH) (2 REQ'D)
6) 1" PIPE CARBON STEEL (WH) (60 LF)
7) 3" FLANGE 150# RF SS WN (TH) (4 REQ'D)
8) 6" 150# RF SO FLANGE SS (TH) (4 REQ'D)
9) 2" 90 DEG ELL SS BW (TH) (10 REQ'D)
10) 3"x2" CONC RED SS BW (TH) (2 REQ'D)
11) 2" ID HOSE, TEFLON LINED, 1'-6" LONG, W/LAP JOINT STUB END RF SS FLANGES (TH) (4 REQ'D)
12) 2" BOLT-UPS (TH) (8 REQ'D)
13) 2" PIPE SCH 40 SS (TH) 10'-0" LONG
14) 6" x 3" ECC RED BW SCH 40 SS (TH) (2 REQ'D)
15) 3" FLANGE 150# RF SS WN (TH) (4 REQ'D)
16) 1" DIA AIR HOSE 10'-0" LONG, W/ SS CHICAGO COUPLING EA END (TH) (2 REQ'D)
17) CHICAGO COUPLING (TH) SS MPT (4 REQ'D) X 2-1" MPT; 2-¾" MPT)
18) ½" UNION SCR'D SS (TH) (2 REQ'D)
19) ½" PIPE NIPPLE TBE 3" LONG SS (TH) (2 REQ'D)
20) 6" x 2" CONC RED BW SCH 40 SS (TH) (2 REQ'D)
21) 6" BOLT-UPS (TH) (2 REQ'D) (INCLUDES 4 GASKETS AND 2 PI BOLT-THRUS)
22) 3" BOLT-UPS (TH) (4 REQ'D)

REF DWG NO.	DRAWING TITLE
92X-5900-P-00059	PIPING PLAN AND SECTIONS DILUTION-NEUTRALIZATION NFS TANKS
92X-5900-P-00060	PIPING PLAN AND SECTIONS DILUTION-NEUTRALIZATION CD BLEND TANKS
92X-5900-P-00061	PIPING PLAN AND SECTIONS DILUTION-NEUTRALIZATION DK LIQUOR TANK
92X-5900-P-00062	PIPING PLAN AND SECTIONS DILUTION-NEUTRALIZATION HOT RAFFINATE TANKS
92X-5900-P-00063	PIPING PLAN AND SECTIONS DILUTION-NEUTRALIZATION PLANT 2/3
SK-N-03408	MECHANICAL PROCESS P&ID FOR UNH TRANSFER

REV NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	INITIALS AND DATE
A	ISSUED PER FERMCO LETTER: CARSON(FP): 94-0082	

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
URANYL NITRATE NEUTRALIZATION PROJECT

DRAWING TITLE
PIPING/PLANT DESIGN
PIPING PLAN, SECTIONS AND DETAILS
UNH PUMPS SHEET 2 OF 3

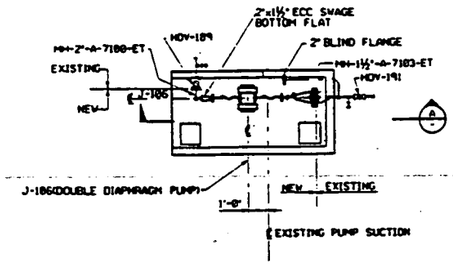
DRAWN BY	DATE	TECH CHECKED	DATE	CHECKED BY	DATE
D. ROSENE	10-27-94	D. ROSENE	10-31-94	D. CARLSON	10-31-94

PLANT/BLDG NO.	TITLE	SCALE	CLASS
		AS NOTED	

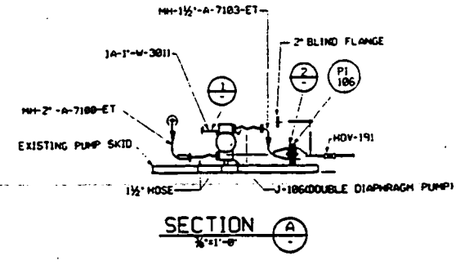
SUBMITTED FOR APPROVAL | TITLE/CO DW APPROVAL

PREPARED UNDER PARSONS PROJECT GROUP NUMBER	DATE	DOE PROJECT NO.	DATE	FEMP PROJECT NO.	DRAWING REF CODE NO	SHEET NO.	REV NO
CRU2/P0110				WBS 00-90701	SK-P-03407	P0002	A

skp03424.m(6346.ws422) po110@ws422. Wed Nov 9 08:36:48 EST 1994



PIPING PLAN
SCALE ⅜"=1'-0"



SECTION A
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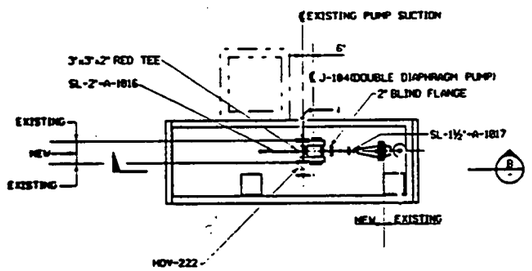
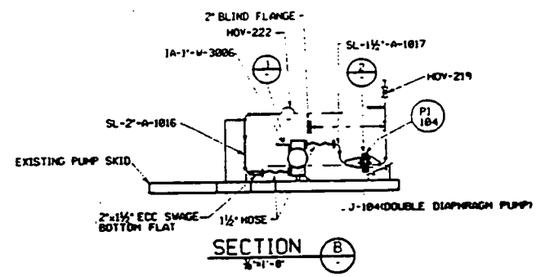


PIPING PLAN
SCALE ⅜"=1'-0"



SECTION B
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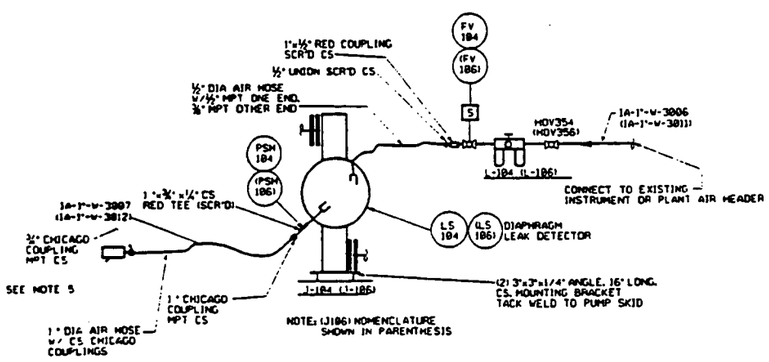
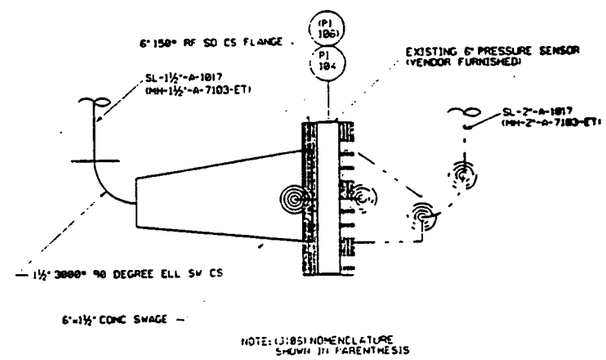


DETAIL 1
NTS



DETAIL 2
NTS

NOTES

1. FIELD TO REMOVE EXISTING PIPING AND RELIEF VALVE ASSEMBLY BETWEEN EXISTING 3" BALL VALVES. STORE THIS ASSEMBLY FOR FUTURE PROGRESSIVE CAVITY PUMP INSTALLATION.
2. FOR LOCATIONS AND ORIENTATIONS OF PUMPS J-104 AND J-106 SEE DRAWINGS 92X-5900-P-00063 AND 92X-5900-P-00065.
3. FOR MECHANICAL PROCESS P&ID SEE DRAWING SK-M-03400.
4. LEGEND:
   NEW PIPING: ————————
   EXISTING PIPING: — — — — —
5. DISCONNECT MUFFLER FROM PUMP AND RELOCATE IN A SAFE CONTAINMENT AREA.
6. PUMP J-106 SHALL BE INSULATED AND ELECTRIC TRACED.
7. FIELD TO SUPPORT EXISTING PIPING AS NECESSARY.

MATERIAL LIST-J-104 & J-106
QUANTITIES SHOWN ARE FOR TWO PUMPS

1) 1" AIR REGULATOR/FILTER/LUBRICATOR (2 REQ'D)
2) 1" BALL VALVE CARBON STEEL (MF) (2 REQ'D)
3) 1"x¾"x¼" RED TEE CARBON STEEL (MF) (2 REQ'D)
4) ½" DIA AIR HOSE 4'-0" LONG, W/ CARBON STEEL FITTINGS: ½" MPT ONE END, ¾" MPT OTHER END (MF) (2 REQ'D)
5) 1"x½" RED COUPLING CARBON STEEL (MF) (2 REQ'D)
6) 1" PIPE CARBON STEEL (MF) (62 LF)
7) 1½" PIPE CARBON STEEL (MF) (5 LF)
8) 6" 150# RF SO FLANGE CS (MF) (2 REQ'D)
9) 2" 90 DEG ELL CS BW (MF) (4 REQ'D)
10) 2"x1½" ECC SWAGE CS BW BLE/PSE (MF) (2 REQ'D)
11) 1½" ID HOSE, NEOPRENE LINED, 1'-3" LONG, W/ LAP JOINT STUB END RF CS FLANGES (A) (4 REQ'D)
12) 1½" BOLT-UPS (MF) (8 REQ'D)
13) 2" PIPE CARBON STEEL (MF) 10'-0" LONG
14) 1½" 90 DEGREE ELL CLASS 3000# SW CS (A) (4 REQ'D)
15) 1½" FLANGE 150# RF CS SW (MF) (4 REQ'D)
16) 1" DIA AIR HOSE 10'-0" LONG, W/CS CHICAGO COUPLING EA END (MF) (2 REQ'D)
17) CHICAGO COUPLING (MF) CS MPT (4 REQ'D)(2-1" MPT, 2-¾" MPT)
18) ½" UNION SCR'D CS (MF) (2 REQ'D)
19) ½" PIPE NIPPLE TBE 3" LONG CS (MF) (2 REQ'D)
20) 6" x 1½" CONC SWAGE BW CS BLE, PSE (MF) (2 REQ'D)
21) 6" BOLT-UPS (MF) (2 REQ'D) (INCLUDES 4 GASKETS AND 2 PI BOLT-THRUS)
22) 3"x3"x2" RED TEE CS BW (MF) (1 REQ'D)
23) 2" FLANGE 150# RF CS BW (MF) (1 REQ'D)
24) 2" BLIND FLANGE 150# RF CS (MF) (2 REQ'D)
25) 3" FLANGE 150# RF CS BW (MF) (2 REQ'D)
26) 2" BOLT-UPS (MF) (3 REQ'D)
27) 3" BOLT-UPS (MF) (2 REQ'D)

REF DWG NO.	DRAWING TITLE
92X-5900-P-00063	PIPING PLAN AND SECTIONS DILUTION/NEUTRALIZATION PLANT 2/3
92X-5900-P-00065	PIPING PLAN AND SECTIONS DEWATERING SYSTEM PLANT 8
SK-M-03400	MECHANICAL PROCESS P&ID FOR UNH TRANSFER

REV. NO.	REVISION	CHKD	APPROVED	DATE
A	ISSUED PER FERMCO LETTER: CARSON(FP): 94-0002			

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
URANYL NITRATE NEUTRALIZATION PROJECT

DRAWING TITLE
PIPING/PLANT DESIGN
PIPING PLAN, SECTIONS, AND DETAILS
UNH PUMPS SHEET 3 OF 3

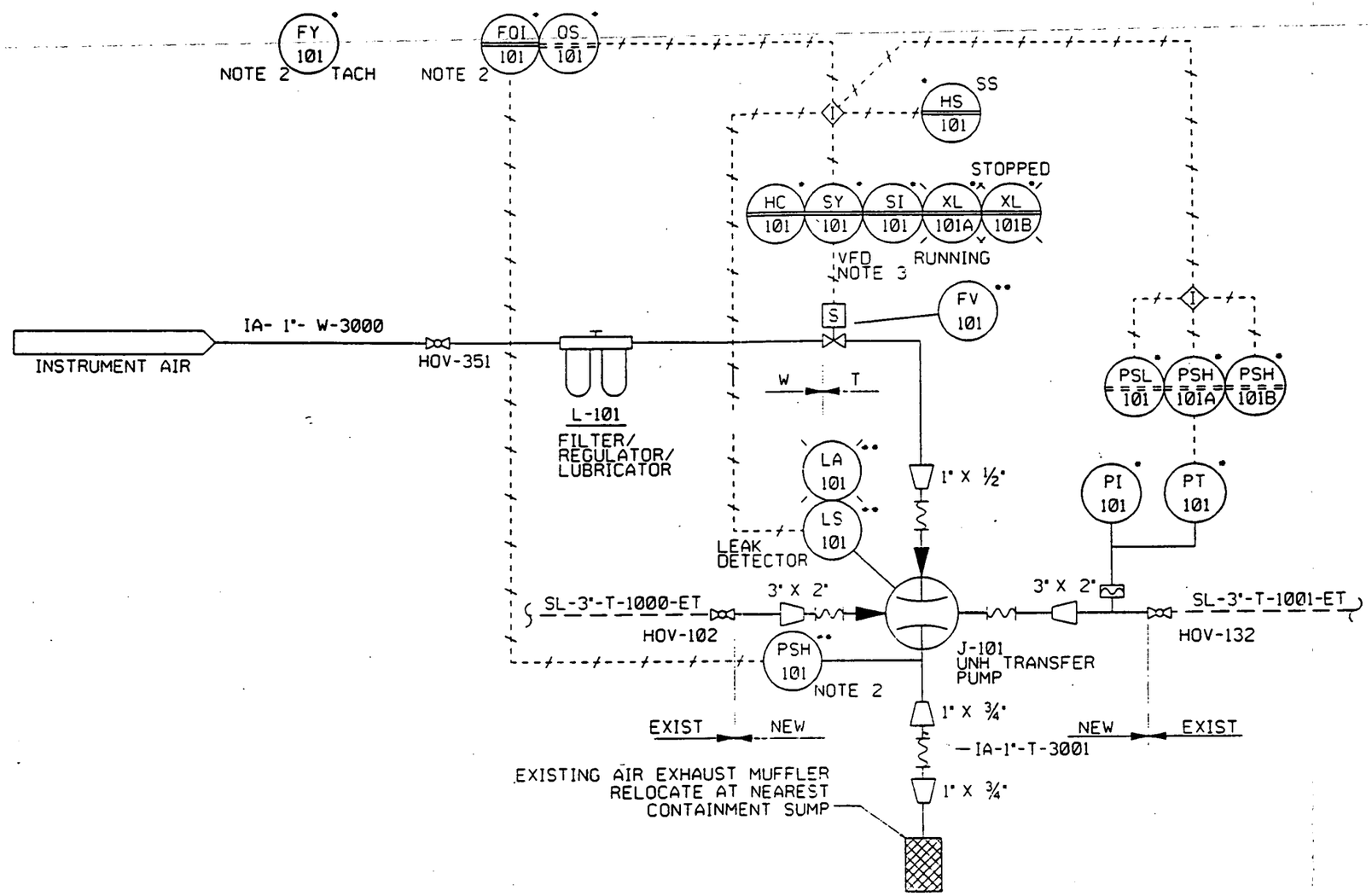
DRAWN BY	DATE	LEAD DISCIPLINE	DATE	CHECKED BY	DATE
D. ROSENE	10-27-94	D. ROSENE	11-9-94	D. CARLSON	11-9-94

PLANT/BLDG. NO. | TUBE | SCALE: AS NOTED | CLASS

SUBMITTED FOR APPROVAL | FERMCO DWG APPROVAL

PREPARED UNDER FERMCO PROJECT ORDER NUMBER	DOE PROJECT NO.	FTMP PROJECT NO.	DRAWING SHEET CODE NO.	SHEET NO.	REV. NO.
CRU2/P0110		V95 00-90701	SK-P-03424	P0003	A

ku03408.un(6578.ws406) po110@ws406, Tue Nov 1 08:38:01 EST 1994



NOTES

1. "•" - INDICATES EXISTING INSTRUMENT PROVIDED WITH PUMP SKID.
2. DURING THE INTERIM CONFIGURATION THE TACHOMETER FY101 WILL BE DISCONNECTED FROM THE FLOW TOTALIZER FQI101 AND PRESSURE SWITCH PSH101 WILL BE CONNNECTED.
3. THE VARIABLE FREQUENCY DRIVE (VFD) WILL HAVE THE MOTOR LOAD DISCONNECTED. THE SPEED (FREQUENCY) CONTROL AND THE VOLTS PER HERTZ WILL BE SET TO THE MINIMUM VALUE. THE RUNNING CONTACT WILL BE CONNECTED TO FV101 (NEW) TO PROVIDE AN INPUT SIGNAL TO OPEN/CLOSE THE AIR SUPPLY TO THE DIAPHRAM PUMP
4. "••" - INDICATES NEW INSTRUMENTS BEING PROVIDED BY FERMCO.

REF DWG NO.	DRAWING TITLE

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DRAWN	CHECKED	DATE
A	ISSUED PER FERMCO LETTER CASOOFP94-0082			

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
URANYL NITRATE NEUTRALIZATION PROJECT

DRAWING TITLE
MECHANICAL PROCESS
P & ID FOR UNH TRANSFER
J-101 (TYPICAL)

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
NH TERRY	10-25-94	S. CHANTOUS	10-26-94	G. W. CARLSON	10-26-94

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL | FORMED ON APPROVAL

PREPARED UNDER PARSONS PROJECT, GROUP NUMBER	DOE PROJECT NO.	TYP PROJECT NO.	DRAWING SERIES CODE NO.	SHEET NO.	REV NO.
CRU2/P0110		WBS 00-90701	SK-N-03408	N0001	A

PARSONS

South Gilmore Road
eld Executive Center
eld, OH 45014
) 870-0300
(513) 870-0444

6587

December 20, 1994
PARSONS ID#:04:119:223:0545-94

Mr. Dave Brettschneider
Fernald Environmental Restoration
Management Corporation
P.O. Box 538704
Cincinnati, OH 45253-8704
Attn: Mr. Stan Frank

Subject: Review of Capabilities of Diaphragm Pumps - REVISED
UNH Neutralization Project
Project Order 119 (PO-119)
Subcontract No. 2-21487
PARSONS Environmental Remedial Action Project

Dear Mr. Brettschneider:

This letter is a clarification of my letter of December 19, 1994, PARSONS ID#04:119:223:0545-94, on this subject. Additions to the original letter are in **boldface, and** deletions are ~~struck-out~~.

The UNH processing system was originally designed around progressive cavity (PC) pumps. Upon delivery, the PC pumps were found to leak, and FERMCO instructed PARSONS to substitute Wilden air-operated double-diaphragm pumps into the design. Two kinds of Wilden pumps are used: M8 pumps are used for pumping UNH and neutralized slurry (pumps J-101, J-102, J-103, and J-105), and M4 pumps are used for pumping magnesium hydroxide (pump J-106) **and for feeding the Eimco filters (pump J-104)**. The following discussion compares the UNH system operating requirements to the capabilities of the Wilton M8 and M4 pumps.

Original design operating requirements (pumps J-101,102,103,105)

1. Pumped fluid: Nitrate solutions with up to 4N nitric acid
2. Maximum fluid temperature: 140 degrees F
3. Ambient temperature conditions: -10 degrees F to 110 degrees F
4. Solids in fluid: up to 50%
5. Discharge flowrate: 25 gpm to 100 gpm
6. Suction lift: 20 feet

M8 pump capabilities

1. Pumped fluid: Kynar and Teflon compatible with all solutions to be encountered in UNH processing
2. Maximum fluid temperature: see #3
3. Ambient temperature conditions[1]: Kynar temp range 20 - 200 degrees F
   Teflon temp. range 10 - 225 degrees F
4. Solids in fluid: up to 50%
5. Discharge flowrate[2]: 80 gpm at 30 psig discharge pressure at 80 psig air pressure
6. Suction lift: 25 feet

Original design operating requirements (pumps J-104,106)

1. Pumped fluid: magnesium hydroxide slurry
2. Maximum fluid temperature: ambient indoor
3. Ambient temperature conditions: inside Plant 8 and Plant 2/3
4. Solids in fluid: up to 55%
5. Discharge flowrate: up to 50 gpm

M4 pump capabilities

1. Pumped fluid: Kynar and Teflon compatible with all solutions to be encountered in UNH processing
2. Maximum fluid temperature: see #3
3. Ambient temperature conditions[1]: Kynar temp range 20 - 200 degrees F
   Teflon temp. range 10 - 225 degrees F
4. Solids in fluid: capable of 55%
5. Discharge flowrate: 50 gpm at 30 psig discharge pressure and 80 psig air pressure

Notes:
[1] Outdoor processing will not be performed if liquid temperatures are below 20 degrees F
[2] The discharge flowrate of the M8 pumps is limited by the ~~80 psig~~ air pressure.

Based on this review of original design requirements, expected operating conditions and vendor data, PARSONS believes that the Wilden M8 and M4 air-operated double-diaphragm pumps are acceptable replacements for the Tarby progressive cavity pumps.

Please contact me at 870-8159, or Scott Vaaler ar 738-9488, if you have any questions on this matter.

Very truly yours,
PARSONS

William F. Ubbes
Manager, SVE

WFU:nw
cc: FERMCO
B.K. Copsey
S.J. Reutcke
D.C. Wright

PARSONS
T. Hiles
S. Vaaler
Document Control
DC6

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ENG-IDR-101
February 1, 1995

E-6

Design Review Team
Evaluation of Documentation for Vendor Deliverables

As part of the overall Design Review effort performed on the UNH Neutralization Project, a subteam (consisting of 3 FERMCO engineers and 4 PARSONS engineers) was charged with examining the equipment and hardware procurements made for the UNH project. The stated goal of the subteam was to verify that Specification requirements for materials and documentation were adequately translated into procurement documents and further, that the actual materials and documentation received could be shown to be in conformance with Specification requirements.

To facilitate this investigation, the subteam leader developed a work sheet (following this summary) to be utilized as a checklist in reviewing the UNH project procurement packages. Each member was trained on the use and intent of this worksheet prior to reviewing any Purchase Order packages. The work sheet required the reviewer to answer the following questions for each procurement package:

a. Does the Purchase Order as written adequately describe or identify Specification requirements for the material or item being procured?
b. Does the Purchase Order as written adequately identify all documentation required by the Specification (such as Certificates of Conformance, certified Test Reports, operating manuals, etc.)?
c. Does the shipping documentation (vendor packing list or shipping manifest) identify the materials shipped in sufficient detail to demonstrate that the material received complies with Purchase Order requirements?
d. Does the shipping documentation either include all documentation required by the Purchase Order or identify it as having been shipped separately?
e. Does the shipping documentation together with the receiving report prepared by FERMCO adequately demonstrate that the material received conforms to Specification requirements?
f. Does the shipping documentation together with the receiving report adequately demonstrate that the documentation received was complete and in conformance with Specification requirements?

Questions a-d were addressed by FERMCO engineering personnel who had familiarity with both the Specification and the procurement process, while questions e-f were addressed by discipline specific representatives from PARSONS who had participated in the development or use of the Design Specifications.

The population of Purchase Orders issued for the UNH project was generated from Acquisitions Department CMMS database using the two charge numbers 3BPC1 and 9BAA2 available to the UNH Project. Purchase Order packages were then retrieved from the Acquisitions Department files in Building 45 and at the Showcase Center, the storage location being dependent on the location of the Buyer involved. The review included evaluation of all documentation located in the Acquisitions Department files. In general, each Purchase Order package contained the following documents:

a. The original Purchase Requisition (PR) which initiated the procurement action,
b. Documented records of the Buyer's Request for Proposal (RFP) and bid evaluation process,
c. The formal Purchase Order (PO) and associated procurement "boiler plate" terms and conditions,
d. The FERMCO (RIMIA) Receiving Report identifying the items and quantities received,
e. The vendors shipping manifest or packing list identifying the materials shipped.

The subteam reviewed each Purchase Order package, line item by line item, against the Specification requirements for the item or material being procured, answering the above questions as possible for each line item based on the documentation available in the Purchase Order package. A total of 267 Purchase Order packages were reviewed, 238 against Charge Number 3BPC1 and 29 against Charge Number 9BAA2.

Results of Design Review

The subteam segregated the Purchase Order packages reviewed according to the design Divisions of the Design Specification, and then further for the Mechanical Division into the specific Sections addressing the item or material. Utilizing this process, the 267 Purchase Order packages were grouped as shown in Table 1.

Results of the above review relative to the questions of primary concern (e-f), are as noted in Table 2. The basis for the results are that if the packing list or shipping documents could definitively identify the item or material as fully compliant with the Design Specification, the reviewers answered the question YES. If full compliance, by virtue of review of the shipping document, could not be demonstrated then they answered NO. Likewise, if the documentation supplied by the vendor complied with the Design Specification, a YES was entered for the question, if not then a NO was entered.

ENG-IDR-101
February 1, 1995

Table 1
SUMMARY OF PROCUREMENTS FOR UNH PROJECT
(as of 1/11/95)

TOTAL PURCHASE ORDERS - 267* (238 on 3BPC1, 29 on 9BAA2)

MECHANICAL

Mechanical, Stainless - 37
(includes pipe, fittings, flanges, swages, gaskets, bolting)

Mechanical, Stainless (Ball, Gate, or Globe Valves) - 6

Mechanical, Carbon - 31
(includes pipe, fittings, flanges, swages, gaskets, bolting)

Mechanical, Carbon (Ball, Gate, or Globe Valves) - 8

Mechanical, Plastic (includes pipe, fittings, flanges) - 3

Mechanical, Heat Trace - 4

Mechanical, Pumps - 12
(includes pumps, hoses, fittings, parts, speed controller, surge suppressor)

Mechanical, Insulation - 9

Mechanical, Hangers - 21
(includes rod, beam clamps, u-bolts, snubbers, and electrical hangers)

Mechanical, Weld Rod - 7
(includes 6010, 7018, 308, 309-16, ER316L)

Table 1 (cont'd.)

ELECTRICAL

Electrical, Power - 18
(includes conduit, boxes, enclosures, wire & cable, SO cord, instrument cable, terminal blocks, splicing & termination kits, switches, plug connectors)

INSTRUMENT & CONTROL

I&C, various - 29

STRUCTURAL

Structural, misc. - 14
(includes steel, wood, concrete, unistrut)

MISCELLANEOUS

Misc. supplies, rentals, equipment - 62

Misc. labor support - 15
(includes temp, analytical, and support services)

* Total PO's generated for UNH project as of 1/11/95 was 271. Four of these reflected PO's issued for Parsons support (3) and Wise Construction services (1), hence the number of procurements will be considered as 267. Note also that the total of PO's from the above list is 276 because some PO's are considered in more than one category.

Table 2

Analysis was documented using the PARSONS procedure ENG-018, Processing Vendor/Supplier Submittals. The procedure had to be modified slightly to accomplish the Analysis in that the status indicators used (A,B,C) were modified to A, B, C, D, E, and F with descriptors as follows:

A = **YES** for material meeting Specification and **YES** for documentation meeting Specification.

B = **YES** for material meeting Specification and **NO** for documentation meeting Specification.

C = **NO** for material meeting Specification and **YES** for documentation meeting Specification.

D = **NO** for material meeting Specification and **NO** for documentation meeting Specification.

E = Used to designate Purchase Orders for tools, misc. Construction items, or items/materials which were not specified but which were reviewed and accepted by the design engineers.

F = Items/materials which are no longer applicable to the project.

Table 2 (con't.)

The 267 Purchase Orders written for the UNH Project represent 196 written by Construction Procurement, and 71 written by others (either RSO maintenance or Safe Shutdown).

Of 192 Construction PO's thoroughly reviewed, the following categorizations can be made:

21 (11%) are Category A, material and documentation acceptable.

50 (26%) are Category B, material acceptable, documentation incomplete. Items/materials categorized B principally lack a Certificate of Conformance from the Vendor, no questions exist relative to the suitability of the material received or its conformance to Specification requirements.

31 (16%) are Category D, material status indeterminate based on incomplete documentation. Items/materials categorized D lack sufficient shipping documentation to establish their conformance to Specification requirements. However, in the judgement of the design engineers who reviewed the items/materials, a more descriptive shipping slip or physical inspection of the material would allow reclassification to B. **Only two (2) PO's evidenced inappropriate material (ERW rather than seamless carbon steel pipe).**

79 (41%) are Category E, primarily construction tools or equipment, or miscellaneous items which were left to good construction practices to procure. The Design Engineers reviewed all Category E items and in all cases concurred with their appropriateness for use.

11 (6%) are Category F, material which no longer has application to the UNH project.

Table 2 (con't.)

An additional issue raised during review of the Purchase Orders was the apparent duplicate purchase of twelve (12) 3" ball valves for use on the project. An investigation revealed the following information:

The UNH Performance Specification called out Class 150, Full Port, Stainless Steel, 304L, ASTM A351, Grade CF8, Beveled Ends, Fire Safe, 316 SS Trim, **UHMWPE Full Seat Around Ball**, Wrench Operator Ball Valves.

Sixteen (16) 3" Ball Valves intended to meet this specification were ordered 3/3/94 (**PO 94CP002354**), received, installed and performed successfully. These were manufactured by Apollo Valves.

Twelve (12) additional 3" Ball valves were subsequently ordered 3/29/94 (**PO 94CP002939**) which were received, installed, and found to leak considerably. These valves were manufactured by Marwin Valve.

Two (2) of the leaky valves were removed and returned to the supplier, and then to Marwin for repair. Analysis revealed the leak was due to faulty seating material. Repair by Marwin was delayed due to seating material availability, and a decision was therefore made to procure twelve (12) additional replacement valves. RFP's were issued to numerous vendors, all of whom could not meet the timetable for the UHMWPE Full Seat criteria. Based on the acceptable performance of the original 16 Apollo valves, an RFP was issued for these, and in so doing the Buyer learned that the particular Apollo valve originally delivered was not a UMHWPE Full Seat, but rather an UMHWPE Standard Seat model.

FCR 0074 was then issued (12/22/94) to allow variance from the Specification for use of the UHMWPE Standard Seat valves. Twelve (12) additional Apollo Standard Seat valves were then purchased on 12/29/94 (**PO 95CP001409**).