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DESIGN CRITERIA PROJECT FOR THE GROUNDWATER TREATMENT FACILITY, REV 0 - (USED AS A REFERENCE IN OU 5 FS - APPENDIX F)

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REPORT

F-7343

Design Criteria Report for the Groundwater Treatment Facility

Operable Unit 5
Project Order 69

September 1994
Revision 0

Environmental Remedial Action Project
Fernald Environmental Management Project
Fernald, Ohio
FERMCO Subcontract No. 2-21487

PARSONS

Fairfield Executive Center
6120 South Gilmore Road
Fairfield, Ohio 45014

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Design Criteria Report for the Groundwater Treatment Facility

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LIST OF ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Hygienists
ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
API	American Petroleum Institute
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASNT	American Society for Non-Destructive Testing
ASTM	American Society of Testing and Materials
AWS	American Welding Society
AWWT	Advanced Wastewater Treatment
CFR	Code of Federal Regulations
DAC	Derived Air Concentration
DACS	Data Acquisition and Control System
DBA	Design Basis Accident
DCR	Design Criteria Report
DOE	United States Department of Energy
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
GAC	Granulated Activated Carbon
GMA	Great Miami Aquifer
gpm	gallons per minute
GTF	Groundwater Treatment Facility
HID	High Intensity Discharge
I/O	Input/Output
IX	Ion Exchange
LAN	Local Area Network
MSS	Manufacturers Standard Society
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NPDES	National Pollutant Discharge Elimination System
NTS	Nevada Test Site
OBBC	Ohio Basic Building Code
ODOT	Ohio Department of Transportation
OSHA	Occupational Safety and Health Act
OU	Operable Unit
PC	Performance Category

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

PIV	Post Indicator Valve
psi	pounds per square inch
RPU	Remote Processing Unit
SAE	Society of Automotive Engineers
SAR	Safety Analysis Report
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
SSC	Structure, System or Component
SWM	Stormwater Management
SWRB	Stormwater Retention Basin
TSS	Total Suspended Solids
UBC	Uniform Building Code
UCRL	University of California Research Laboratory
UL	Underwriter's Laboratory, Inc.
UPC	Uniform Plumbing Code
US EPA	United States Environmental Protection Agency

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SECTION 1

INTRODUCTION AND OBJECTIVES

This Design Criteria Report (DCR) establishes the design criteria for Title I/II Design of Phases I and II of the Groundwater Treatment Facility (GTF) at the Fernald Environmental Management Project (FEMP). The GTF will treat contaminated groundwater extracted from the Great Miami Aquifer (GMA) as part of the Operable Unit 5 (OU-5) remedial action.

The objective of this report is to provide criteria, assumptions, and references used in the design of the GTF Phases I and II. Section 2 presents groundwater characterization data. Section 3 presents the project description and assumptions. Section 4 addresses the general design criteria and considerations on a functional basis. Section 5 presents the design criteria by specific engineering design discipline. Section 6 lists the preliminary engineering sketches that will be used as the basis for Title I/II Design. Section 7 presents the references used in the development of this report.

SECTION 2

GROUNDWATER CHARACTERIZATION

The GTF treatment system design will be based on characterization of the system influent - GMA groundwater. The following subsections present a statistical analysis of available groundwater monitoring data and identify additional groundwater characterization required to support Title II Design.

2.1 Statistical Analysis

The objective of the statistical analysis of groundwater monitoring data is to provide the statistical mean values and upper bound 90 percent confidence interval of constituent concentrations as contained in GMA groundwater. The statistical analysis was restricted to monitoring data gathered since 1992 from the 2000 series wells' samples collected in the upper portion of the GMA. For the purposes of this analysis, the following guidelines were developed:

1) Each calculation required more than 10 data points.

2) Unfiltered values were considered first.

3) Validated data were used where available.

3) If 10 or fewer data points were available for the calculation, the records were searched for data qualifiers as follows: "J = Quantitation limits may be inaccurate or imprecise," "U = Non-Detect," and "UJ = Non-detect. Quantitation limits may be inaccurate or imprecise."

4) If none of the above qualifiers were available, then non-validated "NV" data were used.

Thorium required consideration of all 2000, 3000, and 4000 series wells; plus unfiltered, filtered, "U," "NV," and "NA = No validation information in data base" qualified data.

Table 2-1 presents the results of the analyses conducted in accordance with the above guidelines.

Table 2-1 - Groundwater Statistical Analysis

Constituent	Mean	Upper Bound (90% Confidence Interval)
Alkalinity (mg/l)	307	319
Barium (mg/l)	0.0788	0.0945
Calcium (mg/l)	131	139
Chloride (mg/l)	33.2	46.6
Chromium (mg/l)*	0.2569	0.6166
Iron (mg/l)	5.7	9.9
Magnesium (mg/l)	33.3	34.1
Manganese (mg/l)	0.3127	0.4322
Molybdenum (mg/l)*	0.0223	0.0260
Nitrate (mg/l)*	0.9031	1.2552
pH	7.41	7.48
Ra-226 (pCi/l)*	1.079	1.1477
Ra-228 (pCi/l)*	3.10	3.25
Sodium (mg/l)	20.7	25.4
Sulfate (mg/l)	121	144
Tc-99 (pCi/l)*	25	35
Thorium - Total (μg/l)*	11.52	20.59
Total Dissolved Solids (mg/l)	544	584
Total Organic Carbon (mg/l)	8.0	11.9
Uranium - Total (μg/l)	48	76

*Constituents for which values were calculated on less than 30 data points and/or include nonvalidated data.

2.2 Additional Characterization

The South Plume is well characterized. However, there are indications of contaminated groundwater in areas of the GMA not influenced by the South Plume recovery system. As part of the Title I Design, a contaminant characterization study will be performed to establish the influent wastewater quality from these other areas to the GTF Phases I and II systems. An adequate analysis of the contaminants and their concentrations is important for optimizing the treatment system.

A statistical analysis similar to that previously described will be performed on the most current groundwater monitoring data base provided by FERMCO. The data base should be reviewed to identify any data gaps and, if necessary, additional sampling performed. Sampling and analytical methods for additional groundwater parameters that are not analyzed during quarterly monitoring should be defined. This will provide a more complete groundwater influent characterization on which to optimize the treatment system design. Other groundwater properties include:

1) Water temperature
2) Hardness/alkalinity
3) Total organics
4) Anion and cation analysis, including important radionuclides (e.g., ionic balance)
5) Conductivity
6) Total dissolved solids
7) Total suspended solids (TSS) with particle size distribution

In addition, it is recommended that influent and effluent to the SPIT system be analyzed for thorium concentrations to study the removal of thorium from groundwater by filtration and ion exchange. This data will help optimize the GTF.

It is assumed that FERMCO will procure all necessary groundwater sampling and analysis results.

SECTION 3

PROJECT DESCRIPTION AND ASSUMPTIONS

3.1 Project Description

The GTF consists of two design and construction phases. Each phase will provide 2,500 gpm treatment capacity. This phasing provides flexibility to add treatment capacity, if required, and to accommodate DOE funding levels.

Phase I consists of one 2,500 gpm (maximum) treatment unit to treat groundwater from the South Plume Removal Action, Part 3, groundwater recovery system and all common support and ancillary systems for future phases. Phase II consists of one 2,500 gpm (maximum) treatment unit to treat groundwater from other anticipated contaminated groundwater streams. Additional phases consisting of one 2,500-gpm treatment unit each may be added in the future if groundwater contaminant concentrations warrant increased treatment capacity.

The treatment process for each phase of the GTF is identical. The treatment process is designed for the removal of uranium from groundwater. Title I Design will assess the applicability of the proposed process design to remove other radionuclides and contaminants from groundwater. There are six major functional components of the GTF Phases I and II treatment process: equalization, filtration, adsorption, ion exchange, effluent monitoring, and ancillary systems. The following subsections describe the functional components of a typical 2,500 gpm treatment unit and ancillary systems. Figure 3-1 presents a block flow diagram of the process.

3.1.1 Typical 2,500 gpm Treatment Unit

3.1.1.1 Equalization

Groundwater will be pumped from each groundwater recovery system to one of two equalization tanks in each 2,500 gpm treatment unit. Each tank will be sized to provide a residence time of 40 minutes, which is considered adequate for equalization. If necessary, the pH will be adjusted ($6.5 < pH < 9.0$) in these tanks by adding either sulfuric acid or caustic soda.

One equalization tank will be agitated and operated continuously. A redundant agitated tank will be provided as a stand-by. The groundwater will be pumped from the equalization tanks to the filtration system.

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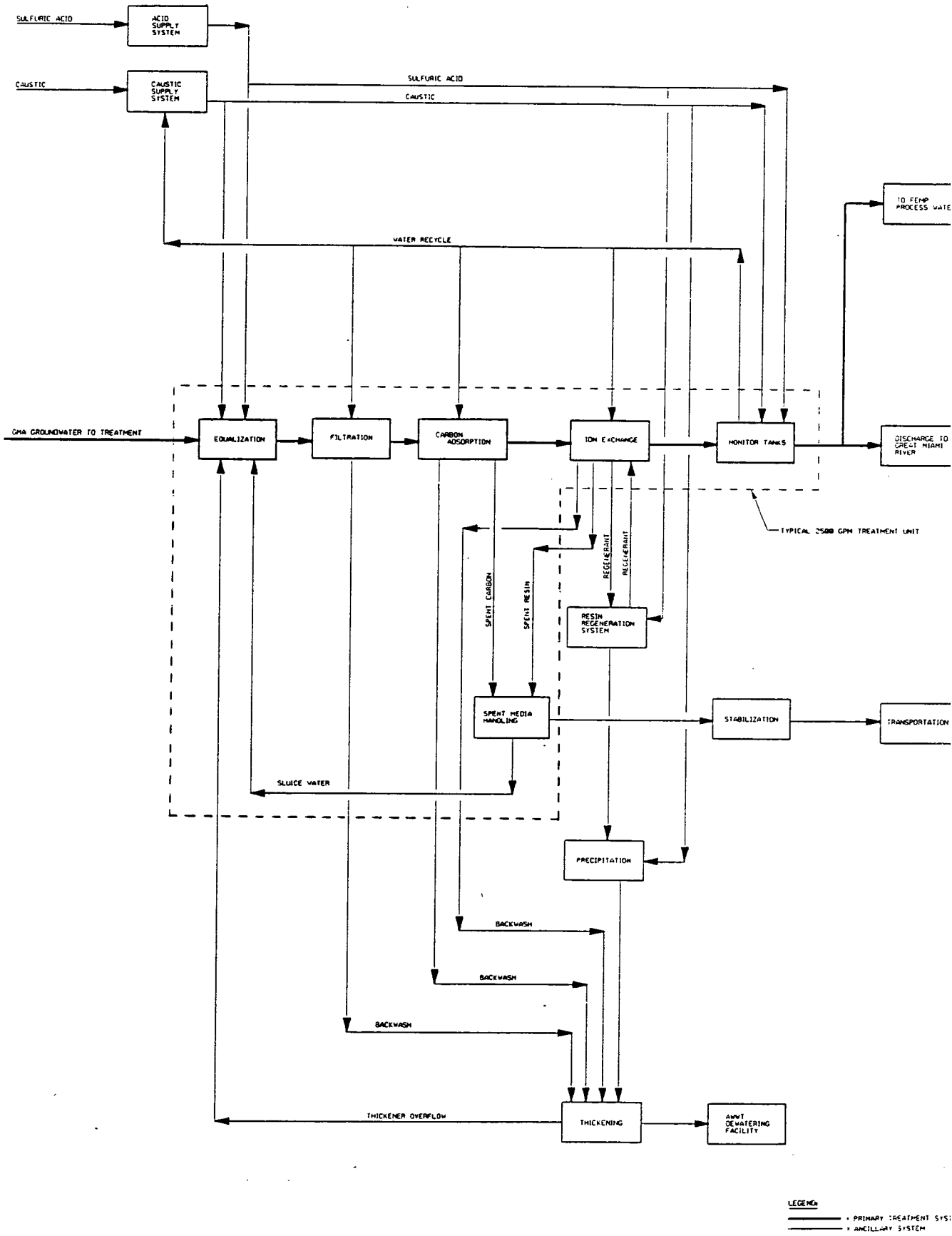

Figure 3-1 - Groundwater Treatment Block Flow Diagram

The need for a redundant equalization tank and pH adjustment is based on groundwater (treatment system influent) characteristics. These issues will be further evaluated as updated groundwater characterization data are made available during Title I Design of the GTF.

3.1.1.2 Filtration

The multimedia filtration system includes a bank of multimedia filter vessels operating in parallel flow. Each filter vessel will contain layers of media of different densities and sizes from coarse to fine. The filtration system will operate with one vessel in a stand-by or backwash mode while the remaining vessels are providing filtration. The multimedia filters will be periodically backwashed when high differential pressure is experienced across the filter vessel.

After multimedia filtration, the groundwater will be routed to one of two bag filter vessels for final polishing by removal of particles larger than 10 microns. One filter will be operating with the second filter in stand-by mode. Filled filter bags will be removed for disposal and replaced with new bags when required as indicated by high differential pressure across the filter vessel.

The filtered groundwater will be sent to a break tank prior to subsequent treatment. This tank will be at atmospheric pressure to allow the use of lower pressure pumps upstream of the filtration system and to make the pressure requirements less stringent for the filter vessels.

3.1.1.3 Adsorption

From the break tank, the water will be pumped to an activated carbon adsorption system for semi-volatile and volatile organic compound removal. The activated carbon system will consist of a bank of activated carbon vessels operating in parallel flow. One of the vessels will be maintained in a stand-by condition. The activated carbon media will be used to full adsorption capacity by periodic backwashing initiated by high differential pressure across the vessel.

Activated carbon that has lost its adsorption capacity will not be regenerated because it will be radioactively contaminated and activated carbon vendors, who routinely regenerate the exhausted carbon in high-temperature furnaces for resale to other users, will not accept it due to the potential for cross-contamination. This spent activated carbon will be sluiced to the spent media tank for holding prior to treatment (assumed to be stabilization) and disposal.

GTF Title I Design activities will define organic concentrations in groundwater and further evaluate the feasibility of carbon regeneration.

3.1.1.4 Ion Exchange

After treatment by the carbon adsorption system, the groundwater will be treated by an Ion Exchange (IX) system, which is the primary means of uranium removal. The system will consist of multiple pairs of IX vessels operating in parallel flow. Each vessel pair will be piped in series. One pair of vessels will always be in regeneration or stand-by mode. The IX resin will be Dowex 21K™, which was developed specifically for uranium removal and has been demonstrated to be effective at the FEMP. The Dowex 21K™ resin will initially be supplied in the chloride form. After regeneration with sulfuric acid, it will be used in the sulfate form.

When the uranium concentration exceeds resin breakthrough limits in the effluent of a lag IX column pair, that pair of columns will be isolated and the exhausted resin in the lead column will be regenerated with different concentrations of sulfuric acid recirculating sequentially through the IX column from the regenerant recycle tanks. The regenerated IX column will be filled with treated water and put into lag operation, and the previous lag column will become the lead column. This pair will be on line when the next lead IX vessel requires regeneration. At the end of the resin's useful life, it will be sluiced to the spent media tank for holding prior to treatment (assumed to be stabilization) and disposal.

The IX column arrangement will be further evaluated and a final arrangement selected during Title I Design.

3.1.1.5 Effluent Monitoring

After treatment by the IX system, the groundwater will be sent to one of two monitor tanks. The pH and uranium concentrations will be monitored in these tanks to ensure that the treated groundwater is suitable for discharge or use as utility water such as backwash, rinse, or dilution. Groundwater which does not meet the discharge requirements will be returned to the equalization tanks for reprocessing. Sulfuric acid or caustic will be available for final pH adjustment in the monitor tanks.

3.1.2 Ancillary Systems

The ancillary systems that will be designed to support the main treatment process include: acid and caustic supply and metering systems, a backwash and rinse water collection system, a resin loading system, a resin regeneration system, a uranium precipitation system, and a spent media handling system.

3.1.2.1 Acid and Caustic Supply

The sulfuric acid supply system will consist of a storage tank; an acid day tank at each 2,500 gpm treatment unit for IX resin regeneration and pH adjustment; and pumps for acid unloading, supply, and metering. The system will supply a 93 percent sulfuric acid solution.

The caustic supply system will consist of a storage tank; day tanks; and pumps for caustic unloading, supply, and metering. The sodium hydroxide will be received at a strength of 50 percent but diluted to a 20 percent solution in the day tank. The day tanks will provide 20 percent sodium hydroxide solution to the eluate precipitators and to the equalization and the monitor tanks for pH adjustment.

As part of the GTF Title I Design, the capacities of the AWWT acid and caustic supply systems will be evaluated for possible integration with the GTF acid and caustic supply systems.

3.1.2.2 Backwash and Rinsewater Collection

An agitated tank will be provided in each 2,500 gpm treatment unit to receive the backwash and rinse water from the multimedia filters, the activated carbon adsorbers, and the IX columns. The combined backwash and rinse will be pumped to a thickener for suspended solids settling. The thickener underflow will be dewatered at the proposed AWWT Slurry Dewatering facility and stabilized, if required. The thickener overflow will be sent to the equalization tanks for recycle through the treatment system.

3.1.2.3 Resin Loading

The new resin loading system for the IX vessels will include an air-operated diaphragm pump taking suction from either tank trucks or 5-cubic-foot drums of new resin. New resin will be slurried with treated water and pumped to the IX vessels. Because each IX vessel will contain a large volume of resin, it is expected that new resin will be supplied via tank trucks. The diaphragm pump will be used as the primary means to off-load new resin because of its high capacity and ease of handling. An eductor may be used as an alternate method for unloading resin drums.

3.1.2.4 Resin Regeneration

Exhausted IX resin will be regenerated by elution with dilute sulfuric acid recirculating through the IX column from the regenerant recycle tanks. Some bench testing has been performed on this method; however, further testing is required. It is assumed that process data, including resin regeneration from AWWT Phases I and II, will be available for study prior to the start of Title II Design.

3.1.2.5 Uranium Precipitation

Uranium will be precipitated from the eluate at an elevated temperature with caustic. Uranium precipitates will be separated from the neutralized eluate in the thickener.

3.1.2.6 Spent Media Handling

Spent resin from the IX vessels and spent carbon from the activated carbon adsorbers will be sluiced to an agitated spent media tank. Excess sluice water will be decanted from the spent media and pumped back to the equalization tanks for recycling through the system. The spent media slurry will be transferred to a stabilization unit. This unit will mix the spent media with cement in drums. Liquids decanted during the solidification process will be transferred back to the spent media tank. Alternatively, spent media can be dried in the AWWT Slurry Dewatering facility prior to packaging and disposal. Both are viable options for spent media handling and will be further evaluated during Title I Design.

3.2 Assumptions

3.2.1 General Assumptions

The GTF will operate 24 hours per day, 7 days per week. The planned operating life will be 30 years and may be extended depending upon the GMA groundwater contamination. Supporting facilities for electrical power, domestic water, fire protection, sanitary sewer, and stormwater management will be available during the operating life of the facility.

3.2.2 Process Assumptions

Based on a statistical analysis of available groundwater monitoring results provided by the Fernald Environmental Restoration Management Corporation (FERMCO), TSS, organics, and uranium are the major GMA contaminants (see Section 2). As a result, the GTF will involve the following treatment:

1) Influent equalization and pH adjustment
2) Filtration for removal of suspended solids
3) Carbon adsorption for removal of organic compounds
4) IX for removal of uranium
5) Regeneration of exhausted IX resin
6) Precipitation of uranium from spent regenerant
7) Handling and transfer of precipitates and suspended solids
8) Storage and transfer of spent media (carbon and resin) to a stabilization facility

Based on the limited experience gained in the South Plume Interim Treatment project, TSS will be removed from the groundwater with multimedia filters followed by polishing bag filters.

To allow for filtration of precipitated soluble metal contaminants (not currently identified), only initial pH adjustment of the influent groundwater will be performed. The system will not incorporate any specific treatment methods (e.g., oxidation, chlorination, manganese greensand filtration, cation exchange, etc.) for the removal of iron and manganese.

Granulated Activated Carbon (GAC) will be used for the removal of organic contaminants from the groundwater. The exhausted GAC, which will be radioactively contaminated, will not be regenerated as vendors do not accept it for regeneration and recycling due to the potential for cross contamination.

Sulfuric acid will be used to regenerate the exhausted resin. Some bench-scale testing has been done to support this; however, further testing is required to generate design data for resin regeneration, precipitation of uranium from the regenerant with sodium hydroxide, and the settling rates of uranium precipitate for thickener sizing.

Spent IX resin and exhausted GAC will be stabilized with cement for disposal. Stabilization is a proven technology that is currently used in the industry. Other alternative spent media handling methods, such as incineration and dewatering, will be considered during the GTF Title I Design.

The stabilized media will be characterized, labeled, and prepared for on- or off-site storage or disposal. Sludge will be transferred to the proposed AWWT Slurry Dewatering facility for subsequent treatment and disposal.

3.2.3 Architectural Assumptions

The process area will consist of a series of individual, pre-engineered process buildings approximately 50 feet by 215 feet and one pre-engineered general use building approximately 70 feet by 75 feet. Access for handicapped persons will be required in the general use building but not in the process buildings. The facility will not be used to store classified documents.

Models or architectural renderings will not be required for this project.

3.2.4 Civil Assumptions

FERMCO will provide a field run topographic and location survey of the work zone which includes the building site, adjacent grounds, and utility line construction routes. When possible, existing utility location and elevations will be determined. In addition, the location of proposed soil borings will be

staked and will include a reference elevation hub. FERMCO will also set a minimum of two construction control points. An as-built survey will be performed to accurately locate structures and utilities as they were constructed. All survey work will use the North American Datum of 1983 for horizontal control and the North American Vertical Datum of 1929 for vertical control.

FERMCO will provide a geotechnical investigation to determine the engineering characteristics and physical properties of the in situ soil. This investigation shall be performed to provide geotechnical design parameters for foundation, pavement, or other geotechnical design. The objectives of the geotechnical investigations are to determine the stratigraphy and nature of subsurface materials and their expected behavior under structure and pavement loadings, and to permit proper design and savings in construction costs. The investigation is expected to reveal if there are any adverse subsurface conditions that could lead to construction difficulties, excessive maintenance, or possible failure of the structure. A report of geotechnical investigation should contain sufficient description of field and laboratory investigation, subsurface conditions, typical test data, basic assumptions, and analytical procedures to permit detailed review of the conclusions, recommendations, and final design parameters.

Domestic water, fire protection water, sanitary sewer and lift station, process lines, and electric service are required. FERMCO will provide all communication and security telephone lines. FERMCO will also provide flow rates and pressures available for water and fire lines at the proposed point of connection. The field run survey will update, correct, or supplement existing FEMP Grid Utility Drawings. Input from FERMCO is needed to determine the storage capacity of an exterior treated water holding tank. FERMCO will also provide future process water routes from the GTF.

The majority of the site appears to drain towards the northwest corner. Water then flows westerly towards Paddys Run just south of the K-65 Silos. The existing Stormwater Retention Basin's (SWRB's) capacity should be evaluated to determine if it is adequate. The need for modifications or new facilities should also be evaluated. Existing calculations of the site's Stormwater Management (SWM) system with hydrologic analysis should be provided by FERMCO. New SWM facilities should be designed with consideration to the future development within their catchment. Collected stormwater will be treated at the AWWT Phase I facility. The runoff must be collected and discharged in accordance with the requirements of the FEMP National Pollutant Discharge Elimination System (NPDES) permit.

The proposed site (see Appendix B, sketch SK-G-02101) is not in the 100-year flood plain (as designated per the *CERCLA/RCRA Unit 2 100 - 500 Year Sitewide Flood Plain Determination* [PARSONS Project Order 91). Depending on the route selected by FERMCO for the effluent lines, the utility line routes may run through FEMP-designated wetlands. FERMCO will obtain all necessary permits and approvals, or will instruct PARSONS to avoid interference.

The Draft OU-5 Remedial Investigation concluded that uranium contamination is present in most FEMP surface and subsurface soils. In addition, perched groundwater zones may contain uranium contamination exceeding maximum concentration levels. Contamination could impact construction costs and worker safety during GTF construction. Additional soil and groundwater monitoring is required to fully characterize the extent of contamination of the proposed GTF site.

The GTF will not be constructed over contaminated perched groundwater. The leading remedial alternative for OU-5 as proposed in the Draft Proposed Plan includes excavation of all surface and subsurface soils, and perched groundwater zones containing uranium at concentrations exceeding remediation levels. This may require excavation of a greater quantity of soils during construction.

It is assumed that the extent of soil and perched groundwater contamination will be fully defined prior to the start of Title II Design.

3.2.5 Structural Assumptions

The facility is assumed to be classified as a low hazard facility. The performance category for all structures, systems, and components (SSC) is assumed to be Category 2 per United States Department of Energy (DOE) Order 5480.28 and DOE-STD 1021.

PARSONS will provide pre-engineered building and foundation plans for the process building. The pre-engineered building vendor will provide building reactions to PARSONS for confirmation of the final foundation design. Floors shall be coated with epoxy compound and designed for forklift traffic. Tank areas shall be curbed for containment with water stops at the junctions of slab and curb.

3.2.6 Instrumentation and Controls Assumptions

Control, monitoring, and data acquisition will be performed by a microprocessor-based control system. The system will be referred to here as a Data Acquisition and Control System (DACS). The DACS will be purchased by a qualified system integrator. The system integrator will be responsible for the control logic, data highway, installation, programming, personnel training, and interfacing of the DACS.

Monitoring of facility effluent water to satisfy the Ohio Environmental Protection Agency (Ohio EPA) NPDES requirements will be done at the Parshall Flume Chamber located downstream of Manhole 176B. Monitoring requirements for radiation will be defined, specified, and implemented by FERMCO.

Separate equipment packages with controls and instruments necessary for operation and interfacing with the DACS will be provided by the equipment supplier.

Field instruments will be purchased by a general subcontractor. The general subcontractor will be responsible for purchase, installation, initial calibration, pressure testing of instrument piping and tubing, wiring of the field instrumentation to the DACS, and circuit testing.

3.2.7 Electrical Assumptions

Adequate electrical power will be supplied from 15 kV, three phase feeders F2B and F4B located at Manhole 238. 15 kV feeders shall be installed in new underground electrical ductbanks using 350 kcmil cables.

Unit substations will be located at the GTF for distribution to electrical loads. Unit substations will contain normal and auxiliary incoming fused switches, a 13.2 kV to 480 V transformer, and secondary circuit breakers. The secondary circuit breakers will serve separately unitized motor control centers containing motor starters and distribution circuit breakers.

The existing AWWT Phases I and II fire alarm and evacuation systems will extend to the GTF.

Detailed design of the plant's telephone system will be provided by the telephone company.

Energy efficient, high intensity discharge and fluorescent fixtures will be utilized in the design.

A backup diesel generator will serve critical loads. An uninterruptible power supply will serve the control system.

Electrical heat tracing will be provided for freeze protection of pipes, equipment, and tanks.

3.3 Issues for Consideration

Appendix C contains the FERMCO review comments of the 90 percent draft of this DCR. Included with each review comment is a resolution statement. Some of the FERMCO review comments cannot be completely resolved at this time. Additional analysis and/or consideration of these unresolved comments is required during Title I/II Design of the GTF and its associated groundwater extraction system. However, all review comments and their corresponding resolutions are included in Appendix C.

SECTION 4

GENERAL DESIGN CRITERIA AND CONSIDERATIONS

4.1 Applicable DOE Orders, FEMP Standards, National/State/Local Standards and Specifications

DOE Order 6430.1A, "General Design Criteria," is applicable to the design of the GTF. Specific portions of the DOE Order are identified in the discipline-specific criteria subsections in Section 4.

The design Applicable or Relevant and Appropriate Requirements for groundwater remediation as identified in the *Functional Requirement Document for Operable Unit 5 Groundwater Remediation* (PARSONS 1993) for this action have been incorporated into the specific criteria discipline subsections in Section 4.

4.2 Security and Safeguards

Nuclear safeguards do not directly apply to the GTF since the facility will not process special nuclear material.

As a radiological facility, the GTF will have security to limit potential trespassing or inadvertent entry. The security fence which surrounds the entire FEMP site will serve to control the area. The access for the GTF will be based on the requirements for a radiological facility. See Subsection 5.11.4 for additional requirements.

4.3 Health and Safety

The facilities shall be designed in accordance with 29 Code of Federal Regulations (CFR) 1910 (Occupational Safety and Health Act [OSHA] Standards), and 1926 (Safety and Health Regulations for Construction), DOE Orders, and the FERMCO *Comprehensive Environmental Occupational Safety and Health Program Manual* (ESH-1-1000) for the FEMP where applicable. These requirements are typically implemented by National Fire Protection Association (NFPA), American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), and other standards. These standards are referenced in Section 5.

All control equipment shall be designed to protect any electrical connection over 30 volts from accidental contact during service, adjustment, or any other activity that may occur when a person accesses the rear of a control panel or similar equipment.

4.4 Emergency Planning

Subpart D of 40 CFR 264 requires that facilities have a contingency plan and procedures. The plan must be designed to minimize hazards to human health or the environment from fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water. The requirements for this plan may be met by amending a Spill Prevention, Control, and Countermeasures Plan to include hazardous waste management provisions. The plan must include instruction (or a procedure) for shutting down the process under emergency conditions. The development of this plan is **not** in the PARSONS scope of this project.

The following electrical systems have been provided for emergency planning:

1) Quartz and emergency lighting
2) Backup generator for orderly process shutdown and maintaining critical loads
3) Uninterruptible power supply for control system
4) Fire alarm and evacuation alarm systems
5) Redundant power source

4.5 Telecommunications

Telephone connections for the GTF shall be made at existing manhole TMH453 or TMH454. Installation of telephone lines will route through the existing underground conduit system. As noted in Subsection 3.2.7, design of the GTF telephone system shall be provided by the local telephone company.

4.6 Maintenance and Operations Considerations

All process equipment must undergo scheduled routine maintenance. For the GTF facility, routine maintenance will include, but not be limited to, mechanical seal replacement on pumps and moving equipment parts requiring lubrication. Routine maintenance will be coordinated with corresponding scheduled plant shutdown or equipment down time. Major non-routine maintenance and repairs are carried out by the maintenance department employees (i.e., electricians, instrument technicians, etc.).

From an operational standpoint, all filters (multimedia and bag) are equipped with differential pressure gauges to alert the operator of high pressure drops across the filters. A high pressure differential indicates the need for a particular filter to be taken off line and then backwashed, or have its filter bag replaced.

The activated carbon vessels are also equipped with differential pressure gauges. The activated carbon in each vessel will be used to full adsorption capacity. Periodic backwashing, which is initiated by high

differential pressure across the particular vessel, will also be required. Spent activated carbon that can no longer be regenerated is sluiced to the spent media tank for holding prior to stabilization and disposal.

The IX effluent will be sampled to detect the uranium concentration. When the uranium concentration in the effluent stream of the lag column of any pair exceeds 20 $\mu g/l$, the pair is taken off-line, and the resin in the lead column is regenerated with sulfuric acid. Spent resin that can no longer be regenerated is sluiced to the spent media tank for holding prior to stabilization and disposal.

Process equipment shall be designed with operability and maintainability in mind in accordance with DOE Order 6430.1A. Isolation and bypass valving, equipment spacing, equipment life, accessibility, maintenance frequency, and operator safety are some of the requirements which will be fully defined during Title I/II Design.

Redundant equipment will be provided where necessary so that maintenance operations can take place without interrupting the treatment operation.

The stormwater management system needs to operate with minimum manual operator input; therefore, an automatic system will be designed. This will likely consider the flows into and out of the existing SWRB if the stormwater from the GTF is discharged into the SWRB.

The storm drainage and stormwater management system will require periodic maintenance to remove sediment. Any pumps or valves used for the stormwater management system will also require maintenance typical for the equipment used. Periodic mowing of areas will also be necessary.

The underground utilities will require minimal maintenance. Typically, it will include maintenance of valves and hydrants. Sanitary lines and manholes may require cleaning and repair after a long period. Sanitary lift station equipment will require periodic maintenance typical for the equipment contained within.

Selection of road surfacing materials will determine maintenance needs for roads. Asphalt or concrete will require limited maintenance if properly designed, constructed, and maintained. Gravel surfaces will require annual maintenance at a minimum.

4.7 Interface with Other Facilities

Phases I and II of AWWT will provide treatment of contaminated stormwater and site process wastewater, respectively. These phases are **not** in the scope of this project. The GTF will provide treatment of contaminated groundwater. For this design, it is assumed that GTF Phases I and II are not intended to provide treatment capacity for anything other than groundwater.

Interfaces between the GTF and other FEMP remediation facilities may exist. Treated water from the GTF Phases I and II will either be discharged through a NPDES outfall into the Great Miami River or will be used as process water for remediation facilities.

Waste products (other than sludge) from the GTF will be stabilized for on- or off-site disposal. These waste products include spent carbon from the carbon adsorbers and spent resin from the IX vessels. These materials will be sent to a stabilization system. They will be stabilized by mixing with cement, and then placed in drums. Sludge produced by the GTF includes solids resulting from the backwash of multimedia filters, carbon adsorbers, and IX vessels; and the precipitated uranium from the eluate. This sludge will be transferred to the proposed AWWT Slurry Dewatering Facility for treatment prior to disposal.

The SWRB will need to interface with the stormwater management system for the GTF if the SWRB receives discharge from that system. Otherwise, combining the peak flows from both systems into one may cause the runoff to overflow the SWRB. If systems are kept separate, only interfaces to isolate appropriate drainage areas will be needed.

Sanitary flow from the GTF will be discharged into the FEMP sanitary sewer system for treatment. The ability of the FEMP sanitary system to handle additional flow needs to be assessed (by FERMCO).

Domestic and fire protection water will come from the FEMP water supply systems. The ability of appropriate water systems to supply the additional flows needs to be assessed (by FERMCO).

Traffic into and out of the GTF will need to have reasonable access to the FEMP road system. Horizontal and vertical obstructions within the FEMP need to be considered. Proper signage and other traffic control measures will be incorporated.

Other process effluent and raw water well pipe lines will cross various utilities and operable unit work areas. Coordination of routes through these areas need to assess future remediation activities to minimize impact. If effluent is used for sitewide process water demands, coordination in existing systems will need to be determined.

4.8 Provisions for Future Expansion

The area south and west of the proposed GTF is a reasonable location for additional facilities. It is more cost effective to design roads, utilities, and stormwater management facilities which would be able to support additional development in this area of the FEMP. Utilities may be constructed larger than necessary to support just the GTF Phases I and II to accommodate future site development. Utilities impacted include the electrical power and sanitary, fire, and domestic water systems.

At this time, no special need has been identified for more than a 7,500-gpm treatment capacity or a 30-year operating period. However, the capacity and duration may be extended beyond 30 years, if necessary, due to actual groundwater flows and contaminant concentrations.

4.9 Utilities Support

Utilities and support systems will be provided for the GTF Phases I and II facility for construction and operation. Utility plans must be developed to identify the specific utilities, particularly electrical power and process water, required for operation and construction needs. Potable water, fire protection water, sanitary sewer, storm drain systems, and electrical power supplies will need to be constructed to support the GTF.

4.10 Future Decontamination and Dismantling

Upon completion of the remedial action for groundwater at the FEMP and when other wastewater treatment is no longer necessary, the GTF will be decontaminated and dismantled. DOE Order 5820.2A requires that designs be developed based on a proposed decommissioning method or a conversion method permitting other uses. The GTF design should incorporate materials and components that are easily decontaminated and/or dismantled.

For the purposes of this design, it is assumed that the operating life of the facility will be 30 years. There should be minimal radioactive and/or hazardous constituent contamination resulting from this process. Since the design of the GTF shall include decontamination and dismantling considerations per DOE Order 6430.1A, only equipment in direct contact with the wastewaters may be significantly contaminated. Process vessels will be size reduced, decontaminated, and then either recycled or shipped for off-site disposal. The facility structure will be dismantled and disposed of either as construction waste or low-level radioactive waste. That determination will be made by the DOE at the time of dismantling and the operation will be detailed in a work plan.

Prior to the start of any decontamination and dismantling activities, a complete structural and radiological characterization must be performed. The characterization provides the baseline information to make decisions on the decontamination equipment, techniques, and procedures which are most appropriate.

4.11 Energy Conservation

Energy conservation will be considered as required by DOE Order 6430.1A, Section 0110-12. The *Energy Conservation Manual for New and Existing Federal Buildings, Systems, and Processes*, American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Standard 90, and ASHRAE Standard 62 will be followed as guidance. Items such as high efficiency motors; variable speed

drives on heating, ventilation, and air conditioning (HVAC) equipment; and use of high efficiency, high intensity discharge lighting will be considered.

SECTION 5

DISCIPLINE SPECIFIC CRITERIA

5.1 Process

The process design criteria are presented in Subsection 5.1.1. Additional criteria such as flow rates, flow stability, heating and cooling requirements, steady state and transient temperature limits, and pressure drops/profiles are discussed in the following subsections.

5.1.1 Process Design Criteria

The design criteria for the process components are defined below.

Equalization

Equalization tanks will be operated continuously. A redundant equalization tank will be required. Necessary facilities will be provided for pH adjustment to within the range of 6.5 to 9.0 standard units using sodium hydroxide or sulfuric acid. A residence time of 40 minutes is considered adequate for pH adjustment and equalization.

Filtration

Multimedia filters will operate in parallel to remove particulates of 10 micron size or larger at 90 percent efficiency. They will be designed for automatic backwash at predetermined high pressure differential or periodic manual backwash. Only one filter will be backwashed at a time. Treated groundwater from the monitor tank will be used for filter backwash. One spare filter will be provided and remain in stand-by or backwash mode.

Bag filters will provide polishing filtration to remove the remaining particulates of 10 micron size or larger at 90 percent efficiency. One spare filter will be provided.

Carbon Adsorption

Carbon adsorption units will operate in parallel to remove volatile organic compounds at a minimum 99.9 percent removal efficiency. The design will provide for bypass of the entire carbon adsorption system. Units will be designed for manual backwash at preset intervals or at a predetermined high differential pressure. Treated groundwater from the monitor tank will be used for the backwash. One spare unit will

be provided and will remain in stand-by or backwash mode. Activated carbon that has lost its adsorption capacity will not be regenerated.

Ion Exchange

The ion exchange system will initially use DOWEX 21K™ resin, which has been successfully used at the FEMP in past uranium removal operations. It may be replaced at a future date by a superior resin when and if one is available. Sluicing of resin will be done manually.

Multiple pairs of ion exchange vessels will operate in parallel. Each will be designed for lead/lag operation. The uranium concentration in the effluent will be less than 20 μg/l.

The design will provide capacity for regeneration of ion exchange resin with sulfuric acid using AWWT Phases I and II methodology and design data. Regeneration will be initiated manually and then proceed through various steps automatically. Only one vessel (lead vessel of a pair) will be regenerated at a time.

Effluent Monitoring

The monitoring tank will have the necessary equipment to provide pH adjustment to within 6.5 to 9.0 standard units using sodium hydroxide or sulfuric acid. The uranium concentration will also require periodic sampling and analysis to ensure effluent is lower than 20 μg/l. Effluent exceeding discharge limits will be recycled to the equalization tank for reprocessing. A redundant tank will be provided.

Ancillary Process Systems

Uranium will be precipitated from spent regenerant with sodium hydroxide using AWWT Phases I and II methodology and design data. The slurry containing uranium precipitates and total suspended solids will be transferred to the proposed AWWT Slurry Dewatering Facility for treatment prior to off-site disposal.

Spent carbon and ion exchange resin not being regenerated will be stabilized prior to disposal.

5.1.2 Flow Rates

Each module of the groundwater treatment system will be designed for a continuous rated capacity of 2,500 gpm. If necessary, the system should be capable of operation at a reduced capacity continuously.

5.1.3 Flow Stability

Feed into the facility may have wide fluctuations depending upon the number of wells in operation. The system shall be designed to operate in modules to handle these fluctuations.

5.1.4 Heating and Cooling Requirements

There are no process temperature requirements for the groundwater treatment system except for uranium precipitation from eluate covered under Subsection 5.1.5.

5.1.5 Steady State and Transient Temperature Limits

The groundwater treatment system will operate at ambient temperatures. However, the precipitation of uranium from eluate (sulfuric acid regenerant) with sodium hydroxide will require an elevated temperature. The system design will provide for an electric heat exchanger and temperature controls as required.

5.1.6 Pressure Drops/Profiles

The groundwater treatment system involves significant pressure drops (up to approximately 25 pounds per square inch [psi] or 58 feet of water) in various operations such as multimedia filtration, polishing bag filtration, activated carbon adsorption and IX. System design will provide for an atmospheric break tank to eliminate the need for 2,500 gpm capacity pumps operating at high pressure (greater than 100 psi or 231 feet of water). This will also limit the design pressure for large capacity treatment vessels (e.g., filters, IX units) to 100 psi or 231 feet of water.

5.1.7 Laws, Regulations, Codes, Standards, and Orders

The groundwater will be treated to comply with the NPDES permit discharge limitations. Other applicable requirements are identified in the appropriate subsections (e.g., Mechanical Process, Piping, etc.).

5.2 Civil and Site Development

The civil discipline is responsible for the specification of site clearing, earthwork, slope protection and erosion control, paving and surfacing, process utilities, water distribution, storm sewer and stormwater management systems, septic and sewerage systems, fences and gates, and landscaping and seeding.

5.2.1 Site Clearing

The siting of the GTF will minimize the amount of clearing required. Work shall be performed in accordance with Ohio Department of Transportation (ODOT) standards. Fence material and topsoil will be removed and salvaged for reuse. FEMP standards for waste material will be followed for material that can not be reused and must be removed from the work zone. Impacts to other FEMP facilities caused by GTF construction will be assessed during Title I Design.

5.2.2 Earthwork

Earthwork shall include all grading, excavation, trenching, and filling and shall be specified to conform to ODOT standards. Trenching shall conform to OSHA standards. Where feasible, slopes should be a minimum of 0.5 percent for impervious surfaces, 2 percent for vegetated surfaces, and no greater than 3H:1V.

5.2.3 Slope Protection and Erosion Control

Temporary measures to prevent erosion and control sediment during construction shall be specified. Some measures will need to be taken prior to any earthwork being performed. Additional measures, such as new catch basins, will be required during construction. All erosion and sediment control measures will require maintenance during construction. ODOT standards for control measures will be specified as well as Hamilton County Earthwork Regulations.

5.2.4 Paving and Surfacing

All paving and surfacing methods, materials, design, and details shall conform to ODOT standards. The American Association of Highways and Transportation Officials *A Policy on Geometric Design of Highways and Streets* 1990 (GDHS-90) will be used as a reference in site layout. Unless conditions dictate otherwise, the minimum slope shall be 0.50 percent.

5.2.5 Process Utilities

Process utilities include utilities that are more than 5 feet from any well, tank, or structure relating to the recovery well lines to the GTF, effluent lines from the GTF, and any valve/pump house facilities. The design of these utilities will allow for possible expansion or extension of the utility. The design of these lines and valve/pump facilities shall follow the same standards and criteria as identified in the Mechanical Process and Piping sections of this DCR.

5.2.6 Water Distribution

All water lines shall have a minimum cover depth of 3.5 feet for frost protection. The layout shall minimize the amount of line under pavement. Water lines shall maintain 10 feet horizontal separation from sanitary sewer (except as stated in Subsection 5.2.8) and contaminated process lines. Thrust blocks are required for all lines 2 inches or greater. Gate valves or post indicator valves (PIV) shall be installed at line intersections and selected points throughout the distribution system to provide control over the service area in accordance with DOE Order 6430.1A.

Domestic water quality lines shall comply with 40 CFR 141. Domestic water distribution systems shall be designed to deliver the peak domestic flow of two and one-half times the average daily demand at a minimum residual pressure of 30 psi at ground elevation. Building service lines shall be a minimum of 1 inch in diameter. American Water Works Association standards for potable water mains and disinfection shall be followed.

All water mains supplying fire protection systems, fire hydrants, etc. shall be treated as fire mains and installed in accordance with NFPA 24 and DOE Order 6430.1A. Each fire hydrant within the distribution system must be capable of delivering 1,000 gpm at a residual pressure of not less than 20 psi. Fire hydrant branches (from main to hydrant) shall be at least 6 inches in diameter and no longer than 300 feet. A gate valve shall be installed with each hydrant. Fire hydrants shall be installed at a maximum spacing of 400 feet and shall not be located more than 300 feet from the building nor closer than 50 feet from the building to be protected. Each building shall be protected by a minimum of two hydrants.

5.2.7 Storm Sewer and Stormwater Management Systems

New systems will be designed for the 25-year, 24-hour storm. Open channels will use the 5-year storm for evaluating velocity. SWM basins will be designed to safely pass the 100-year storm. Storm drain systems not directly connected to the SWM system with catchments of less than 160 acres will be designed by the Rational method. Those storm drain systems directly connected to the SWM system as well as the SWM system will be designed by Soil Conservation Service methods (e.g., TR-55, TR-20). Design details, construction methods, and materials will be in accordance with ODOT standards. This section will also include the design of the SWM control structure/system. Other disciplines may also have input depending on the system and discharge requirements.

5.2.8 Septic and Sewerage Systems

Hydraulic design of sanitary collection systems shall comply with American Society of Civil Engineers (ASCE) M & R No. 37 and Department of the Army TM 5-814-1 and 2. Gravity sewer lines shall be

designed with a minimum velocity of the probable maximum daily flow (or full flow, whichever yields a greater slope) of 2.5 feet per second. Wherever feasible, sewers and force mains shall not be routed under buildings or other permanent structures and should be adjacent and parallel to roadways. Wherever feasible, sewers and force mains should have at least 10 feet horizontal separation from potable water lines. Otherwise, they must be encased.

5.2.9 Fences and Gates

Fencing shall be limited to that required for safety, physical security, and activity control. Temporary fencing shall be used during construction. FERMCO is responsible for radiation control fencing. Existing fence material that is to be removed shall be salvaged for reuse. New fences and hardware shall be standard chain link fabric with three strands of barbed wire and a total fence height of 8 feet. The integrity of site perimeter security fencing shall be maintained. The DOE and FEMP standard for fencing will be followed. Signs will also be provided that are legible from a distance of 25 feet.

5.2.10 Landscaping and Seeding

All areas disturbed during construction, but not being surfaced, shall be stabilized with topsoil, seed and mulch, or sod. Sod shall be specified if conditions warrant its use, such as velocity in channels. Supplements to the soil shall be specified if necessary. Seed and supplement rates and materials shall conform to ODOT standards. Temporary seeding of exposed soil shall be required per ODOT standards if the area is not expected to be worked for 30 days.

5.2.11 Laws, Regulations, Codes, Standards, and Orders

1) AASHTO GDHS-90 Policy on Geometric Design of Highways and Streets, 1990, by American Association of State Highway and Transportation Officials.

2) DOE Order 6430.1A.

3) ASCE 37 Design and Construction of Sanitary and Storm Sewers, American Society of Civil Engineers.

4) 40 CFR 141 National Primary Drinking Water Regulations.

5) 40 CFR 142 National Interim Primary Drinking Water Regulations Implementation.

6) NAD of 1983.

7) NAVD of 1929.

8) NFPA 24 Installation of Private Fire Service Mains and their Appurtenances, National Fire Protection Association.

9) SCS TR-55 Urban Hydrology for Small Watersheds, Technical Release 55, Soil Conservation Service.

10) TM 5 814-1 Sanitary and Industrial Wastewater Collection-Gravity Sewers and Appurtenances. U.S. Dept. of Army.

11) TM 5 814-2 Sanitary and Industrial Wastewater Collection-Pumping Stations and Force Mains. U.S. Dept. of Army.

12) TP-40, Rainfall Frequency Atlas of the United States for Durations from 30 minutes to 24 Hours and Return Periods from 1 to 100 Years, National Weather Service.

13) Hamilton County Earthwork Regulations.

5.3 Structural

The design and evaluation of Structures, Systems, and Components (SSCs) for Natural Phenomena Hazards (NPHs) due to wind, earthquake, and flood shall be in accordance with DOE Order 6430.1A and DOE-STD-1020 (formerly UCRL 15190).

All the SSCs for the GTF are assumed to be NPH Performance Category 2 (PC-2) per DOE Order 5480.28 and DOE-STD-1021. It is further assumed that there are no safety class SSCs. The Final Safety Analysis Report shall confirm these assumptions.

The SSCs for the GTF include pre-engineered buildings, miscellaneous structural steel supports, and concrete foundations.

5.3.1 Dead Loads

Dead loads shall include loads that remain permanently in place, including weights of all permanent materials, equipment, self weights, and provisions for future loads, if required.

The unit weights of materials and assemblies for buildings and other structures may be based on sources of data from manufacturer's drawings and catalogs, Table C1 of ASCE 7-93 and Table 5-1.

Dead loads shall also include weights of all permanent service equipment, including piping, air conditioning equipment, electrical equipment, and fixed furnishings.

Dead loads for partition walls shall be per Section 0111-2.2.4 of DOE Order 6430.1A.

Table 5-1 - Minimum Design Dead Loads

Structure	Load
Pipe racks	Actual load but not less than 35 psf at each level
Electrical raceways	Actual load but not less than 15 psf at each level
Materials and equipment	Actual load

5.3.2 Live Loads

Live loads shall include all loads resulting from occupancy and use of the structures. Live loads may act in any direction. Impact loads, moving loads, and operating loads shall be considered as part of live loads.

Live loads for buildings and other structures shall be as shown in Table 5-2, but not less than the minimum uniform or concentrated loads stipulated in ASCE 7-93.

Roof live loads shall include snow loads, snow drifts, or rain loads as applicable per ASCE 7-93.

Table 5-2 - Minimum Design Live Loads

Structure	Load
Building floors	125 psf, or equipment load or storage weight if greater
Walkways (other than exitways)	60 psf
Stairs and exitways	100 psf
Equipment platforms	100 psf
Trench covers	16,000-lb. wheel load
All other areas	100 psf
Roofs	20 psf where tributary area is less than 200 sf and roof pitch is less than 4:12
Impact loads	In accordance with ASCE 7-93, Subsection 4.7

5.3.3 Wind Loads

Wind load design criteria presented in this section shall be based on the requirements of DOE Order 6430.1A, DOE-STD-1020, ASCE 7-93, and the Ohio Basic Building Code (OBBC). Exposure "C" shall be used for all wind load calculations, per Section 0111-2.4.2 of DOE Order 6430.1A.

The effective velocity pressure q_x at any height Z above the ground shall be calculated using the following equation:

$$q_x = 0.00256\ K_Z\ (IV)^2 \text{ (Section 6.5.1 of ASCE 7-93)}$$

where:

I = Importance Factor = 1.07 (Table 3-1 of DOE-STD-1020)

K_z = Velocity pressure coefficient at height Z (Table 4 of ASCE 7-93)

V = Basic wind speed = 80 mph (Section 1112.3.2 of OBBC)

Design wind loads shall be based on factors and coefficients stipulated in ASCE 7-93.

5.3.4 Tornado Loads

Tornado loadings, tornado missiles, and atmospheric pressure change loads are not applicable for PC-2 facilities per DOE-STD-1020 (Table 3.1). Tornado loadings, therefore, are not considered.

5.3.5 Seismic Design and Evaluation

The seismic criteria for the design and evaluation of SSCs shall be based on procedures detailed in Section 2.3.1 of DOE-STD-1020, PC-2, and Uniform Building Code (UBC) Section 1628.

The earthquake response shall be evaluated in accordance with procedures given in UBC Section 1627.8 using the static force method.

The design base shear using the static force procedure shall be calculated using the following formula:

$$V = \frac{ZIC}{R_w} W$$

where

Z = A seismic zone factor equivalent to peak ground acceleration = 0.13 (based on site-specific seismic hazard curve for the FEMP from UCRL 53582)

I = Importance Factor = 1.25

C = Spectral Amplification Factor = 2.75 (based on site-specific response spectra for the FEMP from UCRL 53582)

R_w = Reduction factor from UBC Table 16-N or Table 16-P, as applicable

W = Total weight

The capacities shall be evaluated using the strength design or allowable stress design method.

The story drift limitations shall be per UBC Section 1628.8.

The SSCs shall meet the UBC Seismic Zone No. 2 detailing provisions in accordance with UBC Section 1631.

Non-building structures shall meet the requirements of UBC Section 1632.

Lateral force on elements of structures and non-structural components shall be in accordance with UBC Section 1630.

Quality assurance and peer review shall be in accordance with Appendix C, Section C.8, of DOE-STD-1020 for PC-2.

5.3.6 Other Loads

1) Other Loads: Load criteria not specified above shall conform to DOE Order 6430.1A, Paragraph 0111-2.8, "Other Loads for Buildings and Other Structures."

2) Cyclic/Dynamic Loads: Consideration should be given to dynamic loading of any vibrating equipment such as pumps or compressors.

5.3.7 Other Structural Material/Design Requirements

The following items present design requirements for structural materials and design:

1) Concrete: Concrete material, design, and construction for buildings and other structures shall be per ACI 318-89. Minimum concrete strength at 28 days shall be 3,000 psi. Concrete exposed to weather shall be a minimum of 4,000 psi.

2) Reinforcement: Deformed billet steel shall conform to ASTM A-615, Grade 60.

3) Grout: High strength, non-shrink grout shall be 1 inch minimum thickness under equipment, columns, and pipe support base plates unless otherwise recommended by equipment supplier.

4) Structural Steel: Design, details, fabrication, and erection of structural steel shall conform to the UBC and the AISC Manual, 9th edition. The material for structural steel shapes and plates shall conform to ASTM A36. All structural steel and connections, including ladders, handrailing, and grating, shall be painted or galvanized. Connection bolts shall be high strength ASTM A325 with hardened washer and nut.

5) Field Connections: Connections may be bolted or welded connections per AISC.

6) Operating and Maintenance Platforms: These shall be a minimum of 3 feet, 0 inches wide, with walkways 2 feet, 6 inches minimum width.

7) Minimum Headroom Clearance: Clearance shall be 7 feet, 6 inches above nosing line of stairs and shall conform to OSHA requirements.

8) Masonry: Materials, design, and construction of masonry structures shall be per UBC-94, assuming special inspection. Hollow, non-loadbearing block shall be per ASTM C-129. Hollow loadbearing block shall be per ASTM C-90. Mortar shall be per ASTM C-35 or C-56, Type M or N.

9) Open Pipe Trenches: Locate tops of walls at the same elevations as surrounding grades/slabs. Slope trench floors at least 1 percent to drains. Cover with grating weighing not over 150 pounds per piece. Size to allow easy access to in-trench pipe and fittings. Allow 3-inch minimum between flanges or pipe, and walls and floor. Provide anchorage and supports for pipe. Supply reinforced concrete or ductile iron covers if heavy trucks will pass over the trenches.

10) Concrete Slabs-on-Grade: Show control joints except where floor covering occurs, preferably in line with the faces of the foundation pedestals, pilasters, etc., but not over 20 feet apart. Pour strips to be a maximum of 20 feet wide.

11) Foundations: Per DOE Order 6430.1A, Section 0111-3.4, the provisions of UBC Chapter 18 shall be the minimum requirements for foundation design. Use spread, mat-type, or continuous strip footings placed in the upper natural soils, or properly compacted fill, for a presumed allowable bearing pressure of 2,000 psf at a depth of 3 feet below the adjacent final grade. Allowable soil bearing pressures and any other special foundation requirements shall be verified by the final soil report. Allowable stresses may be increased by a value of 1/2 when wind or earthquake forces are included. The minimum embedment depth of foundations in soil shall be 3 feet, 0 inches to prevent problems with frost penetration. Comply with specific requirements based on the soil report.

12) Pre-Engineered Buildings: Pre-engineered buildings shall comply with the MBMA Metal Building Systems Manual and Section 0111 of DOE Order 6430.1A, "Structural Design Requirements." Certified shop drawings and calculations shall be submitted in accordance with applicable specifications. Worked in conjunction with the Architectural discipline.

5.3.8 Factor of Safety Against Overturning

Per UBC Section 1619.1, the base overturning moment for the entire structure, or for any of its individual primary lateral-resisting elements, shall not exceed 2/3 of the dead-load-resisting moment. For an entire structure with a height-to-width ratio of 0.5 or less in the wind direction and a maximum height

of 60 feet, the combination of the effects of uplift and overturning will be reduced by 1/3 (i.e., factor of safety equal to 1.0).

The weight of earth superimposed over footings will be used to calculate the dead-load-resisting moment. Per Section 1112.1.2 of the OBBC, the overturning moment due to wind load shall not exceed 2/3 of the dead load stabilizing moment unless the building or structure is anchored to resist the excess moment (i.e., factor of safety equal to 1.5).

5.3.9 Loading Combinations

Combinations of loads, allowable stresses, and strength requirements for buildings and other structures shall be in accordance with UBC 91, Chapter 23, Section 1603.6.

5.3.10 Laws, Regulations, Codes, Standards, and Orders

The following are the codes, standards, and orders applicable to the structural design follow:

1) UBC 1994.

2) OBBC 1994.

3) Metal Building Manufacturers' Association - Recommended Design Practice Manual.

4) ASTM standards as referenced.

5) DOE Order 6430.1A, "General Design Criteria."

6) DOE-STD-1020, 1994. "Natural Phenomena Hazards, Design, and Evaluation Guidelines for DOE Facilities."

7) UCRL-53582, "Natural Phenomena Hazards Modeling Project; Seismic Hazard Models for DOE Sites."

8) ASCE 7-93. "Minimum Design Loads for Buildings and Other Structures."

9) ACI 318. "Building Code Requirements for Reinforced Concrete."

10) AISC Manual, 9th edition.

11) DOE Order 5480.28, "Natural Phenomena Hazards Mitigation."

12) DOE-STD-1021. "Natural Phenomena Hazards Performance Categorization Criteria for Structures, Systems, and Components."

5.4 Architectural

The architectural design criteria addresses the building occupancy, building interior materials of construction, and building space allocation.

5.4.1 Occupancy

The process buildings will be categorized as storage occupancy, low hazard (S-2). The general use building will be categorized as business occupancy, Business (B).

The general use building will include storage areas, office space, laboratory, training/conference space, lockers, toilets, and a break room.

All buildings will be categorized as Type II, unprotected construction, with an automatic fire suppression system in accordance with NFPA 13 and 101, UBC, and OBBC.

The buildings will be pre-engineered steel structures, rigid frame with purlins and metal roof panels, and wall girts with metal wall panels with insulation.

A minimum of two exits will be required for each occupancy, with all exits leading directly to the exterior of the building. The maximum allowable length of exit access travel for the storage buildings will be 400 feet and the general use building maximum allowable length will be 250 feet.

5.4.2 Materials

The exterior walls for all buildings will be 22 gage minimum, pre-finished corrugated metal panels.

The roof covering for all buildings will be 24 gage minimum, pre-finished corrugated metal panels. The roof classification shall be Class B (minimum).

Interior walls of office area shall consist of metal stud framing and gypsum board finish. Exit access corridors shall have 1 hour fire rating; interior wall, ceiling, and floor finishes at exit access shall be Class B (minimum) per NFPA 101.

Doors in exit access corridors shall be rated at 20 minute minimum. All exterior personnel doors, interior doors, and fire rated doors shall be hollow metal fabricated from 16-gage sheet steel conforming to ASTM A366. All exterior doors shall be insulated. Hollow metal door frames shall be fabricated from 14-gage sheet steel conforming to ASTM A366.

Fire doors and frames shall conform to the requirements of the Underwriters' Laboratories, Inc. for the class of door furnished and shall carry the Underwriters' label.

Overhead coiling doors shall be fabricated to resist a wind load of 25 pounds per square foot. Door tracks shall be of gage and size to meet door size and windloading. Doors shall be chain hoist operated.

Exterior windows in the general use building will have fixed windows in aluminum frames. Window glazing requirements will be determined during Title II Design.

Ceiling finish in the office areas shall be suspended, prefinished, fire-rated mineral acoustical ceiling panels, Nuclear Regulatory Commission range of 0.65 - 0.75 and Sound Transmission Class of 40-44; Class A conforming to ASTM E1264 with a 0-25 flame spread rating in accordance with ASTM E84.

Ceiling finish in storage buildings will be exposed structure and fiberglass blanket insulation faced with a vapor barrier. Insulation assembly shall carry Underwriters' Laboratories flame spread rating of 0-25.

Floor finishes in the general use building will include commercial grade vinyl composition tile for the break room and lockers/toilets; commercial sheet vinyl for offices, conference room, lobby, and corridor; concrete floor sealed with epoxy coating at boiler room, maintenance area and control room. Floors shall be designed to have a coating in areas where liquid waste spills or overflows are likely.

Maintenance coatings in the storage buildings will be durable, abuse resistant and resistant to the high humidity and moisture levels present. Coatings shall be lead and chromate free. Process and fire protection piping shall be painted to comply with FEMP standards.

Painting of all surfaces shall be in accordance with the recommendations of a single source manufacturer of the painting system selected. Primers, paints, and finishes shall conform to the standards and other requirements of the single source supplier of the painting system. Typical surfaces to be painted include the following:

1) Exterior and Interior Ferrous Metals
2) Exterior and Interior Galvanized Metals (touch-up)
3) Exterior and Interior Concrete Masonry Units
4) Gypsum Wallboard

5) Ferrous Piping, Ducts, Conduits, Valves, Electrical Alarm Boxes, Pull Boxes, Cabinets
6) Ferrous Pipe and Conduit Hangers and Supports

Painting of pumps, motors, meters, instrument panels, fans, instrument cases, electrical equipment, and other standard manufactured items furnished with a factory finish is not included in this criteria.

Finish hardware for doors shall include butts, locks, kickplates, closures, doorstops, thresholds, and silencers.

5.4.3 Space Allocation

Exits from each occupancy shall lead directly to the exterior of the building and cannot exit through another space or room. Exit doors are required to be a minimum of 3 feet wide and corridors shall have a minimum width of 3 feet, 8 inches. Dead end corridors shall not exceed 20 feet in length.

5.4.4 Personnel Access Requirements and Limitations

Personnel access for the GTF shall meet the requirements of 10 CFR 835.501, Subpart F - Radiological Areas and DOE-EH-0256T, Radiological Control Manual. The facility is outside the current controlled area of the FEMP and requires establishment of a controlled area. The GTF shall use signs and barricades, control devices on entrances, or locked entrance ways to both identify the areas and limit access to those general employees requiring access.

Because the GTF is treating uranium in wastewater at low concentrations, the radiological hazards are only due to direct contact and ingestion. Therefore, the DOE-EH-0256T requirements for physical controls for high and very high radiation areas are not applicable.

5.4.5 Laws, Regulations, Codes, Standards, and Orders

Codes, standards, and orders applicable to the architectural design follow:

1) NFPA 13, Installation of Sprinkler Systems
2) NFPA 101, Life Safety Code
3) UBC 1994
4) OBBC 1993
5) Metal Building Manufacturers Association - Recommended Design Practice Manual
6) ASTM Standards as referenced
7) DOE Order 6430.1A General Design Criteria
8) Americans with Disabilities Act

9) 40 CFR 101-19.6, "Uniform Federal Accessibility Standards"

5.5 Mechanical Utilities

The mechanical utilities discipline will be responsible for HVAC and plumbing. The specifications that will be written for this are packaged air conditioners, air handling, air distribution, heat transfer units, controls and accessories, testing, adjusting and balancing, and plumbing. Steam, cooling water, refrigeration, and inert gases will not be required by this project.

5.5.1 Domestic Water (Potable Water)

Domestic water shall be supplied from an underground domestic water header for the process buildings and general use building. Sizes and location of pipe entrances will be determined during Title I/II Design. See Plumbing and Utilities under Subsection 5.5.3.

5.5.2 Heating,Ventilation, and Air Conditioning

The HVAC system for this project shall be based on 95 degrees F ambient outdoor temperature for summer and 1 degree F ambient outdoor temperature for winter.

The design of the HVAC for this facility will encompass the process buildings and the general use building with areas such as office support, lab, control room, wash room, electrical distribution room, waste drum storage room, and resin drum storage room. These criteria shall be based on DOE Order 6430.1A, ASHRAE, American Conference of Governmental Industrial Hygienists (ACGIH) Handbooks and Standards, OBBC, and NFPA.

Indoor design temperature and relative humidity shall be in accordance with DOE Order 6430.1A, Section 1550-1, and ASHRAE Handbook and Standards.

All air shall be exhausted to the atmosphere without use of a high-efficiency particulate air filtration system.

All mechanical utilities equipment selected shall not exceed any of the National Electrical Manufacturer Association (NEMA) equipment ratings.

All mechanical utilities HVAC systems shall be thermostatically controlled so that all systems will satisfy all demands in the design requirements.

5.5.3 Plumbing and Utilities

Plumbing for the GTF will be designed primarily for the wash room and lab area, but will be able to serve other areas. All sizes and designs shall comply with DOE Order 6430.1A, Section 1540; Uniform Plumbing Code (UPC); Ohio State Plumbing Code; BOCA National Plumbing Code; and ASHRAE Handbooks and Standards.

Other waste drains and non-mechanical utilities equipment shall be directed to a separate drain system other than the domestic plumbing system as described in this section.

5.5.4 Laws, Regulations, Codes, Standards, and Orders

1) AABC National Standards for Total System Balance

2) ACGIH Industrial Ventilation

3) Air Movement and Control Association, Inc. 210, Laboratory Method of Testing Fans

4) ANSI Z358.1, Eyewash and Shower Equipment, Emergency

5) ARI 460, Remote Mechanical Draft Air-Cooled Refrigerant Compressors

6) ARI 520, Positive Displacement Refrigerant Compressors and Condensing Units

7) ARI 1010, Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers

8) ASHRAE-1989, Handbook of Fundamentals

9) ASHRAE 15, Safety Code for Mechanical Refrigeration

10) ASHRAE 20, Methods of Testing for Rating Remote Mechanical Draft Air-Cooled Refrigerant Condensers

11) ASHRAE 55, Thermal Environmental Conditions for Human Occupancy

12) ASHRAE 62, Ventilation for Acceptable Indoor Air Quality

13) ASHRAE 90.1-1989, Energy Conservation in New Building Design

14) BOCA National Mechanical Code

15) 29 CFR 1910, Occupational Safety and Health Standards

16) DOE 6430.1A, "General Design Criteria"

17) DOE/TIC-11603-Rev I, Standards and Criteria Guide Non-Reactor Nuclear Facilities

18) ERDA 76-21, Nuclear Air Cleaning Handbook

19) FS-WW-P-541 Series, Plumbing Fixtures

20) NFPA 90A, Installation of Air Conditioning and Ventilating Systems

21) NFPA 90B, Installation of Warm Air Heating and Air Conditioning System

22) NFPA 91, Installation of Exhaust Systems for Air Conveying Material

23) Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) 75, Accepted Industrial Practice for Industrial Ducts

24) SMACNA 77, Round Industrial Duct Construction Standards

25) Underwriters Laboratories, Inc. (UL) 207, Refrigerant-Containing Components and Accessories, Non-Electrical

26) UL 900, Test Performance of Air Filter Units

27) BOCA National Plumbing Code

28) Uniform Plumbing Code

29) Ohio State Plumbing Code

5.6 Fire Protection

The fire protection system for the GTF buildings shall consist of a wet pipe sprinkler and standpipe (if required) system which shall supply hose racks and sprinkler heads in all areas in accordance with DOE Order 5480.7A; DOE Order 6430.1A, Section 1530; and 29 CFR 1910. The fire water used for

servicing the buildings shall enter from an underground fire water header. Pipe sizes will be determined during Title I/II Design.

Fire water supply for these systems shall be provided through connections from an underground fire water header.

Fire water pressure shall be tested to ensure that the water is at the required pressure and to determine if a booster pump is required.

The location of the fire hydrants shall be the basis for determining the need for a redundant fire protection.

The location of the outside fire hydrants with associated post indicator valves shall be in accordance with DOE Order 6430.1A, Section 1530.

Sprinkler systems, standpipe systems (if required), and deluge systems shall comply with all requirements under NFPA 13, NFPA 14, and NFPA 15.

Fire extinguishers shall be provided for suppression of Class A, B, C, and equipment fires in compliance with NFPA 10, 11, 11A, 12, 15, 16, and 16A.

All fire protection systems and components shall have a fail-safe feature, and audible and visible alarms for operability and trouble indication.

All fire detection and alarm devices shall be UL-listed and Factory Mutual-approved components. Devices and systems shall comply with NFPA 71, 72, 72E, and 72H.

Underground fire water mains, including valves, hydrants, and fittings, shall be installed, flushed, sterilized, and tested in accordance with NFPA 24 and DOE Order 6430.1A, Section 1530.

The design and installation of the systems shall be the responsibility of a licensed fire protection contractor who regularly engages in the engineering and installation of fire protection systems. The contractor shall obtain the approval or acceptance of all governing authorities, including the insurance underwriter (if any).

5.6.1 Laws, Regulations, Codes, Standards, and Orders

1) 29 CFR 1910, Occupational Safety and Health Standards

2) DOE Order 5480.7A, "Fire Protection"

3) DOE Order 6430.1A, "General Design Criteria"

4) National Fire Protection Association
   (1) NFPA 10, Portable Fire Extinguishers
   (2) NFPA 11, Low Expansion Foam and Combined Agent Systems
   (3) NFPA 11A, Medium- and High-Expansion Foam Systems
   (4) NFPA 12, Carbon Dioxide Extinguishing Systems
   (5) NFPA 13, Installation of Sprinkler Systems
   (6) NFPA 13A, Inspection, Testing, and Maintenance of Sprinkler Systems
   (7) NFPA 14, Installation of Standpipe and Hose Systems
   (8) NFPA 14A, Inspection, Testing, and Maintenance of Standpipe and Hose Systems
   (9) NFPA 15, Water Spray Fixed Systems for Fire Protection
   (10) NFPA 16, Installation of Deluge Foam-Water Sprinkler Systems and Foam-Water Spray Systems
   (11) NFPA 16A, Installation of Closed-Head Foam-Water Sprinkler Systems
   (12) NFPA 24, Installation of Private Fire Service Mains and Their Appurtenances
   (13) NFPA 71, Installation, Maintenance, and Use of Signaling Systems for Central Station Service
   (14) NFPA 72, National Fire Alarm Code
   (15) NFPA 72E, Automatic Fire Detectors
   (16) NFPA 72G, Installation, Maintenance, and Use of Notification Appliances for Protective Signaling Systems
   (17) NFPA 72H, Testing Procedures for Local Auxiliary, Remote Station, and Proprietary Protective Signaling Systems

5.7 Mechanical Process Equipment

The GTF will be designed to meet the requirements of DOE Order 6430.1A, Paragraph 1323. Design shall emphasize the use of multiple barriers to restrict the movement of radioactive waste that has the potential for human contact or reducing groundwater quality. When necessary to prevent chemical reactions or introduction of contaminants, individual lines shall be used for each waste stream fed to collection tanks. Bypass lines that permit waste streams to be routed around collection tanks shall be avoided. Materials shall be selected for corrosion resistance and ease of decontamination. Provisions shall be made so that liquids can be analyzed prior to transfer.

Tank systems will be equipped with spill prevention devices (i.e., check valves, dry disconnect couplings) and overfill controls (i.e., liquid level probes, high level alarms, interlocks to stop flow, etc.). The

mechanical process discipline is responsible for the specification of tanks, process pumps, tank agitators, filters, ion exchangers, carbon adsorbers, and thickeners.

Process equipment shall be skid-mounted to the extent possible. All equipment skids shall be fully piped and ready for hook-up to other skids/equipment.

5.7.1 Equipment

Tank design shall meet the requirements of American Petroleum Institute (API) 650. Confinement systems shall meet the criteria in DOE Order 6430.1A, Paragraphs 1300-7 and 1323-5.

Centrifugal pumps shall meet the requirements of American Society of Mechanical Engineers (ASME) B73.1M.

Tank agitators shall be top-mounted impeller type.

Equipment design for filters, ion exchangers, and adsorbers shall meet the requirements of ASME Section VIII, Division 1. Minimum design pressure shall be 100 pounds per square inch gauge.

Thickener shall be the rake type with an aboveground steel settling tank. Tank design shall meet the requirements of API 650.

5.7.2 Process Water

Process water will be obtained from existing sources in the Building 51 area. Exact locations will be identified during Title I Design.

5.7.3 Vibration

Rotating equipment will be dynamically balanced in accordance with the manufacturer's standard practice.

5.7.4 Limiting Dimension/Tolerances

There are no limiting dimensions for this facility.

5.7.5 Containment, Sump Requirements

Confinement systems shall meet the criteria in DOE Order 6430.1A, Paragraphs 1300-7 and 1323-5.

5.7.6 Accessibility for In-Service Inspection

All equipment shall be provided with access, including platforms and ladders (if required), for inspection while in service.

5.7.7 Corrosion Allowance

Stainless steel and epoxy-coated steel tanks will not require a corrosion allowance. Unprotected carbon steel tanks shall have a 1/16-inch corrosion allowance.

5.7.8 Laws, Regulations, Codes, Standards, and Orders

1) ASME Section VIII, Division 1 Boiler and Pressure Vessel Code, 1992

2) ASME B73.1 M-91, Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process

3) DOE Order 6430.1A, "General Design Criteria"

4) API Standard 650-93, Ninth Edition, Welded Steel Tanks for Oil Storage

5.8 Material Handling

The material handling section is responsible for establishing design requirements for material handling equipment for the spent media stabilization system. Spent media such as spent carbon from carbon adsorption and spent resin from IX processes will be stabilized in 55-gallon drums by mixing with cement.

Title I Design will evaluate the benefits of a vendor-supplied stabilization process versus a permanent, installed stabilization system.

5.8.1 Laws, Regulations, Codes, Standards, and Orders

1) FEMP Site Policy and Procedure PP-0314
2) Department of Transportation HM-181
3) DOE Order 6430.1A, "General Design Criteria"
4) Ohio EPA

5.9 Piping

The piping discipline is responsible for the specification of pipes, fittings, valves, pipe supports/anchors, and piping and equipment insulation.

5.9.1 General Criteria

ASME B31.3, B31.11, and the ASME Boiler and Pressure Vessel Code shall be the basis for the various piping systems designs.

For seismic zone conditions, refer to Subsection 5.3.1.

5.9.2 Flexibility

The impacts of dynamic effects (wind and vibration) and weight effects (live loads, dead loads, and test loads) shall be considered in the design so that stresses created by these combined loads do not exceed the allowable stresses as prescribed by ASME B31.3 and, where applicable, the ASME Boiler Pressure Vessel Code.

5.9.3 Double-Walled Pipe

In accordance with DOE Order 6430.1A, Paragraph 1300-7.4, radioactive or other hazardous materials shall be carried in double-walled pipes where the primary pipe leaves a secondary confinement structure. In areas within the secondary confinement structure, the use of double-walled pipe shall be considered. Paragraph 1323-5.1 states that actual secondary confinement requirements are determined on a case-by-case basis using Table 1323-5.1 as a guide. Leakage monitoring shall be provided to detect leakage into the space between the carrier (inner) and containment (outer) pipes. The FERMCO Regulatory Group will provide an interpretation and direction regarding secondary containment during Title I Design.

5.9.4 Pressure

Design and test pressures shall comply with ASME B31.3.

5.9.5 Testing

Pipe and piping systems testing shall conform to the requirements set forth in ASME B31.3 and American Society for Nondestructive Testing (ASNT) SNT-TC-1A.

5.9.6 Special Flow Considerations

Slurry pipe flow capacities shall maintain a velocity in the 4 to 7 feet per second range to prevent settling of solids.

5.9.7 Heat Tracing

Electrical heat tracing and insulation will be provided for all piping, fittings, valves, and equipment which are subject to freezing temperatures or require process heating.

5.9.8 Insulation

Insulation requirements shall be in accordance with the applicable ASTM insulation and sheeting specifications.

5.9.9 Pipe Supports

Pipe supports shall be spaced in accordance with Manufacturers Standard Society (MSS), SP-69.

Pipe hanger material, design, manufacture, selection, application, fabrication, and installation shall be in accordance with MSS, SP-58, SP-69, and SP-89.

Auxiliary steel supports shall be in accordance with ASTM A-36 and A-576.

5.9.10 Welding Requirements

Welding shall be in accordance with ASME B31.3 and American Welding Society (AWS) D1.1

5.9.11 Material

Corrosion, abrasion resistance, and ease of decontamination shall be considered when selecting pipe, fittings, valves, and equipment items.

5.9.12 Special Valves

Slurry valves shall be full port.

5.9.13 Laws, Regulations, Codes, Standards, and Orders

1) ASME B31.3, Chemical Plant and Refinery Piping
2) ASME B31.11, Slurry Transportation Piping Systems
3) ASME Boiler and Pressure Vessel Codes
4) ASNT SNT-TC-1A, Recommended Practice
5) ASTM A-36, Standard Specification for Structural Steel
6) ASTM A-576, Standard Specification for Steel Bars, Carbon, Hot Wrought, Special Quality
7) AWS D.1.1, Structural Welding Code Steel
8) DOE Order 6430.1A, "General Design Criteria"
9) MSS SP-58, Pipe Hangars and Support - Materials, Design, and Manufacture
10) MSS SP-69, Pipe Hangars and Support - Skeleton and Application
11) MSS SP-89, Pipe Hangars and Support - Fabrication and Installation Practices

5.10 Electrical

The Electrical discipline is responsible for identifying power sources, high lines, and substations as well as grounding, power, communications, and power requirements.

5.10.1 Power Sources, High Lines, and Substations

Electrical power for the GTF Phase I system will be supplied from 15 kV, three phase feeders F2B and F4B located at Manhole 238. An underground ductbank containing 6-1/c 350 kcmil cables will extend from Manhole 238 to an electrical distribution room in the GTF Phase I Building. The electrical distribution room will house a 2500 kVA unit substation consisting of a primary normal fused switch (F2B) and an alternate primary fused switch (F4B); a 2500 kVA, 13.2 to 480V dry-type transformer; and four, 480V secondary circuit breakers. The secondary breakers provide distribution to motor control centers located in two electrical rooms within the facility.

Electrical power for the GTF Phase II system will be supplied from feeders F2B and F4B extended from the Phase III system. A 1500 kVA unit substation will be installed in the Phase I electrical distribution room and contain an incoming normal primary fused switch (F2B) and an alternate primary fused switch (F4B); a 1500 kVA, 13.2 to 480 V dry-type transformer; and two secondary circuit breakers. The secondary breakers serve two motor control centers located in an electrical room installed within the GTF Phase II Building.

The substation sizes (i.e., transformers, breakers, etc.) will be verified during Title I/II Design.

5.10.2 Grounding

A grounding grid system will be installed within and around the facility, around substations, and for fences. Grounding systems shall comply with DOE Order 6430.1A and NFPA 70, National Electrical Code.

5.10.3 Stand-By Power Requirements, Uninterruptible Power

A dual incoming 13.2 kV line will allow an alternate feeder in the event the primary normal feeder loses power. In addition, if power is lost within the facility, a stand-by diesel generator will allow an orderly shutdown of process equipment and maintain ventilation systems. An uninterruptible power supply will provide for continuous power to the DACS during a power loss or system failure.

5.10.4 Communications

Fire alarm and evacuation systems will be extended to the GTF from the central command center via the existing AWWT Phases I and II facility. The fire alarm system will consist of manual pull stations, smoke detectors, tamper and flow switches, and audio and visual alarms connecting to a central fire alarm panel located within the GTF. The evacuation system will consist of speakers located throughout the GTF. No special security or communication systems are required.

5.10.5 Lighting

Illumination levels for the GTF shall be designed in accordance with the Illumination Engineering Society Handbook. As a minimum, process areas shall maintain a lighting level of 30 footcandles and office areas shall maintain a lighting level of 50 footcandles.

High efficiency, high intensity discharge (HID) lighting will be installed in process and outdoor areas of the facility. High efficiency, fluorescent fixtures will be installed in offices, electrical rooms, and control rooms. Battery backed fluorescent and HID quartz fixtures will be provided for emergency lighting.

5.10.6 Laws, Regulations, Codes, Standards, and Orders

1) ANSI C2, National Electrical Safety Code
2) ANSI C84.1, Electrical Power Systems and Equipment - Voltage Ratings (60 Hz)
3) DOE Order 6430.1A, "General Design Criteria"
4) NFPA 70, National Electrical Code
5) NFPA 780, Lightning Protection Code
6) NFPA 110, Emergency and Standby Power Systems

7) Illuminating Engineering Society Handbook
8) NFPA 101, Life Safety Code

5.11 Instrumentation

The Instrumentation discipline will design the DACS as well as identify periodic testing, field instrumentation and monitoring requirements.

5.11.1 Data Acquisition and Control System

The DACS for the GTF Phases I and II will be an integrated system independent from the other AWWT facilities. The only exception will be monitoring the status of the AWWT Sludge Dewatering Facility.

The DACS will consist of the following as a minimum:

1) Remote Processing Units (RPUs), includes input and output (I/O) points
2) Data Highway
3) Operator station
4) Engineering/programming station, can act as an alternate operator station
5) Data logger
6) Printers
7) Audio alarm
8) Tape drive for data back-up
9) Software

The RPUs and associated I/O will be at various locations throughout the GTF. This requirement is to reduce the amount of wire and conduit required.

As a minimum, the DACS shall be capable of performing various activities from the operator station including: collecting and displaying all process parameters selected to control, automatically or manually, selected loops, and initiating sequential or logical functions. The video monitor display program shall include graphic features for displaying process parameters. One video monitor shall be designated for alarm conditions.

The engineering station shall be capable of performing various activities, including data manipulation (complex mathematical functions, trending, and report generation), back-up, and storage and retrieval of data. The engineering station also will allow for system programming, (operator system and data base configuration, modification of set points, and redefining control logic).

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The control logic will be based upon the control philosophy and the information contained in the construction documents.

In addition to supporting the functions mentioned above, the software shall perform on-line and off-line diagnostic programs.

The data highway will consist of a local area network (LAN) that will tie the data gathering unit, the operations console, and the RPUs together. The LAN also will allow for the RPUs to be located at convenient locations in the facility.

5.11.2 Periodic Testing

Periodic testing will be defined in the Operations and Maintenance Manual as prepared by FERMCO according to Preparation of Operations and Maintenance Manual (PMP-505).

5.11.3 Field Instrumentation

General design requirements for field requirements, with exceptions noted, shall be as follows:

1) Electronics housing shall be NEMA ICS 6, Type 4.

2) Span and zero shall be externally adjustable.

3) Analog accuracy shall be plus or minus 1.0 percent of calibrated span including effects of linearity, hysteresis, and repeatability (this requirement will be allowed exceptions to hold down cost, when the process requirements allows or if limited by technology).

4) Electronic analog transmitters and receivers shall have their input and output signals isolated from ground.

5) Contact closure outputs shall be "dry" contacts isolated from ground.

Calibration-Accuracy and Frequency will be defined in the Operations and Maintenance Manual as prepared by FERMCO according to PMP-505, Preparation of Operations and Maintenance Manual.

5.11.4 Air and Personnel Monitoring

Air and personnel monitoring shall at a minimum meet the requirements of 10 CFR 835, Subpart E, Monitoring in the Workplace. Air monitoring shall meet the requirements of 10 CFR 835.403. More

restrictive requirements are established in DOE-EH-0256T, DOE Order 6430.1A and the FERMCO Comprehensive Environmental Safety and Health Manual to maintain worker exposure as low as reasonably achievable (ALARA). DOE-EH-0256T requires that the design shall minimize radiological dose and maintain personnel dose below 500 mrem. FERMCO will specify equipment and provide locations of air monitors. Air and personnel monitors shall operate on 120V, single phase electrical power.

Monitoring shall be required for the individual who would receive an effective dose equivalent to the whole body of 0.1 rem in a year from external radiation. It is assumed for the GTF Phases I and II that external exposure to radiation will not be appreciable. Monitoring for internal exposure shall be required if the radiological worker, under routine conditions, is likely to receive 0.1 rem or more committed effective dose equivalent and/or 5 rems dose equivalent to any organ or tissue, from all occupational radionuclide intakes in a year.

Air monitoring shall meet the requirements of DOE-EH-0256T for occupied areas:

1) Where the individual is likely to receive an annual intake of 2 percent or more of the Annual Limit on Intake (40 Derived Air Concentration [DAC] hours) under normal operating conditions.

2) When real time air monitoring using continuous air monitors shall be used in normally occupied areas where an individual is likely to be exposed to a concentration of airborne radioactivity exceeding one DAC.

Because the GTF treats radioactive liquid waste through filtration, adsorption and IX, airborne contamination will be minimal. The design of the GTF shall ensure that contaminated liquids are contained in process equipment or collection areas for normal operations. Engineering design shall be considered to limit the need for airborne and personnel monitoring. DOE Order 6430.1A requires air monitoring for areas where radiological materials may be airborne and that the monitoring system comply with ANSI N13.1

Personnel contamination monitors and portable friskers will be available at the controlled area entrance for radiological monitoring of personnel. See Subsection 5.14 for more information on radiological controls.

5.11.5 Automation

The level of automation of the GTF system will be defined under Title I design according to the following considerations:

1) Complexity of operation with respect to consequences of error (i.e., mitigation of personnel hazards, environmental hazards, and nonconformance with NPDES permits).

2) Period between operation, daily versus weekly.

3) Equipment protection.

4) Radiation levels.

5) Accessibility.

6) Response time requirements.

5.11.6 Laws, Regulations, Codes, Standards, and Orders

1) DOE Order 6430.1A, General Design Criteria, Subsection 1300-12, Human Factors Engineering
2) Instrumentation Society of America S5.1-84, Instrument Symbols and Identification
3) Instrumentation Society of America S5.4-89, Instrument Loop Diagrams
4) NEMA ICS 6-88, Enclosures for Industrial Control and Systems; Revision 1 - March 1989
5) NFPA 75, Protection of Electronic Computer/Data Processing Equipment

5.12 Environmental

The Environmental discipline is responsible for identifying NPDES program requirements for the GTF.

5.12.1 Gaseous, Liquid, and Solid Discharges Including Special Emphasis on Hazardous Waste

Some gaseous discharges may result from the use of sulfuric acid and caustic in the treatment process. Table 5-3 provides the air discharge standards according to 40 CFR 50, US EPA Regulations on primary and secondary ambient air quality standards.

Table 5-3 - Air Quality Standards

Contaminant	Standard
CO	Not to exceed 9 ppm over an 8-hour period, and 35 ppm over a 1-hour period
NO_x	Not to exceed 0.053 ppm annually
SO_2	Not to exceed 0.03 ppm annually, and 0.14 ppm over a 24-hour period, and 0.5 ppm over a 3-hour period
PM_{10}	Not to exceed 50 $\mu g/m^3$ annually and 150 $\mu g/m^3$ over a 24-hour period
O_3	Not to exceed 0.12 ppm/hour
Pb	Not to exceed 1.5 $\mu g/m^3$ based on a quarterly average

40 CFR 61 Subpart H, National Emission Standards for emissions of Radionuclides other than Radon from DOE Facilities, applies, and public doses must be less than 10 mrem annually. Emissions must be measured if the potential exists to emit more than 1 percent of the standard (e.g., 1/10 mrem per year).

Liquid discharges from the GTF will be in accordance with the NPDES requirements. These requirements are established in the NPDES permit for the FEMP. The FEMP currently has a permit; however, discharge limitations may change as the permit is due for renewal in February 1995. Table 5-4 presents the discharge limitations for the Great Miami River as specified in the *current* NPDES permit.

Table 5-4 - Current NPDES Discharge Limitations

Parameter	Discharge Limitations				
	Concentration			Loading[1]	
	30 day	Daily	Units	30 day	Daily
Residue, Total Nonfilterable	**30**	**45**	**mg/l**	**99**	**149**
Oil and Grease, Total	**15**	**15**	**mg/l**	**50**	**50**
Nitrogen, Ammonia (NH_3)	-	-	**mg/l**	-	-
Nitrate-N	-	-	**mg/l**	-	-
Cyanide, Total	**0.036**	**0.076**	**mg/l**	**0.120**	**0.251**
Fluoride, Total	-	-	**mg/l**	-	-
Chromium, Total	-	-	**µg/l**	-	-
Copper, Total	**23**	**94**	**µg/l**	0.077	0.310
Lead, Total	60	776	**µg/l**	0.199	0.086
Nickel, Total	-	-	**µg/l**	-	-
Silver, Total	12	26	**µg/l**	0.040	0.086
Chromium, Dissolved Hexavalent	-	-	**µg/l**	-	-
Flow Rate	-	-	MGD	-	-
Biochemical Oxygen Demand	20	30	mg/l	66	99
Dissolved Oxygen	5.0 mg/l (minimum)				
pH[2]	6.5 - 9.0 Standard Units				

Notes:

1 Loading from current permit based on 872,000 gallons per day in kg/day.

2 pH shall be maintained within the range specified. The total time during which pH values are outside the required range shall not exceed 7 hours 26 minutes in any calendar month. No individual excursion from the range shall exceed 60 minutes.

Terms used in the table are defined as follows:

1) *Daily load limitation* is the total discharge by weight during any calendar day. If only one sample is taken during a day, the weight of the pollutant discharge calculated from it is the daily load.

2) *Daily concentration limitation* means the arithmetic average (weighted by flow) of all the determinations of concentrations made during the day. If only one sample is taken during the day, its concentration is the daily concentration. Coliform bacteria limitations compliance shall be determined using the geometric mean.

3) *30-day load limitation* is the total discharge by weight during any 30-day period divided by the number of days in the 30-day period that the facility was in operation. If only one sample is taken in a 30-day period the weight of the pollutant discharge calculated from it is the 30-day load. If more than one sample is taken during one 30-day period, the 30-day load is calculated by determining the daily load for each day sampled, totaling the daily loads for the 30-day period and dividing by the number of days sampled.

4) *30-day concentration limitation* means the arithmetic average (weighted by flow) of all the determinations of daily concentration made during the 30-day period. If only one sample is taken during the 30-day period, its concentration is the 30-day concentration for that 30-day period. Coliform bacteria limitations compliance shall be determined using the geometric mean.

5) *Absolute limitations* are those limitations having descriptions of "shall not be less than," "nor greater than," "shall not exceed," "minimum," or "maximum," and shall be determined from any single value for effluent samples and/or measurements collected. Dissolved oxygen and pH are examples of parameters with absolute limitations.

It should be noted that discharge limitations for uranium are <u>not</u> specified in the current NPDES permit. The current discharge limit of 1,700 pounds per year was agreed upon as part of Removal Action #3 (South Groundwater Contamination Plume) negotiations. Based upon a continuous (i.e., 24-hours per day/7 days per week) effluent of 8,600 gpm at a concentration of 20 μg/l, the AWWT should discharge approximately 156 pounds of uranium per year. The 1,700 pounds per year limit may change in the future depending upon Record of Decision negotiations between the DOE and the US EPA and the Ohio EPA.

5.13 Geotechnical

The Geotechnical discipline will be responsible for identifying the geologic conditions, soil, rock, hydrogeologic, and geochemical properties.

Development of specific design criteria targeted for specific GTF components will be on the basis of a complete subsurface investigation that includes boring, sampling, and geotechnical laboratory testing. Current information indicates only one boring at the proposed site of the GTF that penetrates to sufficient depth to begin the analysis of the geotechnical conditions that may affect the project. However, general knowledge of the site, and site geologic setting do provide important information relative to the nature of the subsurface investigation that will be required.

In general, it is anticipated that there will be about 20 feet of stiff, over-consolidated, silty clay till, underlain by sand and gravel of the GMA. Verification of the geologic conditions will be achieved by subsurface investigations that include several subsurface borings to be drilled with a hollow stem auger, standard penetrometer testing, use of split spoon samplers and thin-walled tubes (i.e., Shelby tubes) for collection of subsurface soil samples of the various materials encountered, and subsequent appropriate laboratory testing of the samples collected.

The following sections discuss some specifics regarding geologic conditions; soil and rock properties; hydrogeologic properties; geochemical properties; and laws, regulations, codes, and standards.

5.13.1 Geologic Conditions

In the general vicinity of the site there is evidence of some geologic conditions that may affect the GTF if those conditions are present at the specific site of the facility.

1) Stratigraphic sequences of clay and sand could affect design as a result of analyses of liquefaction potential

2) Although no faulting or evidence of ground rupture due to faulting is known at the site, a large seismic event, coupled with potentially large ground motions requires evaluation to assess liquefaction

3) Depending on the exact location of the proposed facility with respect to Paddys Run, the potential for headward erosion of tributaries will be evaluated taking into account potential extraordinary rainfall events and flooding with consequent undercutting of stream banks

5.13.2 Soil and Rock Properties

There are no rock outcrops at the site of the proposed GTF. The soils will be tested for purposes of identification by means of Atterberg limits testing and Grain Size Analyses. Test results will then be compared with visual classifications as developed during the field drilling and sampling process. Physical characteristics to be tested will determine consolidation and settlement characteristics, moisture/density relationships, internal friction angle, and cohesion. In areas where differential design loads are anticipated, analyses will be conducted to determine the potential for structural or architectural damage due to differential settlement. Combined evaluation of all analyses will permit determination of allowable soil bearing design capacity and provide the basis for recommendation of foundation types. Pertinent pavement structural design data will be obtained from California Bearing Ratio tests or modulus of subgrade reaction tests.

5.13.3 Hydrogeologic Properties

Groundwater levels will be measured in subsurface investigation exploratory borings at the site of the facility, and will be compared with quarterly levels being measured in monitoring wells across the site in general.

5.13.4 Geochemical Properties (Soil and Groundwater)

Analysis of sulphate concentrations will be conducted to provide necessary input to concrete mix designs.

5.13.5 Laws, Regulations, Codes, Standards, and Orders

1)	ASTM D 422-63 (1972)	Method for Particle-Size Analysis of Soils
2)	ASTM D 698-78	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in (305-mm) Drop
3)	ASTM D 854-83	Test Method for Specific Gravity of Soils
4)	ASTM D 1140-54 (1971)	Test Method for Amount of Material in Soils Finer than the No. 200 (75-mm) Sieve
5)	ASTM D 1557-78	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in (457-mm) Drop

6)	ASTM D 1586-84	Method Penetration Test and Split-Barrel Sampling of Soils
7)	ASTM D 1587-83	Practice for Thin-Walled Tube Sampling of Soils
8)	ASTM D-1883-87	Test Method for California Bearing Ratio of Laboratory-Compacted Soils
9)	ASTM D 2166-85	Test Method for Unconfined Compressive Strength of Cohesive Soil
10)	ASTM D 2216-80	Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
11)	ASTM D 2435-80	Test Method for One-Dimensional Consolidation Properties of Soils
12)	ASTM D 2487-85	Test Method for Classification of Soils for Engineering Purposes
13)	ASTM D 2488-84	Practice for Description and Identification of Soils (Visual-Manual Procedure)
14)	ASTM D 2850-87	Test Method for Unconsolidated, Undrained Compressive Strength of Cohesive Soils in Triaxial Compression
15)	ASTM D 4220-89	Practices for Preserving and Transporting Soil Samples
16)	ASTM D 4318-84	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
17)	ASTM D 4767-88	Test Method for Consolidated-Undrained Triaxial Compression Test on Cohesive Soils
18)	DOE Order 6430.1A, Section 201	Subsurface Investigations
19)	Laboratory Soils Testing Manual	Appendix X (Triaxial Compression Tests)
20)	Laboratory Soils Testing Manual	Appendix II (Unit Weights, Void Ratio, Porosity, and Degree of Saturation)

5.14 Nuclear and Systems Safety

Nuclear and Systems Safety is responsible for defining the facility hazard category as well as identifying design basis accidents, nuclear criticality control, safety classification, emergency planning requirements, radiation levels and types, shielding requirements, and the preliminary identification of hazards.

Based on the quantities of radionuclides shown in Table 2-1 for the groundwater, and approximations of the efficiency, size, and operations of the treatment process, it is assumed that the GTF's potentially releasable radiation does not exceed the thresholds in DOE-STD-1027-92 nor 40 CFR 302, Appendix B. However, the chemicals in the GTF will exceed the values in 40 CFR 302.4. Therefore, in accordance with the guidance provided in DOE-EM-STD-5502-94, the GTF is a non-nuclear facility that will require that a SAR be prepared in accordance with DOE Order 5481.1B. The requirements of 29 CFR 1910.119 for Process Safety Management may also apply. For the purposes of design criteria development, the facility is assumed to be in the Low Hazard class. This assumption must be confirmed.

A Safety Assessment shall be conducted to determine the applicable safety requirements for a facility per FERMCO Safety Procedure SPA-01-013. A safety assessment has not yet been made for the GTF.

5.14.1 Design Basis Accidents

The design basis accidents (DBAs) for the engineering design are based on the assumption that the facility is a low hazard facility. The design criteria should be reflected in this assumption. The facility DBAs to be considered are:

1) Largest spill of hazardous material
2) Largest spill of high/low pH materials
3) Largest acid vapor release
4) Chemical offloaded or discharged to wrong storage tank
5) Largest spill of radioactive material

DBAs for a low hazard facility shall have no impact to the public and environment. For the GTF, the DBAs with the maximum consequence will result from one of the DBAs listed above.

The Natural Phenomena Hazards DBAs to be considered are design basis earthquake, design basis wind, and design basis flood. Design basis tornados are not required for Low Hazard facilities. For earthquakes, the evaluation criteria shall be UCRL-53852, Rev. 1, Natural Phenomena Hazards Modeling Project: Seismic Hazard Models for Department of Energy Sites. For winds and floods, the design basis shall be UCRL-15910, Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena Hazards.

5.14.2 Nuclear Criticality Control

It is assumed that nuclear criticality will not be a concern at the facility due to the low enrichment and concentration of the uranium in the process wastewaters. DOE Order 6430.1A, Section 1300-4 states that nuclear criticality control provisions shall meet as a minimum the requirements of DOE Order 5480.5 and the American Nuclear Society 8 series.

5.14.3 Safety Classification

There are no anticipated safety class structures, systems, and components (SSCs) associated with the GTF.

A safety class SSC is any SSC which the safety analyst takes credit for in mitigating or preventing a DBA in the safety documentation for a hazard analysis. The criteria specified for safety class SSCs are not applicable because no SSCs are necessary to ensure that dose levels for proposed DOE-STD-3005-YR DBAs and exposure-base accidents of 25 rem are not exceeded.

5.14.4 Emergency Planning Requirements

The GTF shall have available the site Emergency Message System to notify personnel of an unsafe condition such as a fire, release of hazardous materials, and natural phenomena. A Building Evacuation System shall be in place to warn the occupants of unsafe conditions. The guidance is given in PL-3020, FEMP Emergency Plan, March 1993. DOE Order 6430.1A requires that alarms be designed to ensure they are audible in a work area's ambient conditions. An evacuation alarm system shall comply with ANSI N2.3.

5.14.5 Radiation Level and Types

Uranium present in site wastewaters is the primary radioisotope of concern. Other radioisotopes are present in trace quantities. The predominant radioactive decay is through alpha particle emission. This radiation does not present a significant external hazard. The pipes, tanks, other vessels and water may provide sufficient shielding for the personnel. However, the design of the facility should preclude internal exposure through ingestion or inhalation by limiting external contamination of process equipment.

5.14.6 Shielding

Shielding to limit external exposure is not expected to be required for this facility because the wastewaters are contaminated with uranium concentrations at levels of approximately 140 μg/l and other radionuclides and chemicals at trace levels (see Table 2-1).

Shielding, or other ALARA considerations such as time, distance, and contamination control, may only be needed for the spent media and sludge (uranium precipitate and total suspended solids) generated by the ancillary system. As design data becomes available on the quantities of uranium precipitate generated, an analysis may be made for shielding needs. Because the operations areas are not to be continuously occupied, shielding may not be required based on occupancy times (PARSONS 1994).

5.14.7 Preliminary Identification of Hazards

The Preliminary Identification of Hazards table (Appendix A) has been developed to support safety analysis at an early stage in the design process. The table presents the hazards that may occur in the GTF processes. Based on these processes and associated SSCs the potential types of hazards are identified.

The consequences of hazards are controlled by the design criteria. The evaluation of each hazard results in the implementation of corresponding codes, standards, or design criteria. The pertinent codes and standards are used by the design engineer to eliminate or limit the plausible hazards.

The codes and standards cited by the design engineers recognizes these hazards and thereby reduces their potential impact by establishing safe parameters for normal operations.

5.14.8 Laws, Regulations, Codes, Standards, and Orders

1) 10 CFR 835, "Occupational Radiation Protection"

2) DOE Order 5400.5, ""Radiation Protection of the Public and the Environment"

3) DOE Order 5480.5, "Safety of Nuclear Facilities"

4) DOE Order 5480.23, "Nuclear Safety Analysis Reports"

5) DOE Order 5481.1B, "Safety Analysis and Review System (SARS)"

6) DOE/EH-256T, Radiological Control Manual

7) DOE-STD 1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, "Nuclear Safety Analysis Reports"

8) Draft DOE-DP-STD-3005-93, Definitions and Criteria for Accident Analysis

9) DOE-STD-1020-94, Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities

10) UCRL 53852, Rev. 1, Natural Phenomena Hazards Modeling Project: Seismic Hazard Models for Department of Energy Sites

11) ANSI N2.3, Immediate Evacuation Signal for Use in Industrial Installations

12) ANSI N13.1, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities

13) PL-3020, *FEMP Emergency Plan*, March 1993

14) SPA-01-013, Preparation of Safety Assessments, September 1992

15) DOE-EM-STD-5502-94, "Hazard Baseline Documentation"

SECTION 6

BASIS FOR DESIGN DRAWINGS

The following sketches will be the basis for the discipline design activities. These drawings are from the Engineering Evaluation and Cost Estimate Report (PARSONS 1994).

6.1 Process

Sketch Number	Title
SK-F-01251	Process Flow Diagram, Equalization - South Plume
SK-F-01252	Process Flow Diagram, Filtration - South Plume
SK-F-01253	Process Flow Diagram, Carbon Adsorption - South Plume
SK-F-01254	Process Flow Diagram, Ion Exchange - South Plume
SK-F-01255	Process Flow Diagram, Regeneration Treatment
SK-F-01256	Process Flow Diagram, Media Handling
SK-F-02051	Process Flow Diagram, Equalization - Waste Pits Plume
SK-F-02052	Process Flow Diagram, Filtration - Waste Pits Plume
SK-F-02053	Process Flow Diagram, Carbon Adsorption - Waste Pits Plume
SK-F-02054	Process Flow Diagram, Ion Exchange - Waste Pits Plume

6.2 Piping

Sketch Number	Title
SK-M-01585	Equipment Layout Sheet 1, Phase III
SK-M-02099	Equipment Layout Sheet 2, Phase III and IV

6.3 Civil

Sketch Number	Title
SK-P-02102	Utility Plan
SK-G-02101	Site Plan

SECTION 7

REFERENCES

(PARSONS 1993) PARSONS ERA Project, June 1993. *Functional Requirements Document for Operable Unit 5 Groundwater Remediation (AWWT-Phase III)*, Revision 0. Fairfield: PARSONS.

(PARSONS 1994) PARSONS ERA Project, January 1994. *Engineering Evaluation and Cost Estimate Report (Abbreviated Conceptual Design Report) for Operable Unit 5 Groundwater Remediation*, Revision 0. Fairfield: PARSONS.

APPENDIX A

PRELIMINARY IDENTIFICATION OF HAZARDS

GTF DCR - Preliminary Identification of Hazards

Types of Hazards	Source or Location
Water Hazard	Open top tanks
Mechanical Equipment	Batch tanks with mixer blades
Electrical Equipment	Equipment wiring and cable runs Electrical outlets Pumps, motors and heaters Solenoids, switches, contacts
Standard Industrial Hazards	Noise Electrical Thermal Rotating Equipment Dust High Vibration Overpressure Obstacles Slip, trip and fall
Potential Energy	Stairs, lifts, cranes, hoists
Kinetic Energy (Rotary)	Motors, pumps, fans
Kinetic Energy (Transitional)	Fork lift, crane load
Pressure-Air	Plant air Breathing air Instrument Air
Pressure-Steam	Plant steam
Pressure-Water	Hose station
Explosive Materials	None
Flammable Materials	None

GTF DCR - Preliminary Identification of Hazards (Continued)

Types of Hazards		Source or Location
Chemical Hazards	Corrosive	Caustic Sulfuric Acid
	Toxic	e.g. - Uranium - Methanol - Hexavalent Chromium
	Volatile Organic Compounds	e.g. - Trichloroethylene - Tetrachloroethylene - Chloroform - 1,1,1-Trichloroethane
Radiation Hazards	Radioactive	Low enrichment uranium in wet particle and soluble form. Compounds include UO_2, UO_3, U_3O_8, UO_2F_2 (soluble) and UF_4.
	Fissionable	Uranium - 235
Asphyxiant Materials		None
Loss of Containment		Rupture of piping, vessels or tanks
Loss of Confinement		- Filter failure
Injury to Operating Personnel		- Contact with hazardous materials - Contact with energy sources
Nuclear Criticality		- Failure due to chemical effects - Failure due to human error - Failure due to thermal effects - Failure due to mechanical effects

GTF DCR - Preliminary Identification of Hazards (Continued)

Types of Hazards	Source or Location
Human Factors	Worker errors -Error of omission -Error of Commission -Extraneous act -Sequential error -Time error Inadequate instructions Poor labels/warnings Inadequate displays for control Inadequate staffing Inadequate tools
Equipment Failures	Failures of individual components or entire systems
Interfaces	Failure in interfaces among systems, subsystems, equipment, personnel and any combination thereof - Materials' compatibility - Material deformation/degradation - Electromagnetic interference - Inadvertent activation - Fire initiation and propagation - Loss of services - electric power - plant air - water - steam - Plant 8 waste processing or similar TBD facility
Waste Disposal	System/equipment failures
Maintenance	Extended/frequent downtime Inadequate/infrequent maintenance
Administrative Controls	Failure to Implement
Earthquakes	Impacts to structures, systems, and components (SSCs)
Extreme Hot/Cold Weather	Impacts to SSCs

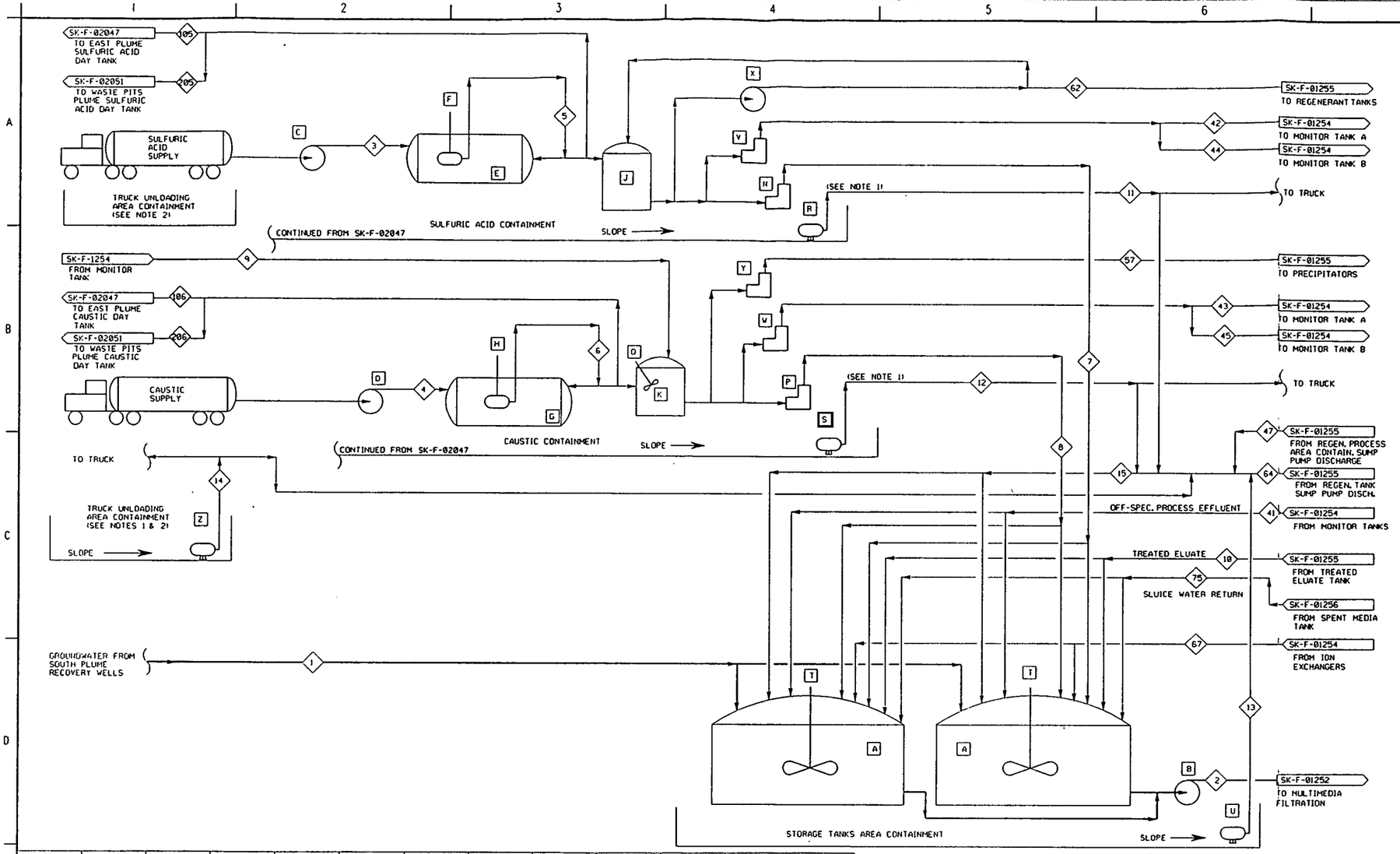
GTF DCR - Preliminary Identification of Hazards (Continued)

Types of Hazards	Source or Location
Tornadoes and Extreme Winds	Impacts to SSCs
Floods	Impacts to SSCs
Lightning	Impacts to SSCs
Heavy Precipitation	Impacts to SSCs
On-Site Vehicle Crashes	Impacts to SSCs

APPENDIX B

SKETCHES

skf01251.m(6654.ws426) po69@ws426. Thu Sep 1 15:53:29 EDT 1994



43	44	45	47	57	62	64	75	67	105	106	205	206
CAUSTIC TO MONITOR TANK A	SULF. ACID TO MONITOR TANK B	CAUSTIC TO MONITOR TANK B	REGN. PROCESS AREA SUMP PUMP	20% CAUSTIC TO PRECIPS.	SULFURIC ACID TO RGNRNT. TANKS	REGENERANT TANKS SUMP PUMP DISCH.	SLUICE WATER RETURN	FAST RINSE	CONC. SULFURIC ACID	50% CAUSTIC	CONC. SULFURIC ACID	50% CAUSITC
INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT
0-1	0-1	0-1	50	2	10	10	50	833	20	20	20	20
100	100	100	50	100	40	50	TBD		25	25	25	25
AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
1.22	1.83	1.22	1.0	1.22	1.83	1.0-1.83	1.0	1.0	1.83	1.53	1.83	1.53
7	50	7	1.0	7	50	1.0 - 38	1.0	1.0	50	100	50	100
20	93	20	TBD	20	93	0-93			93	50	93	50
							7.0					
							TBD					
							TBD					

STREAM NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	41	42
COMPONENT	GROUND WATER	EQUALIZED GROUND WATER	CONCENTRATED SULFURIC ACID	50% CAUSTIC	CONCENTRATED SULFURIC ACID	50% CAUSTIC	CONCENTRATED SULFURIC ACID	20% CAUSTIC	TREATED WATER	TREATED ELUATE	SULFURIC ACID SUMP PUMP	CAUSTIC SUMP PUMP	STG. TANKS SUMP PUMP	TRUCK UNLD. AREA SUMP PUMP	SUMP WATER	RECYCLE FROM MONIT. TANK	SULF. ACID TO MONITOR TANK A
OPERATING (HR/DAY)	24	24	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT
FLOW RATE (GPM)	2500	2500	70	70	20	20	0-1	0-1	20	50	10	10	50	20	100	2500	0-1
PRESSURE (psi)	TBD	120	20	20	25	25	100	100	115	45	50	50	50	50	50	50	100
TEMPERATURE (deg F)	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
SPECIFIC GRAVITY	1.0	1.0	1.83	1.53	1.83	1.53	1.83	1.22	1.0	1.0	1.0-1.83	1.0-1.53	1.0-1.52	1.0-1.83	1.0	1.0	1.83
VISCOSITY (cP)	1.0	1.0	50	100	50	100	50	7	1.0	1.0	50	100	1.0	1.0	1.0	1.0	50
CONCENTRATION (%)			93	50	93	50	93	20			0-93	0-50	0-48	0-93			93
DISSOLVED OXYGEN (NOMINAL) (mg/L)	2.0	2.0														2.0	
pH (NOMINAL)	7.4	7.4							7.0	TBD							
TOTAL SUSPENDED SOLIDS (mg/L)	3.0	3.0															
TOTAL SUSPENDED SOLIDS (%)																	
TOTAL ORGANIC CARBON (ppm)	4.3	4.3														< 0	
URANIUM (ug/L)	140	140								TBD						>20	
NOTES																	

NOTES

1. RAINWATER WILL BE PUMPED TO EQUALIZATION TANKS. ACID OR CAUSTIC SPILLS WILL BE SENT BY TRUCK FOR FURTHER TREATMENT.
2. TRUCK UNLOADING AREA CONTAINMENT IS COMMON FOR ALL CHEMICAL SUPPLY TRUCKS.

F-7342

MAJOR EQUIPMENT LIST

MARK	QTY	EQUIPMENT NAME
A	2	EQUALIZATION TANK
B	2	EQUALIZATION TANK DISCHARGE PUMP
C	2	SULFURIC ACID UNLOADING PUMP
D	2	CAUSTIC UNLOADING PUMP
E	1	SULFURIC ACID STORAGE TANK
F	2	SULFURIC ACID PUMP
G	1	CAUSTIC STORAGE TANK
H	2	CAUSTIC PUMP
J	1	SULFURIC ACID DAY TANK
K	1	CAUSTIC DAY TANK
N	2	EQUALIZATION TANK ACID METERING PUMP
P	2	EQUALIZATION TANK CAUSTIC METERING PUMP
Q	1	CAUSTIC DAY TANK AGITATOR
R	1	SULFURIC ACID SUMP PUMP
S	1	CAUSTIC SUMP PUMP
T	2	EQUALIZATION TANK AGITATOR
U	1	STORAGE TANKS AREA SUMP PUMP
V	3	MONITOR TANK ACID METERING PUMP
W	3	MONITOR TANK CAUSTIC METERING PUMP
X	2	REGENERANT TANK ACID PUMP
Y	2	PRECIPITATOR CAUSTIC PUMP
Z	1	TRUCK UNLOADING AREA SUMP PUMP

000077

REFER DWG NO.	REFERENCE DWG TITLE
SK-F-01252	FILTRATION - SOUTH PLUME
SK-F-01254	ION EXCHANGE - SOUTH PLUME
SK-F-01255	REGENERATION TREATMENT
SK-F-01256	MEDIA HANDLING
SK-F-02047	EQUALIZATION - EAST PLUME
SK-F-02051	EQUALIZATION - WASTE PITS PLUME

LEGEND
MAIN PROCESS FLOW LINES
SECONDARY PROCESS OR SERVICE LINES

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FEMCO	DATE
1	ISSUED FOR DCR			
0	ISSUED FOR FINAL EECER			

INITIALS AND DATE

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
GROUNDWATER REMEDIATION

DRAWING TITLE
PROCESS
PROCESS FLOW DIAGRAM
EQUALIZATION - SOUTH PLUME

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. C. TAYLOR	1-19-93	K. L. NAYAR	08-27-93	K. STRADFORD	08-17-93

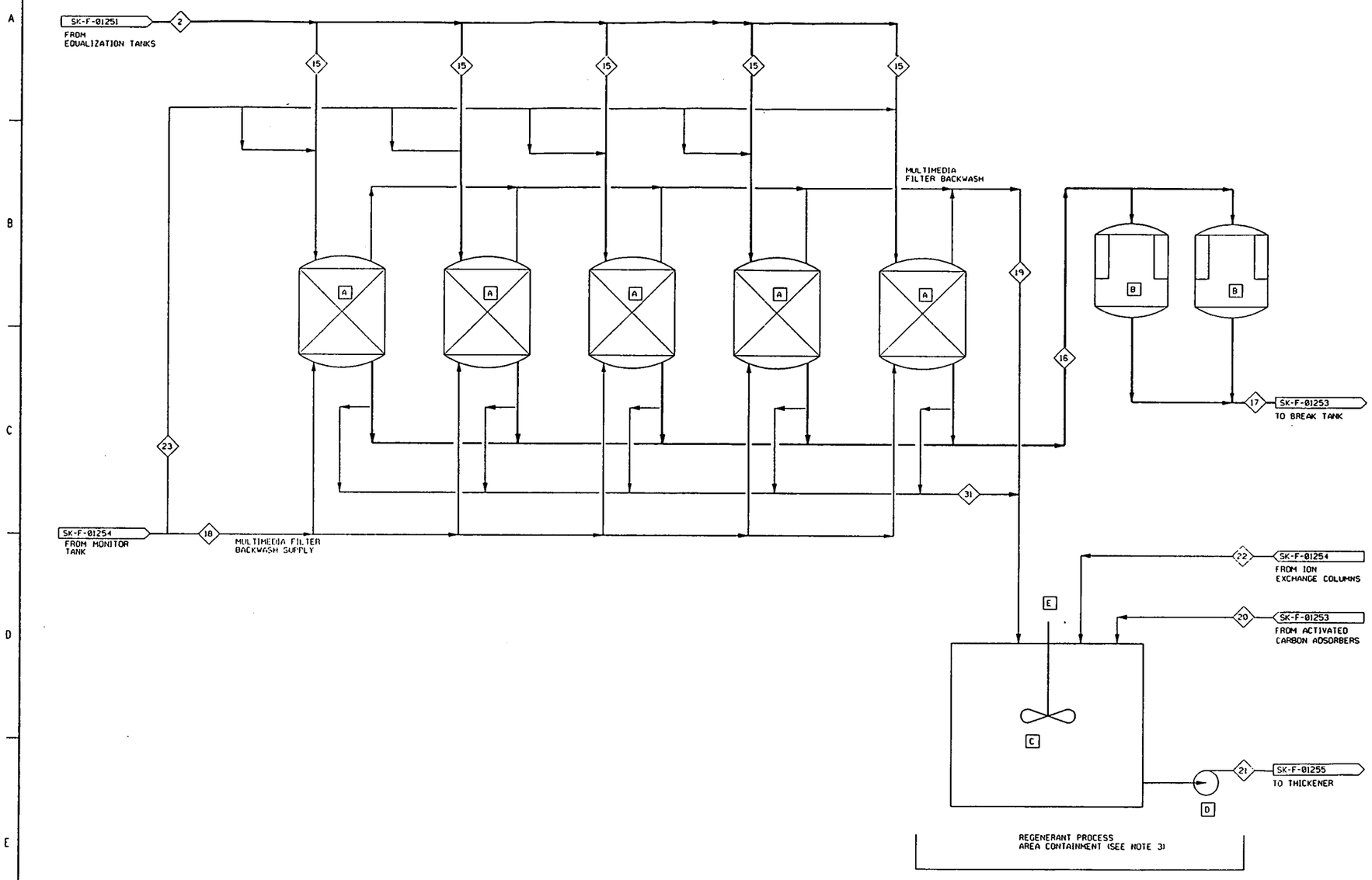
PLANT/BLDG. NO. | FLOOR | SCALE NTS | CLASS

SUBMITTED FOR APPROVAL | FEMCO CRU APPROVAL

A-E DOE PROJECT NO.	DATE	FEMP PROJECT NO.	DATE	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
		WBS 1.1.1.1.5.3.1 00-90701		SK-F-01251	F0001	1

PREPARED UNDER PARSONS PROJECT ORDER NUMBER
CRU5/P069

skf01252.m1(6653.ws426) po69@ws426. Thu Sep 1 15:54:12 EDT 1994



STREAM NO.	2	15	16	17	18	19	20	21	22	23	31
COMPONENT	EQUALIZED GROUNDWATER	MULTIMEDIA FILTER FEED	BAG FILTER FEED	FILTERED WATER	TREATED WATER	MULTIMEDIA FILTER BACKWASH/RINSE	ACTIVATED CARBON BACKWASH/RINSE	BACKWASH TO THICKENER	ION EXCHANGE BACKWASH	MULTIMEDIA FILTER RINSE SUPPLY	MULTIMEDIA FILTER RINSE EFFLUENT
OPERATING (HR/DAY)	24	24	24	24	INTERMITTENT	INTERMITTENT	INTERMITTENT	24	INTERMITTENT	INTERMITTENT	INTERMITTENT
FLOW RATE (GPM)	2500	625	2500	2500	1200	1200/800	800/375	25	250	800	800
PRESSURE (feet)	120	120	85	50	115	80	80	35	80		
TEMPERATURE (deg F)	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
SPECIFIC GRAVITY	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
VISCOSITY (cP)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
CONCENTRATION (%)											
DISSOLVED OXYGEN (NOMINAL) (mg/l)	2.0	2.0	2.0	2.0							
pH (NOMINAL)	7.4	7.4	7.4	7.4	7.0	7.0	7.0	7.0	7.0		
TOTAL SUSPENDED SOLIDS (mg/L)	3.0	3.0	0.3	~ 0							
TOTAL SUSPENDED SOLIDS (%)						0.1	~ 0	0.1	~ 0		
TOTAL ORGANIC CARBON (ppm)	4.3	4.3	4.3	4.3							
URANIUM (mg/L)	140	140	140	140							
NOTES											

NOTES

1. ONE MULTIMEDIA FILTER REMAINS IN STAND-BY CONDITION.
2. ONE BAG FILTER REMAINS IN STAND-BY CONDITION.
3. REGENERANT PROCESS AREA SUMP PUMP SHOWN ON SK-F-01255.

7343

MAJOR EQUIPMENT LIST

MARK	QTY	EQUIPMENT NAME
A	5	MULTIMEDIA FILTER
B	2	BAG FILTER
C	1	BACKWASH SURGE TANK
D	2	BACKWASH TRANSFER PUMP
E	1	BACKWASH SURGE TANK AGITATOR

000078

REFER DWG NO.	REFERENCE DWG TITLE
SK-F-01251	EQUALIZATION - SOUTH PLUME
SK-F-01253	CARBON ADSORPTION - SOUTH PLUME
SK-F-01254	ION EXCHANGE - SOUTH PLUME
SK-F-01255	REGENERATION TREATMENT

LEGEND

MAIN PROCESS FLOW LINES

SECONDARY PROCESS OR SERVICE LINES

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	DATE
1	ISSUED FOR DCR			
0	ISSUED FOR FINAL EECER			

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
GROUNDWATER REMEDIATION

DRAWING TITLE
PROCESS
PROCESS FLOW DIAGRAM
FILTRATION - SOUTH PLUME

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. C. TAYLOR	1-19-93	K. L. NAYAR	08-27-93	K. STRADFORD	08-17-93

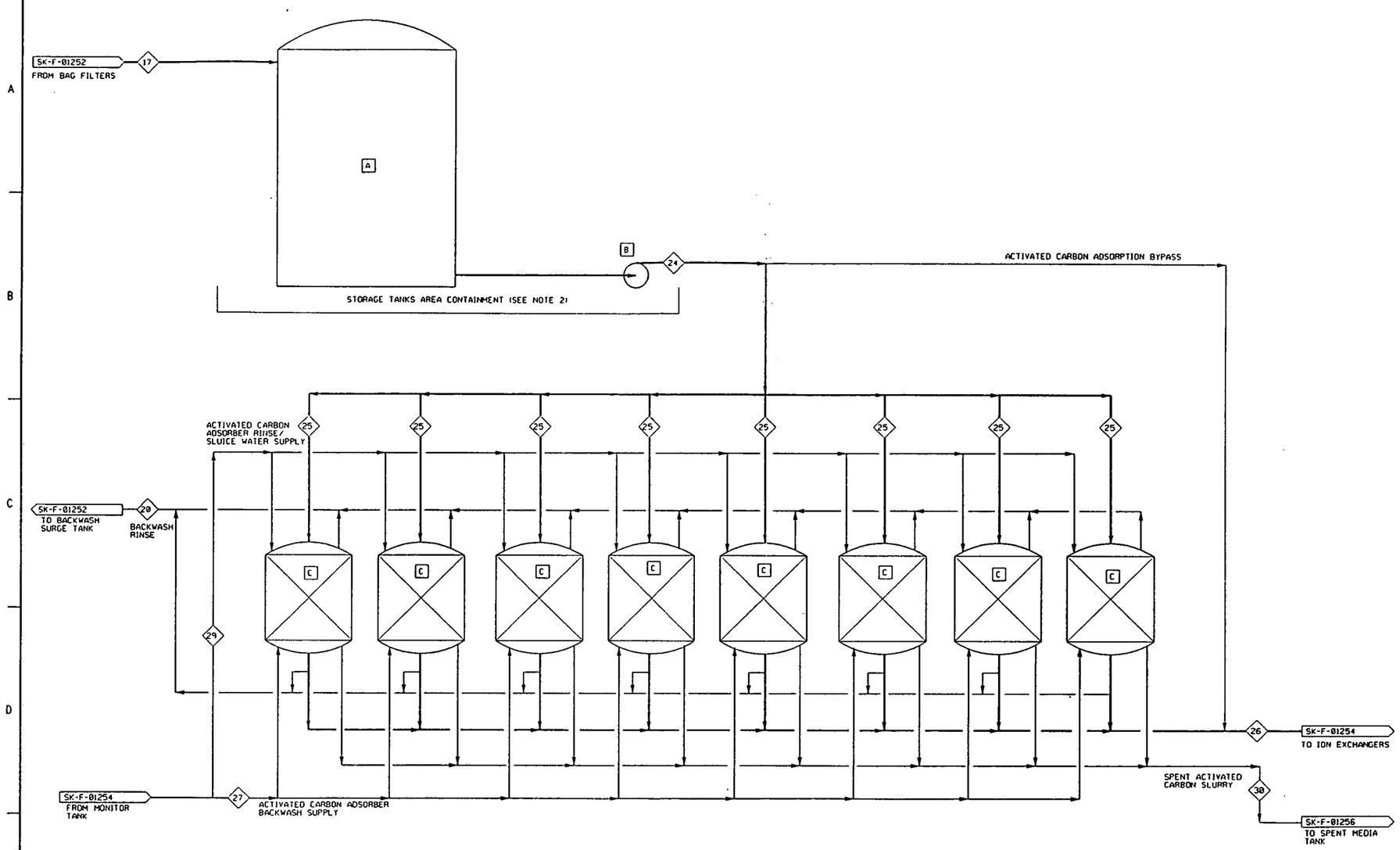
PLANT/BLDG. NO. | FLOOR | SCALE: NTS | CLASS

SUBMITTED FOR APPROVAL | FERNCO CRU APPROVAL | A-E | DATE

DOE PROJECT NO.	TEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
	WBS 1.1.1.1.5.3.1 00-90701	SK-F-01252	F0002	1

PREPARED UNDER PARSONS PROJECT ORDER NUMBER CRU5/PD69

skf01253.m1(6656.ws426) po69@ws426. Thu Sep 1 15:55:20 EDT 1994



STREAM NO.	17	20	24	25	26	27	29	30
COMPONENT	FILTERED WATER	CARBON BACKWASH/ RINSE	BREAK TANK DISCHARGE	CARBON ADSORBER FEED	CARBON ADSORBER EFFLUENT	BACKWASH SUPPLY	RINSE/ SLUICE	SPENT CARBON SLURRY
OPERATING (HR/DAY)	24	INTERMITTENT	24	24	24	INTERMITTENT	INTERMITTENT	INTERMITTENT
FLOWRATE (GPM)	2500	800/135	2500	357	2500	800	375/50	55
PRESSURE (feet)	50	80	160	160	125	115	115	70
TEMPERATURE (deg F)	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
SPECIFIC GRAVITY	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1
VISCOSITY (cP)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	TBD
CONCENTRATION (%)								18.3
DISSOLVED OXYGEN (NOMINAL) (mg/L)	2.0		2.0	2.0	2.0			
pH (NOMINAL)	7.4	7.0	7.4	7.4	7.4	7.0	7.0	7.0
TOTAL SUSPENDED SOLIDS (mg/L)	~ 0		~ 0	0	~ 0			
TOTAL SUSPENDED SOLIDS (%)		~ 0						
TOTAL ORGANIC CARBON (ppm)	0.12		0.12	0.12	~ 0			
URANIUM (ug/L)	140	TBD	100	140	140			TBD
IRON (mg/L)								TBD

NOTES

1. ONE ACTIVATED CARBON ADSORBER REMAINS IN STAND-BY CONDITION.
2. STORAGE TANKS AREA SUMP PUMP SHOWN ON SKETCH SK-F-01251.

F2343

MAJOR EQUIPMENT LIST

MARK	QTY	EQUIPMENT NAME
A	1	BREAK TANK
B	2	BREAK TANK DISCHARGE PUMP
C	8	ACTIVATED CARBON ADSORBER

000079

REFER DWG NO.	REFERENCE DWG TITLE
SK-F-01252	FILTRATION - SOUTH PLUME
SK-F-01254	ION EXCHANGE - SOUTH PLUME
SK-F-01256	MEDIA HANDLING

LEGEND

MAIN PROCESS FLOW LINES
SECONDARY PROCESS FLOW OR SERVICE LINES

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	DATE
1	ISSUED FOR DCR			
0	ISSUED FOR FINAL EECER			

INITIALS AND DATE

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
GROUNDWATER REMEDIATION

DRAWING TITLE
PROCESS
PROCESS FLOW DIAGRAM
CARBON ADSORPTION - SOUTH PLUME

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. C. TAYLOR	1-19-93	K. L. NAYAR	12-22-93	K. STRADFORD	12-22-93

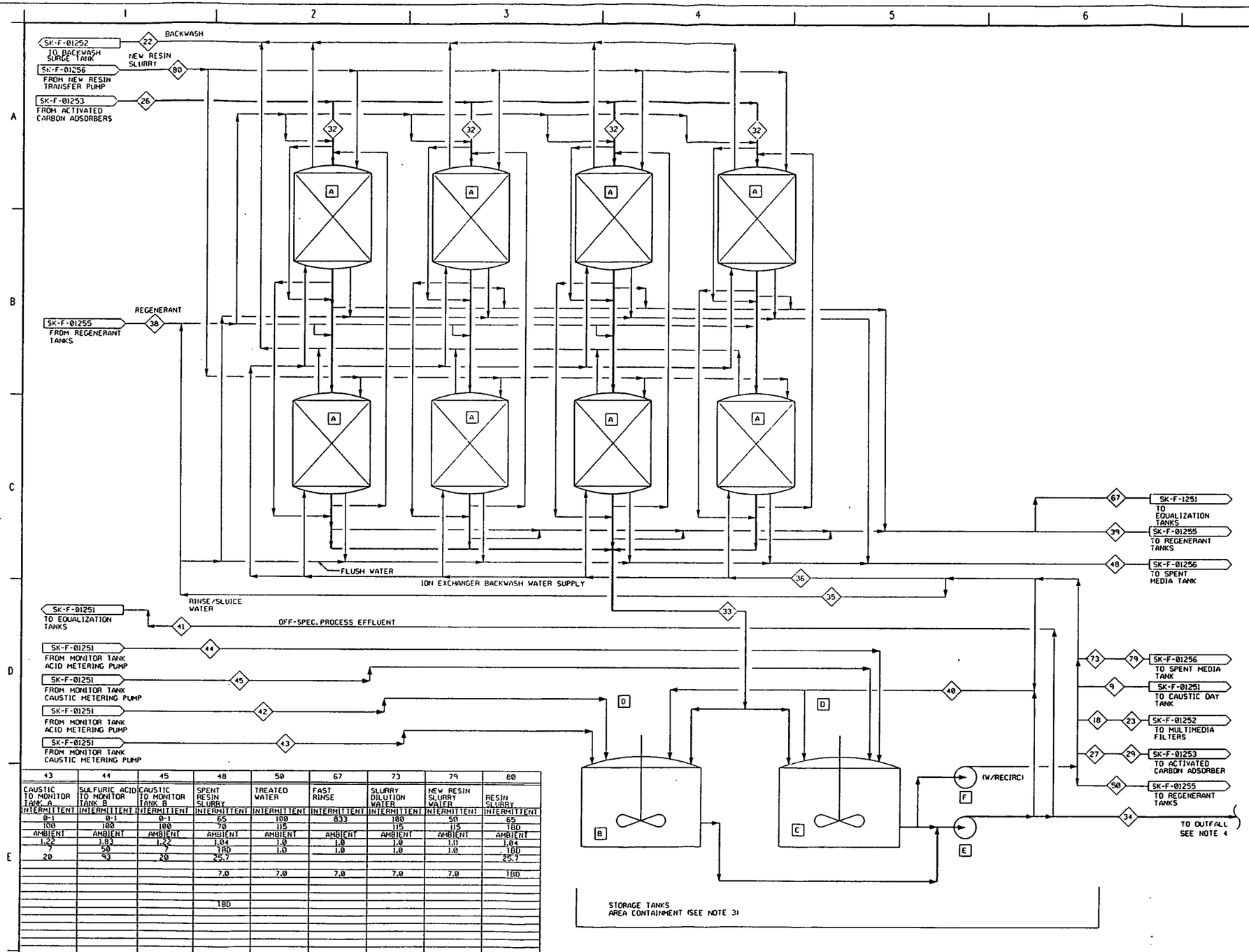
PLANT/BLDG. NO. | FLOOR | SCALE: NTS | CLASS

SUBMITTED FOR APPROVAL | FERNCO CRU APPROVAL

A-E | DATE | DATE

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING SHEET CODE NO.	SHEET NO.	REV. NO.
CRU5/P069		WBS 1.1.1.5.3.1 00-90701	SK-F-01253	F0003	1

skf01254.m(6657.ws426) po69@ws426. Thu Sep 1 15:55:52 EDT 1994



43	44	45	48	50	67	73	79	80
CAUSTIC TO MONITOR TANK A	SULFURIC ACID TO MONITOR TANK B	CAUSTIC TO MONITOR TANK B	SPENT RESIN SLURRY	TREATED WATER	FAST RINSE	SLURRY DILUTION WATER	NEW RESIN SLURRY WATER	RESIN SLURRY
INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT
0-1	0-1	0-1	65	100	833	100	50	65
100	100	100	70	115		115	115	TBD
AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
1.22	1.83	1.22	1.04	1.0	1.0	1.0	1.0	1.04
7	50	7	TBD	1.0	1.0	1.0	1.0	TBD
20	93	20	25.7					25.7
			7.0	7.0	7.0	7.0	7.0	TBD
			TBD					

STREAM NO.	9	18	22	23	26	27	29	32	33	34	35	36	38	39	40	41	42
COMPONENT	TREATED WATER	TREATED WATER	ION EXCHANG BACKWASH E	MULTIMEDIA FILTER RINS SUPPLY	CARBON ADSORBER EFFLUENT	BACKWASH SUPPLY	RINSE/ SLUICE	ION EXCHANGER FEED	ION EXCHANGER EFFLUENT	TREATED GROUNDWATER	RINSE/SLUICE WATER	BACKWASH SUPPLY	REGENERANT SOLUTION	SPENT REGEN SOLUTION/ SLOW RINSE	RECYCLE TO MONITOR TANK	RECYCLE TO EQUALIZATION TANK	SULFURIC ACID TO MONITOR TANK A
OPERATING (HR/DAY)	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	24	INTERMITTENT	INTERMITTENT	24	24	24	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT
FLOW RATE (GPM)	20	1200	250	800	2500	800	375/50	833	2500	2500	320/833/50	250	320	320	2500	2500	0-1
PRESSURE (feet)	115	115	80		125	115	115	125	125	98	115	115	80	45	90	90	180
TEMPERATURE (deg F)	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
SPECIFIC GRAVITY	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	TBD	TBD	1.0	1.0	1.83
VISCOSITY (cP)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	TBD	TBD	1.0	1.0	50
CONCENTRATION (%)													TBD	TBD			93
DISSOLVED OXYGEN (NOMINAL) (mg/L)					2.0			2.0	2.0	2.0					2.0	2.0	
pH (NOMINAL)	7.0	7.0	7.0		7.4	7.0	7.0	7.4	7.4	7.4	7.0	7.0	TBD				
TOTAL SUSPENDED SOLIDS (mg/l)					~ 0			~ 0	~ 0	~ 0							
TOTAL SUSPENDED SOLIDS (%)			~ 0														
TOTAL ORGANIC CARBON (ppm)					~ 0			~ 0	~ 0	~ 0					~ 0	~ 0	
URANIUM (ug/l)					140			140	<20	<20			TBD	TBD	<20	>20	
NOTES										4	5						

NOTES

1. ONE ION EXCHANGE PAIR REMAINS IN STANDBY CONDITION.
2. ION EXCHANGE UNITS ALTERNATE LEAD LAG OPERATION WHEN LEAD UNIT REQUIRES REGENERATION.
3. STORAGE TANKS AREA SUMP PUMP SHOWN ON SKETCH SK-F-01251.
4. STREAM 34 TO OUTFALL WILL UNDERGO AERATION IN THE EXISTING FACILITY TO BRING DISSOLVED OXYGEN LEVEL TO 5.0 mg/L MIN.
5. IX SLOW RINSE WILL GO TO THE ELUATE STORAGE TANK AND FAST RINSE WILL GO TO EQUALIZATION TANK.

F-7343

MAJOR EQUIPMENT LIST

MARK	QTY	EQUIPMENT NAME
A	8	ION EXCHANGE COLUMN
B	1	MONITOR TANK A
C	1	MONITOR TANK B
D	2	MONITOR TANK AGITATOR
E	2	MONITOR TANK PUMP
F	2	MONITOR TANK RECIRC PUMP

000080

LEGEND

MAIN PROCESS FLOW LINES

SECONDARY PROCESS FLOW OR SERVICE LINES

REFER DWG NO.	REFERENCE DWG TITLE
SK-F-01251	EQUALIZATION - SOUTH PLUME
SK-F-01252	FILTRATION - SOUTH PLUME
SK-F-01253	CARBON ADSORPTION - SOUTH PLUME
SK-F-01255	REGENERATION TREATMENT
SK-F-01256	MEDIA HANDLING

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	TEMPO	DATE
1	ISSUED FOR DCR			
0	ISSUED FOR FINAL EECER			

INITIALS AND DATE

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
GROUNDWATER REMEDIATION

DRAWING TITLE
PROCESS
PROCESS FLOW DIAGRAM
ION EXCHANGE - SOUTH PLUME

DRAWN BY	DATE	LEAD ENGINEER	DATE	ORDERED BY	DATE
R. C. TAYLOR	1-19-93	K. L. NAYAR	08-27-93	K. STRADFORD	08-27-93

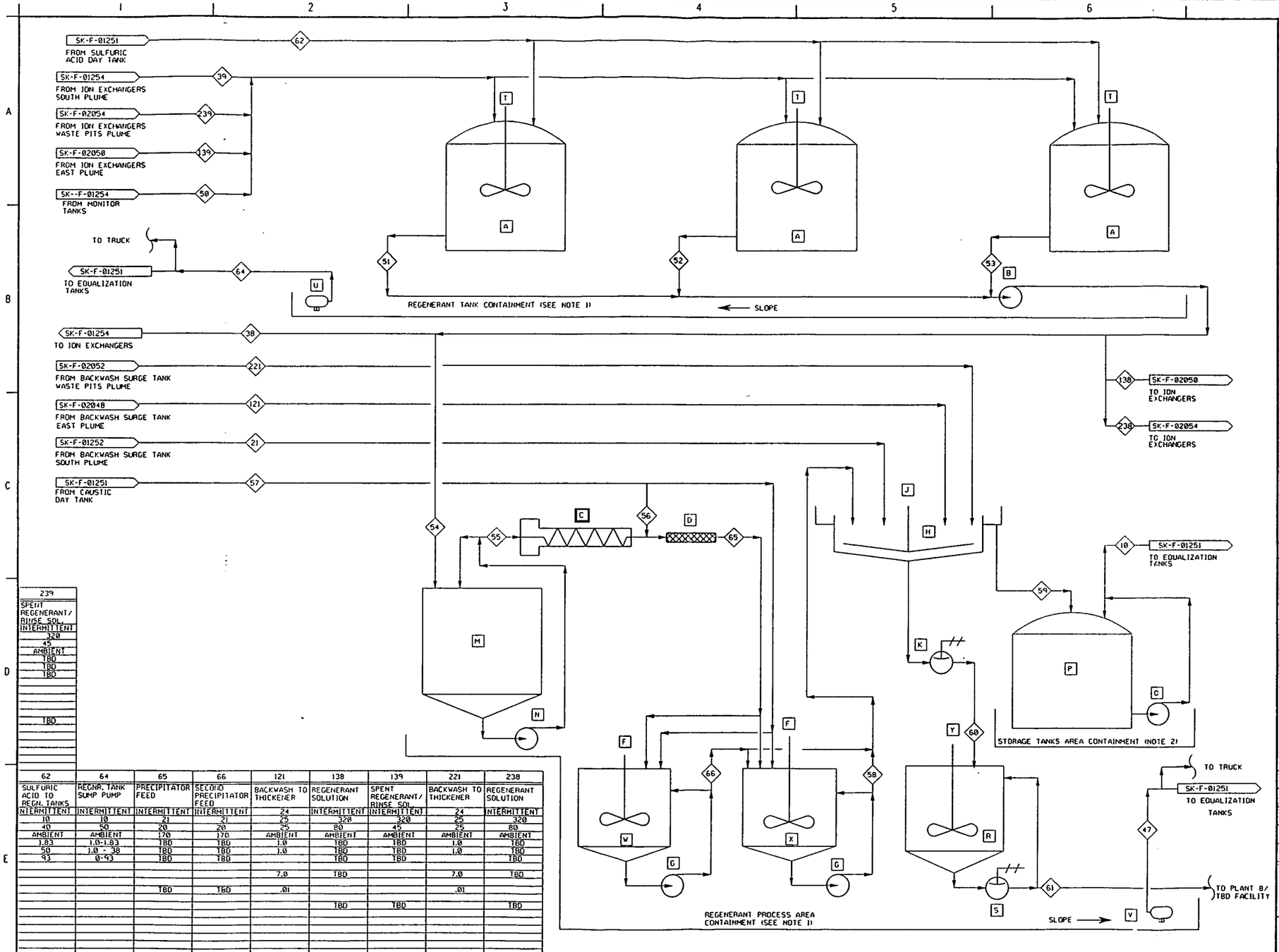
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NTS	

SUBMITTED FOR APPROVAL | FERNCO CRU APPROVAL

A-E DATE	DOE PROJECT NO.	TEMP PROJECT NO.	DATE	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
		WBS 1.1.1.1.5.3.1 00-90701		SK-F-01254	F0004	1

PREPARED UNDER PARSONS PROJECT ORDER NUMBER: CRU5/P069

skf01255.m1(6658.ws426) pc69@ws426. Thu Sep 1 15:57:52 EDT 1994



239
SPENT REGENERANT/ RINSE SOL.
INTERMITTENT
320
45
AMBIENT
TBD
TBD
TBD
TBD

62	64	65	66	121	138	139	221	238
SULFURIC ACID TO REGN. TANKS	REGNR. TANK SUMP PUMP	PRECIPITATOR FEED	SECOND PRECIPITATOR FEED	BACKWASH TO THICKENER	REGENERANT SOLUTION	SPENT REGENERANT/ RINSE SOL.	BACKWASH TO THICKENER	REGENERANT SOLUTION
INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	24	INTERMITTENT	INTERMITTENT	24	INTERMITTENT
10	10	21	21	25	320	320	25	320
40	50	20	20	25	80	45	25	80
AMBIENT	AMBIENT	170	170	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
1.83	1.0-1.83	TBD	TBD	1.0	TBD	TBD	1.0	TBD
50	1.0 - 38	TBD	TBD	1.0	TBD	TBD	1.0	TBD
93	0-93	TBD	TBD		TBD	TBD		TBD
				7.0	TBD		7.0	TBD
		TBD	TBD	.01			.01	
					TBD	TBD		TBD

STREAM NO.	10	21	38	39	47	50	51	52	53	54	55	56	57	58	59	60	61
COMPONENT	TREATED ELUATE	BACKWASH TO THICKENER	REGENERANT SOLUTION	SPENT REGENERANT/ RINSE SOL.	REGEN PROCESS AREA SUMP PUMP DISCH.	TREATED WATER	REGENERANT SOLUTION	REGENERANT SOLUTION	REGENERANT SOLUTION	ELUATE/ SLOW RINSE	ELUATE/ SLOW RINSE	20% CAUSTIC	20% CAUSTIC TO PRECIPITATORS	THICKENER FEED	THICKENER OVERFLOW	THICKENER UNDERFLOW	WASTE SLURRY
OPERATING (HR/DAY)	INTERMITTENT	24	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT
FLOWRATE (GPM)	50	25	320	320	50	100	320	320	320	320	20	1.0	2.0	22	46	1.0	50
PRESSURE (feet)	45	25	80	45	50	115	3	3	3	35	70	30	100	20	20	30	250
TEMPERATURE (deg F)	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	TBD	TBD	TBD	AMBIENT
SPECIFIC GRAVITY	1.0	1.0	TBD	TBD	1.0	1.0	TBD	TBD	TBD	TBD	TBD	1.22	1.22	TBD	1.0	1.02	1.02
VISCOSITY (cP)	1.0	1.0	TBD	TBD	1.0	1.0	TBD	TBD	TBD	TBD	TBD	7	7	TBD	1.0	1.0	1.0
CONCENTRATION (%)			TBD	TBD	TBD		TBD	TBD	TBD	TBD	TBD	20	20	TBD		2.5	2.5
DISSOLVED OXYGEN (NOMINAL) (mg/L)																	
pH (NOMINAL)	TBD	7.0	TBD			7.0					TBD				TBD	TBD	TBD
TOTAL SUSPENDED SOLIDS (mg/L)																	
TOTAL SUSPENDED SOLIDS (%)		0.1												TBD			
TOTAL ORGANIC CARBON (ppm)																	
URANIUM (ug/L)	TBD		TBD	TBD			TBD	TBD	TBD	TBD	TBD			TBD	TBD	TBD	TBD

NOTES

1. RAINWATER WILL BE SENT TO EQUALIZATION TANKS. CHEMICAL SPILLS WILL BE SENT BY TRUCK FOR FURTHER TREATMENT.
2. STORAGE TANKS AREA SUMP PUMP SHOWN ON SKETCH SK-F-01251.

F-7343

MAJOR EQUIPMENT LIST

MARK	QTY	EQUIPMENT NAME
A	3	REGENERANT TANK
B	2	REGENERANT PUMP
C	1	ELECTRIC HEAT EXCHANGER
D	1	STATIC MIXER
F	2	PRECIPITATOR AGITATOR
G	4	PRECIPITATOR PUMPS
H	1	THICKENER
J	1	THICKENER RAKE
K	2	THICKENER UNDERFLOW PUMP
M	1	ELUATE STORAGE TANK
N	2	ELUATE PUMP
P	1	TREATED ELUATE TANK
Q	2	TREATED ELUATE DISCHARGE PUMP
R	1	WASTE SLURRY SURGE TANK
S	2	WASTE SLURRY DISCHARGE PUMP
T	3	REGENERANT TANK AGITATOR
U	1	REGENERANT TANK SUMP PUMP
V	1	REGENERANT PROCESS AREA SUMP PUMP
W	1	FIRST PRECIPITATOR
X	1	SECOND PRECIPITATOR
Y	1	WASTE SLURRY SURGE TANK AGITATOR

000081

REFER DWG NO.	REFERENCE DWG TITLE
SK-F-01251	EQUALIZATION - SOUTH PLUME
SK-F-01252	FILTRATION - SOUTH PLUME
SK-F-01254	ION EXCHANGE - SOUTH PLUME
SK-F-02048	FILTRATION - EAST PLUME
SK-F-02050	ION EXCHANGE - EAST PLUME
SK-F-02052	FILTRATION - WASTE PITS PLUME
SK-F-02054	ION EXCHANGE - WASTE PITS PLUME

LEGEND

MAIN PROCESS FLOW LINES
SECONDARY PROCESS OR SERVICE LINES

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	DATE
1	ISSUED FOR DCR			
0	ISSUED FOR FINAL EECER			

INITIALS AND DATE

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
GROUND WATER REMEDIATION

DRAWING TITLE
PROCESS
PROCESS FLOW DIAGRAM
REGENERATION TREATMENT

DRAWN BY	DATE	LEAD DRAWER	DATE	CHECKED BY	DATE
R. C. TAYLOR	1-19-93	K. L. NAYAR	08-27-93	K. STRADFORD	08-17-93

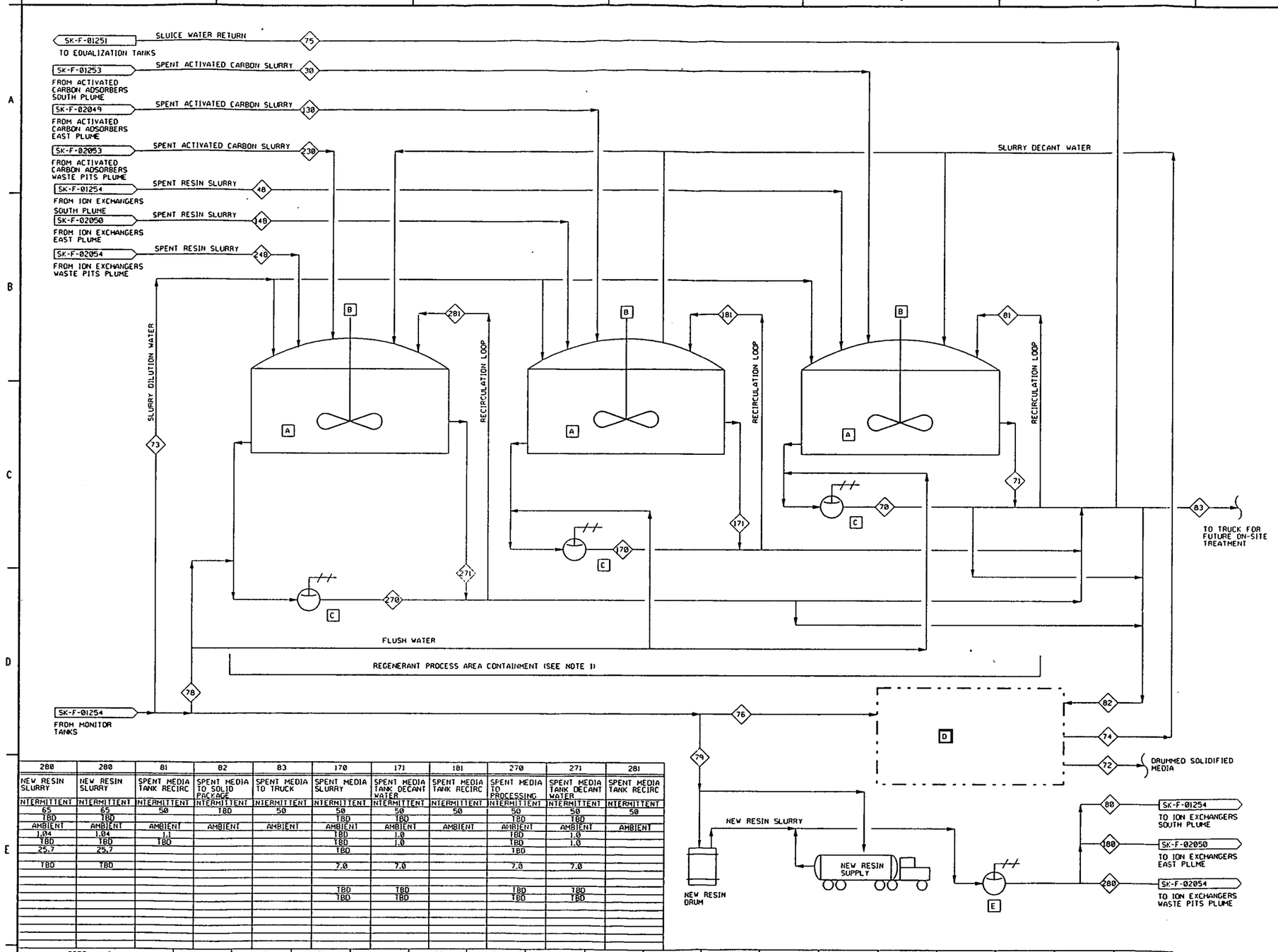
PLANT/BLDG NO.	FLOOR	SCALE	CLASS
		NTS	

SUBMITTED FOR APPROVAL | FERNCO CRU APPROVAL

A-E DOE PROJECT NO.	DATE	FEMP PROJECT NO.	DATE	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
		WBS 1.1.1.5.3.1 00-90701		SK-F-01255	F0005	1

PREPARED UNDER PARSONS PROJECT ORDER NUMBER
CRU5/P069

skf01256.m1(6659.ws426) po69@ws426. Thu Sep 1 15:59:52 EDT 1994



280	280	81	82	83	170	171	181	270	271	281
NEW RESIN SLURRY	NEW RESIN SLURRY	SPENT MEDIA TANK RECIRC	SPENT MEDIA TO SOLID PACKAGE	SPENT MEDIA TO TRUCK	SPENT MEDIA SLURRY	SPENT MEDIA TANK DECANT WATER	SPENT MEDIA TANK RECIRC	SPENT MEDIA TO PROCESSING	SPENT MEDIA TANK DECANT WATER	SPENT MEDIA TANK RECIRC
INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT
65	65	50	TBD	50	50	50	50	50	50	50
TBD	TBD				TBD	TBD		TBD	TBD	
AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
1.04	1.04	1.1			TBD	1.0		TBD	1.0	
TBD	TBD	TBD			TBD	1.0		TBD	1.0	
25.7	25.7				TBD			TBD		
TBD	TBD				7.0	7.0		7.0	7.0	
					TBD	TBD		TBD	TBD	
					TBD	TBD		TBD	TBD	

STREAM NO.	30	48	70	71	72	73	74	75	76	78	79	80	130	148	180	230	248
COMPONENT	SPENT CARBON SLURRY	SPENT RESIN SLURRY	SPENT MEDIA TO PROCESSING	SPENT MEDIA TANK DECANT WATER	SOLIDIFIED MEDIA	SLURRY DILUTION WATER	SLURRY DECANT WATER	SLUICE WATER RETURN	SOLIDIFICATION PROCESS WATER	FLUSH WATER	NEW RESIN SLURRY WATER	NEW RESIN SLURRY	SPENT CARBON SLURRY	SPENT RESIN SLURRY	NEW RESIN SLURRY	SPENT CARBON SLURRY	SPENT RESIN SLURRY
OPERATING (HR/DAY)	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT
FLOWRATE (GPM)	55	65	50	50		100	50	50	TBD	50	50	65	55	65	65	55	65
PRESSURE (feet)	70	70	TBD	TBD		115	TBD	TBD	115	115	115	TBD	70	70	TBD	70	70
TEMPERATURE (deg F)	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
SPECIFIC GRAVITY	1.1	1.04	TBD	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.04	1.1	1.04	1.04	1.1	1.04
VISCOSITY (cP)	TBD	TBD	TBD	1.0		1.0	1.0	1.0	1.0	1.0	1.0	TBD	TBD	TBD	TBD	TBD	TBD
CONCENTRATION (%)	18.3	25.7	TBD									25.7	18.3	25.7	25.7	18.3	25.7
DISSOLVED OXYGEN (NOMINAL) (mg/L)																	
pH (NOMINAL)	7.0	7.0	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0	TBD	7.0	7.0	TBD	7.0	7.0
TOTAL SUSPENDED SOLIDS (mg/L)																	
TOTAL SUSPENDED SOLIDS (%)																	
TOTAL ORGANIC CARBON (ppm)	TBD		TBD	TBD	TBD		TBD	TBD					TBD			TBD	
URANIUM (ug/l)	TBD	TBD	TBD	TBD	TBD		TBD	TBD					TBD	TBD		TBD	TBD

NOTES

1. REGENERANT PROCESS AREA CONTAINMENT SUMP PUMP SHOWN ON SKETCH SK-F-01255.

F-7343

MAJOR EQUIPMENT LIST

MARK	QTY	EQUIPMENT NAME
A	3	SPENT MEDIA TANK
B	3	SPENT MEDIA AGITATOR
C	6	SPENT MEDIA TRANSFER PUMP
D	1	VENDOR SOLIDIFICATION PACKAGE
E	1	NEW RESIN TRANSFER PUMP

000082

REFER DWG NO.	REFERENCE DWG TITLE
SK-F-01251	EQUALIZATION - SOUTH PLUME
SK-F-01253	CARBON ADSORPTION - SOUTH PLUME
SK-F-01254	ION EXCHANGE - SOUTH PLUME
SK-F-02049	CARBON ADSORBTION - EAST PLUME
SK-F-02050	ION EXCHANGE - EAST PLUME
SK-F-02053	CARBON ADSORBTION - WASTE PITS PLUME
SK-F-02054	ION EXCHANGE - WASTE PITS PLUME

LEGEND
MAIN PROCESS FLOW LINES
SECONDARY PROCESS OR SERVICE LINES

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	DATE
1	ISSUED FOR DCR			
0	ISSUED FOR FINAL EECER			

INITIALS AND DATE

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
GROUNDWATER REMEDIATION

DRAWING TITLE
PROCESS
PROCESS FLOW DIAGRAM
MEDIA HANDLING

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. C. TAYLOR	1-19-93	K. L. NAYAR	08-27-93	K. STRADFORD	08-17-93

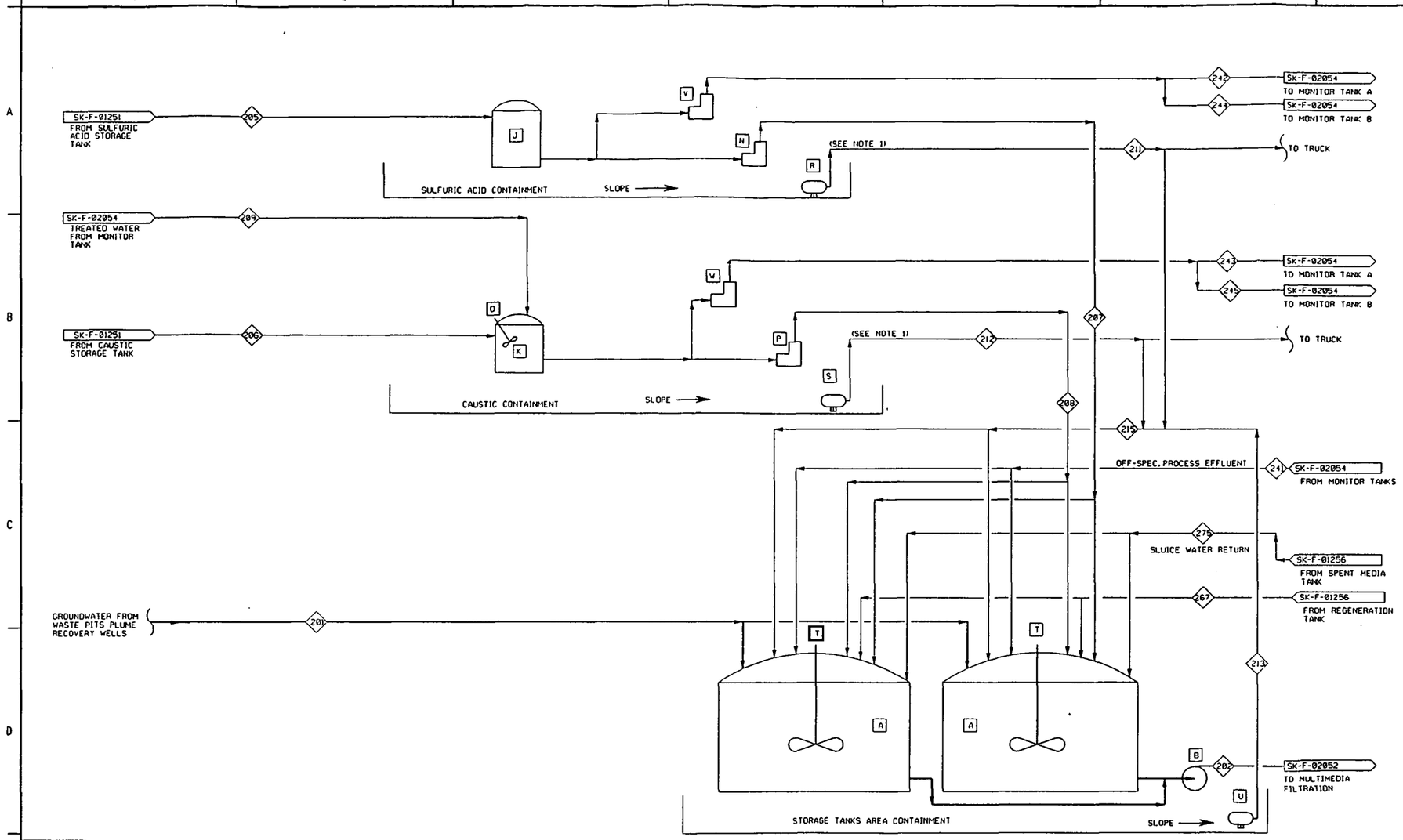
PLANT/BLDG. NO. | FLOOR | SCALE: NTS | CLASS

SUBMITTED FOR APPROVAL | FERNCO CRU APPROVAL

A-E | DATE | DOE PROJECT NO. | FEMP PROJECT NO. WBS 1.1.1.1.5.3.1 00-90701 | DATE | DRAWING INDEX CODE NO. SK-F-01256 | SHEET NO. F0006 | REV. NO. 1

PREPARED UNDER PARSONS PROJECT ORDER NUMBER CRU5/P069

sk02051.m(6660).ws426) po69@ws426. Thu Sep 1 16:02:02 EDT 1994



275
SLUICE WATER RETURN
INTERMITTENT
50
TBD
AMBIENT
1.0
1.0
7.0
TBD
TBD

STREAM NO.	201	202	205	206	207	208	209	211	212	213	215	241	242	243	244	245	267
COMPONENT	GROUND WATER	EQUALIZED GROUND WATER	CONCENTRATED SULFURIC ACID	50% CAUSTIC	CONCENTRATED SULFURIC ACID	20% CAUSTIC	TREATED WATER	SULFURIC ACID SUMP PUMP	CAUSTIC SUMP PUMP	STG. TANKS SUMP PUMP	SUMP WATER	RECYCLE FROM MONIT. TANK	SULF. ACID TO MONITOR TANK A	CAUSTIC TO MONITOR TANK A	SULF. ACID TO MONITOR TANK B	CAUSTIC TO MONITOR TANK B	FAST RINSE
OPERATING (HR/DAY)	24	24	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT
FLOW RATE (GPM)	2500	≥2500	20	20	0-1	0-1	20	10	10	50	100	2500	0-1	0-1	0-1	0-1	833
PRESSURE ((feet)	TBD	120	25	25	100	100	115	50	50	50	50	90	100	100	100	100	
TEMPERATURE (deg F)	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
SPECIFIC GRAVITY	1.0	1.0	1.83	1.51	1.83	1.22	1.0	1.0-1.83	1.0-1.53	1.0-1.32	1.0	1.0	1.83	1.22	1.83	1.22	1.0
VISCOSITY (cP)	1.0	1.0	50	100	50	7	1.0	50	100	1.0	1.0	1.0	50	7	50	7	1.0
CONCENTRATION (%)			93	50	93	20		0-93	0-50	0-48			93	20	93	20	
DISSOLVED OXYGEN (NOMINAL) (mg/l)	2.0	2.0										2.0					
pH (NOMINAL)	7.4	7.4					7.0										
TOTAL SUSPENDED SOLIDS (mg/L)	3.0	3.0															
TOTAL SUSPENDED SOLIDS (%)																	
TOTAL ORGANIC CARBON (ppm)	10	10										~ 0					
URANIUM (ug/L)	100	100										>20					
NOTES																	

NOTES

1. RAINWATER WILL BE PUMPED TO EQUALIZATION TANKS. ACID OR CAUSTIC SPILLS WILL BE SENT BY TRUCK FOR FURTHER TREATMENT.
2. URANIUM CONCENTRATION FOR WASTE PITS PLUME IS ASSUMED 100ug/l.

F-7343

MAJOR EQUIPMENT LIST

MARK	QTY	EQUIPMENT NAME
A	2	EQUALIZATION TANK
B	2	EQUALIZATION TANK DISCHARGE PUMP
J	1	SULFURIC ACID DAY TANK
K	1	CAUSTIC DAY TANK
N	2	EQUALIZATION TANK ACID METERING PUMP
P	2	EQUALIZATION TANK CAUSTIC METERING PUMP
O	1	CAUSTIC DAY TANK AGITATOR
R	1	SULFURIC ACID SUMP PUMP
S	1	CAUSTIC SUMP PUMP
T	2	EQUALIZATION TANK AGITATOR
U	1	STORAGE TANKS AREA SUMP PUMP
V	3	MONITOR TANK ACID METERING PUMP
W	3	MONITOR TANK CAUSTIC METERING PUMP

000083

REFER DWG NO.	REFERENCE DWG TITLE
SK-F-02052	FILTRATION - WASTE PITS PLUME
SK-F-02053	ION EXCHANGE - WASTE PITS PLUME
SK-F-01251	EQUALIZATION - SOUTH PLUME
SK-F-01255	REGENERATION TREATMENT
SK-F-01256	MEDIA HANDLING

LEGEND

MAIN PROCESS FLOW LINES
SECONDARY PROCESS OR SERVICE LINES

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	DATE
1	ISSUED FOR DCR			
0	ISSUED FOR FINAL EECER			

INITIALS AND DATE

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
GROUNDWATER REMEDIATION

DRAWING TITLE
PROCESS
PROCESS FLOW DIAGRAM
EQUALIZATION - WASTE PITS PLUME

DRAWN BY	DATE	LEAD ENGINEER	DATE	ENGINEER	DATE
J. LAWSON	07-22-93	K. L. NAYAR	08-27-93	K. STRADFORD	08-17-93

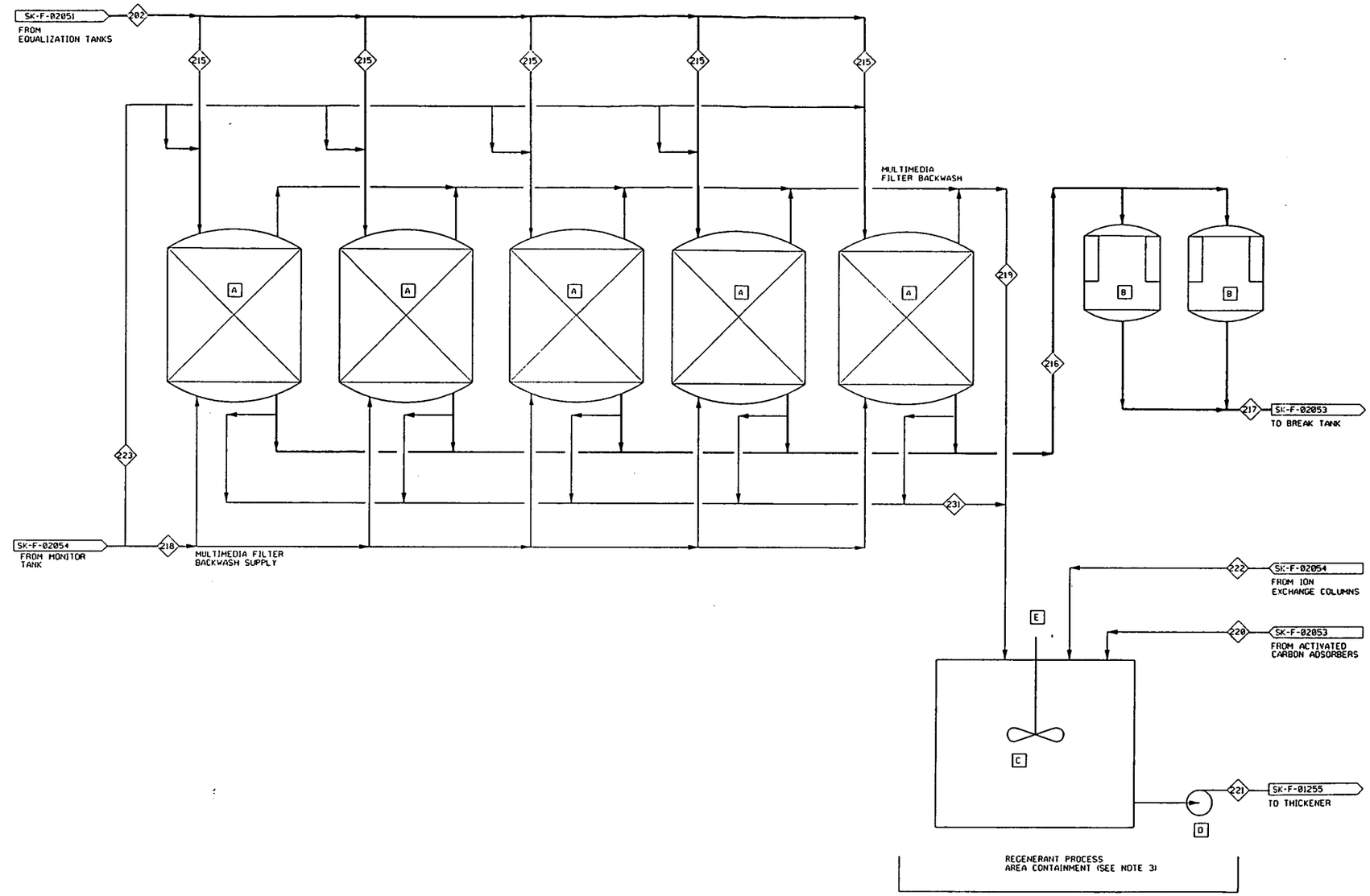
PLANT/BLDG. NO. | FLOOR | SCALE NONE | CLASS

SUBMITTED FOR APPROVAL | FERNCO CRU APPROVAL | A-E DATE | DATE

PREPARED UNDER PARSONS PROJECT ORDER NUMBER CRU5/P069

A-E DOE PROJECT NO.	TEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
	VBS 1.1.1.5.3.1 00-90701	SK-F-02051	F0011	1

sk(02052.m)(6661.ws426) po69@ws426. Thu Sep 1 16:03:54 EDT 1994



STREAM NO.	202	215	216	217	218	219	220	221	222	223	231
COMPONENT	EQUALIZED GROUNDWATER	MULTIMEDIA FILTER FEED	BAG FILTER FEED	FILTERED WATER	TREATED WATER	MULTIMEDIA FILTER BACKWASH/RINSE	CARBON BACKWASH/RINSE	BACKWASH TO THICKENER	ION EXCHANGE BACKWASH	MULTIMEDIA FILTER RINSE SUPPLY	MULTIMEDIA FILTER RINSE EFFLUENT
OPERATING (HR/DAY)	24	24	24	24	INTERMITTENT	INTERMITTENT	INTERMITTENT	24	INTERMITTENT	INTERMITTENT	INTERMITTENT
FLOW RATE (GPM)	2500	625	2500	2500	1200	1200/800	800/375	25	250	800	800
PRESSURE (feet)	120	120	85	50	115	80	80	25	80		
TEMPERATURE (deg F)	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
SPECIFIC GRAVITY	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
VISCOSITY (cP)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
CONCENTRATION (%)											
DISSOLVED OXYGEN (NOMINAL) (mg/l)	2.0	2.0	2.0	2.0							
pH (NOMINAL)	7.4	7.4	7.4	7.4	7.0	7.0	7.0	7.0	7.0		
TOTAL SUSPENDED SOLIDS (mg/L)	3.0	3.0	0.3	~ 0							
TOTAL SUSPENDED SOLIDS (%)						0.1	~ 0	0.1	~ 0		
TOTAL ORGANIC CARBON (ppm)	10	10	10	10							
URANIUM (µg/L)	100	100	100	100			TBD				
NOTES											

NOTES

1. ONE MULTIMEDIA FILTER REMAINS IN STAND-BY CONDITION.
2. ONE BAG FILTER REMAINS IN STAND-BY CONDITION.
3. REGENERANT PROCESS AREA SUMP PUMP SHOWN ON SK-F-01255.

F-7343

MAJOR EQUIPMENT LIST

MARK	QTY	EQUIPMENT NAME
A	5	MULTIMEDIA FILTER
B	2	BAG FILTER
C	1	BACKWASH SURGE TANK
D	2	BACKWASH TRANSFER PUMP
E	1	BACKWASH SURGE TANK AGITATOR

000034

REFER DWG NO.	REFERENCE DWG TITLE
SK-F-02051	EQUALIZATION - WASTE PITS PLUME
SK-F-02053	CARBON ADSORBTION - WASTE PITS PLUME
SK-F-02054	ION EXCHANGE - WASTE PITS PLUME
SK-F-01255	REGENERATION TREATMENT

LEGEND

MAIN PROCESS FLOW LINES

SECONDARY PROCESS OR SERVICE LINES

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	BWM
1	ISSUED FOR DCR			
0	ISSUED FOR FINAL EECER			

INITIALS AND DATE

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
GROUNDWATER REMEDIATION

DRAWING TITLE
PROCESS
PROCESS FLOW DIAGRAM
FILTRATION - WASTE PITS PLUME

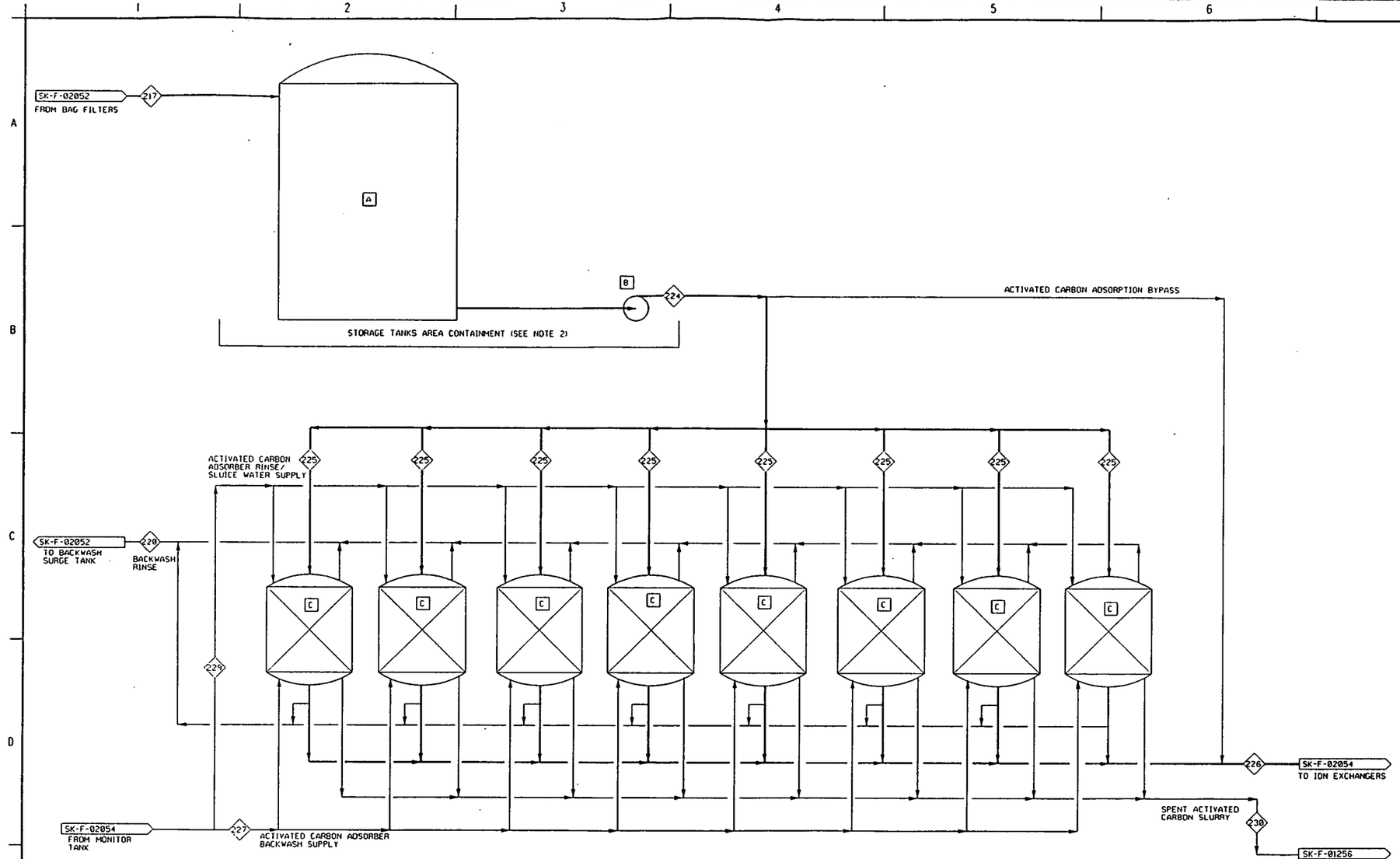
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
J. LAWSON	1-22-93	K. L. NAYAR	08-27-93	K. STRADFORD	08-17-93

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL — A-E DATE
FERNCO CRU APPROVAL — DATE

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO	REV. NO
CRU5/P069		WBS 1.1.1.1.5.3.1 00-90701	SK-F-02052	F0012	1

skf02053.m1(6662.ws426) po69@ws426. Thu Sep 1 16:05:35 EDT 1994



STREAM NO.	217	220	224	225	226	227	229	230
COMPONENT	FILTERED WATER	CARBON BACKWASH/ RINSE	BREAK TANK DISCHARGE	CARBON ADSORBER FEED	CARBON ADSORBER EFFLUENT	BACKWASH SUPPLY	RINSE/ SLUICE	SPENT CARBON SLURRY
OPERATING (HR/DAY)	24	INTERMITTENT	24	24	24	INTERMITTENT	INTERMITTENT	INTERMITTENT
FLOWRATE (GPM)	2500	800/135	2500	357	2500	800	375/50	55
PRESSURE (feet)	50	80	160	160	125	115	115	70
TEMPERATURE (deg F)	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
SPECIFIC GRAVITY	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1
VISCOSITY (cP)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	TBD
CONCENTRATION (%)								18.3
DISSOLVED OXYGEN (NOMINAL) (mg/L)	2.0		2.0	2.0	2.0			
pH (NOMINAL)	7.4	7.0	7.4	7.4	7.4	7.0	7.0	7.0
TOTAL SUSPENDED SOLIDS (mg/L)	~ 0		~ 0	~ 0	~ 0			
TOTAL SUSPENDED SOLIDS (%)		~ 0						
TOTAL ORGANIC CARBON (ppm)	0.12		0.12	0.12	~ 0			TBD
URANIUM (ug/L)	100	TBD	100	TBD	100			TBD
IRON (mg/L)								

NOTES

1. ONE ACTIVATED CARBON ADSORBER REMAINS IN STAND-BY CONDITION.
2. STORAGE TANKS AREA SUMP PUMP SHOWN ON SKETCH SK-F-01251.

D-7343

MAJOR EQUIPMENT LIST

MARK	QTY	EQUIPMENT NAME
A	1	BREAK TANK
B	2	BREAK TANK DISCHARGE PUMP
C	8.	ACTIVATED CARBON ADSORBER

000035

REFER DWG NO.	REFERENCE DWG TITLE
SK-F-02051	EQUALIZATION - WASTE PITS PLUME
SK-F-02052	FILTRATION - WASTE PITS PLUME
SK-F-02054	ION EXCHANGE - WASTE PITS PLUME
SK-F-01256	MEDIA HANDLING

LEGEND

MAIN PROCESS FLOW LINES
SECONDARY PROCESS FLOW OR SERVICE LINES

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	DATE
1	ISSUED FOR DCR			
0	ISSUED FOR FINAL EECER			

INITIALS AND DATE

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
GROUNDWATER REMEDIATION

DRAWING TITLE
PROCESS
PROCESS FLOW DIAGRAM
CARBON ADSORPTION - WASTE PITS PLUME

DRAWN BY	DATE	LEAD DRAWER	DATE	CHKD BY	DATE
J. LAWSON	87-22-93	K. L. NAYAR	12-22-93	K. STRADFORD	12-22-93

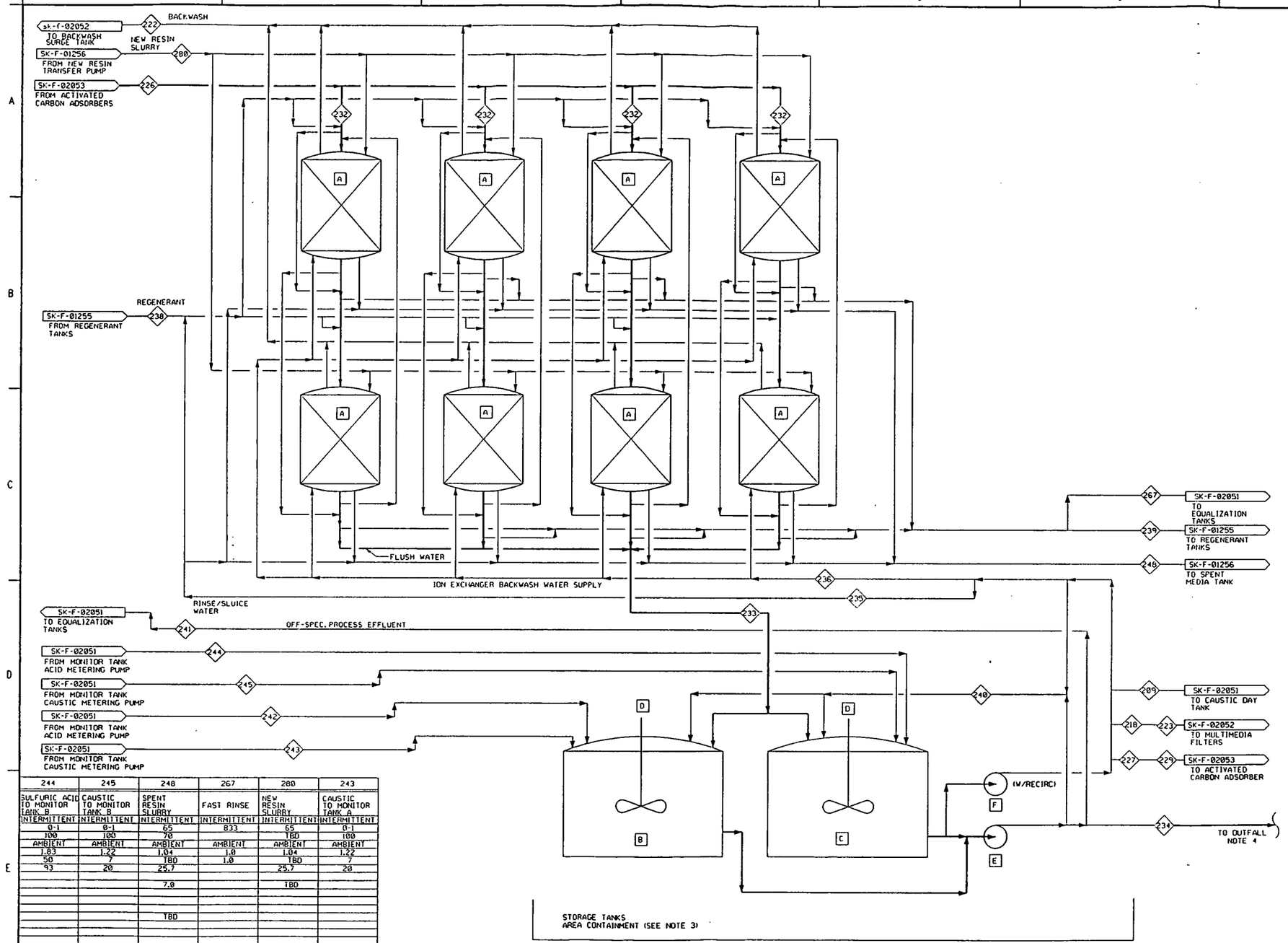
PLANT/BLDG NO. | FLOOR | SCALE: NONE | CLASS

SUBMITTED FOR APPROVAL | FERNCO CRU APPROVAL | A-E | DATE

DOE PROJECT NO. | FEMP PROJECT NO. WBS 1.1.1.1.5.3.1 00-90701 | DRAWING PREFIX CODE NO. SK-F-02053 | SHEET NO F0013 | REV. NO 1

PREPARED UNDER PARSONS PROJECT ORDER NUMBER CRU5/P069

skf02054.m1(6663.ws426) po69@ws426. Thu Sep 1 16:07:39 EDT 1994



244	245	248	267	280	243
SULFURIC ACID TO MONITOR TANK B	CAUSTIC TO MONITOR TANK B	SPENT RESIN SLURRY	FAST RINSE	NEW RESIN SLURRY	CAUSTIC TO MONITOR TANK A
INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT
0-1	0-1	65	833	65	0-1
100	100	70		TBD	100
AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
1.83	1.22	1.04	1.0	1.04	1.22
50	7	TBD	1.0	TBD	7
93	20	25.7		25.7	20
		7.0		TBD	
		TBD			

STREAM NO.	209	218	222	223	226	227	229	232	233	234	235	236	238	239	240	241	242
COMPONENT	TREATED WATER	TREATED WATER	ION EXCHANG BACKWASH	MULTIMEDIA FILTER RINSE SUPPLY	CARBON ADSORBER EFFLUENT	BACKWASH SUPPLY	RINSE/ SLUICE	ION EXCHANGER FEED	ION EXCHANGER EFFLUENT	TREATED GROUNDWATER	RINSE/SLUICE WATER	BACKWASH SUPPLY	REGENERANT SOLUTION	SPENT REGEN SOLUTION/ SLOW RINSE	RECYCLE TO MONITOR TANK	RECYCLE TO EQUALIZATION TANK	SULFURIC ACID TO MONITOR TANK A
OPERATING (HR/DAY)	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	24	INTERMITTENT	INTERMITTENT	24	24	24	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT	INTERMITTENT
FLOW RATE (GPM)	20	1200	250	800	2500	800	375/50	833	2500	2500	320/833/50	250	320	320	2500	2500	0-1
PRESSURE (feet)	115	115	80		125	115	115	125	55	90	115	115	80	45	90	90	100
TEMPERATURE (deg F)	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT
SPECIFIC GRAVITY	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	TBD	TBD	1.0	1.0	1.03
VISCOSITY (cP)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	TBD	TBD	1.0	1.0	50
CONCENTRATION (%)													TBD	TBD			93
DISSOLVED OXYGEN (NOMINAL) (mg/L)					2.0			2.0	2.0	2.0					2.0	2.0	
pH (NOMINAL)	7.0	7.0	7.0		7.4	7.0	7.0	7.4	7.4	7.4	7.0	7.0	TBD				
TOTAL SUSPENDED SOLIDS (mg/l)					~ 0			~ 0	~ 0	~ 0							
TOTAL SUSPENDED SOLIDS (%)			~ 0														
TOTAL ORGANIC CARBON (ppm)					~ 0			~ 0	~ 0	~ 0					~ 0	~ 0	
URANIUM (ug/l)					100			100	<20	<20			TBD	TBD	<20	>20	
NOTES										4	5						

NOTES

1. ONE ION EXCHANGE PAIR REMAINS IN STANDBY CONDITION.
2. ION EXCHANGE UNITS ALTERNATE LEAD LAG OPERATION WHEN LEAD UNIT REQUIRES REGENERATION.
3. STORAGE TANKS AREA SUMP PUMP SHOWN ON SKETCH SK-F-01251.
4. STREAM 34 TO OUTFALL WILL UNDERGO AERATION IN THE EXISTING FACILITY TO BRING DISSOLVED OXYGEN LEVEL TO 5.0 mg/L MIN.

F-7343

MAJOR EQUIPMENT LIST

MARK	QTY	EQUIPMENT NAME
A	8	ION EXCHANGE COLUMN
B	1	MONITOR TANK A
C	1	MONITOR TANK B
D	2	MONITOR TANK AGITATOR
E	2	MONITOR TANK PUMP
F	2	MONITOR TANK RECIRC PUMP

000036

LEGEND

MAIN PROCESS FLOW LINES

SECONDARY PROCESS FLOW OR SERVICE LINES

REFER DWG NO.	REFERENCE DWG TITLE
SK-F-02051	EQUALIZATION - WASTE PITS PLUME
SK-F-02052	FILTRATION - WASTE PITS PLUME
SK-F-02053	CARBON ADSORBTION - WASTE PITS PLUME
SK-F-01255	REGENERATION TREATMENT
SK-F-01256	MEDIA HANDLING

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	DATE
1	ISSUED FOR DCR			
0	ISSUED FOR FINAL EECER			

INITIALS AND DATE

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
GROUNDWATER REMEDIATION

DRAWING TITLE
PROCESS
PROCESS FLOW DIAGRAM
ION EXCHANGE - WASTE PITS PLUME

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
J. LAWSON	07-22-93	K. L. NAYAR	08-27-93	K. STRADFORD	08-27-93

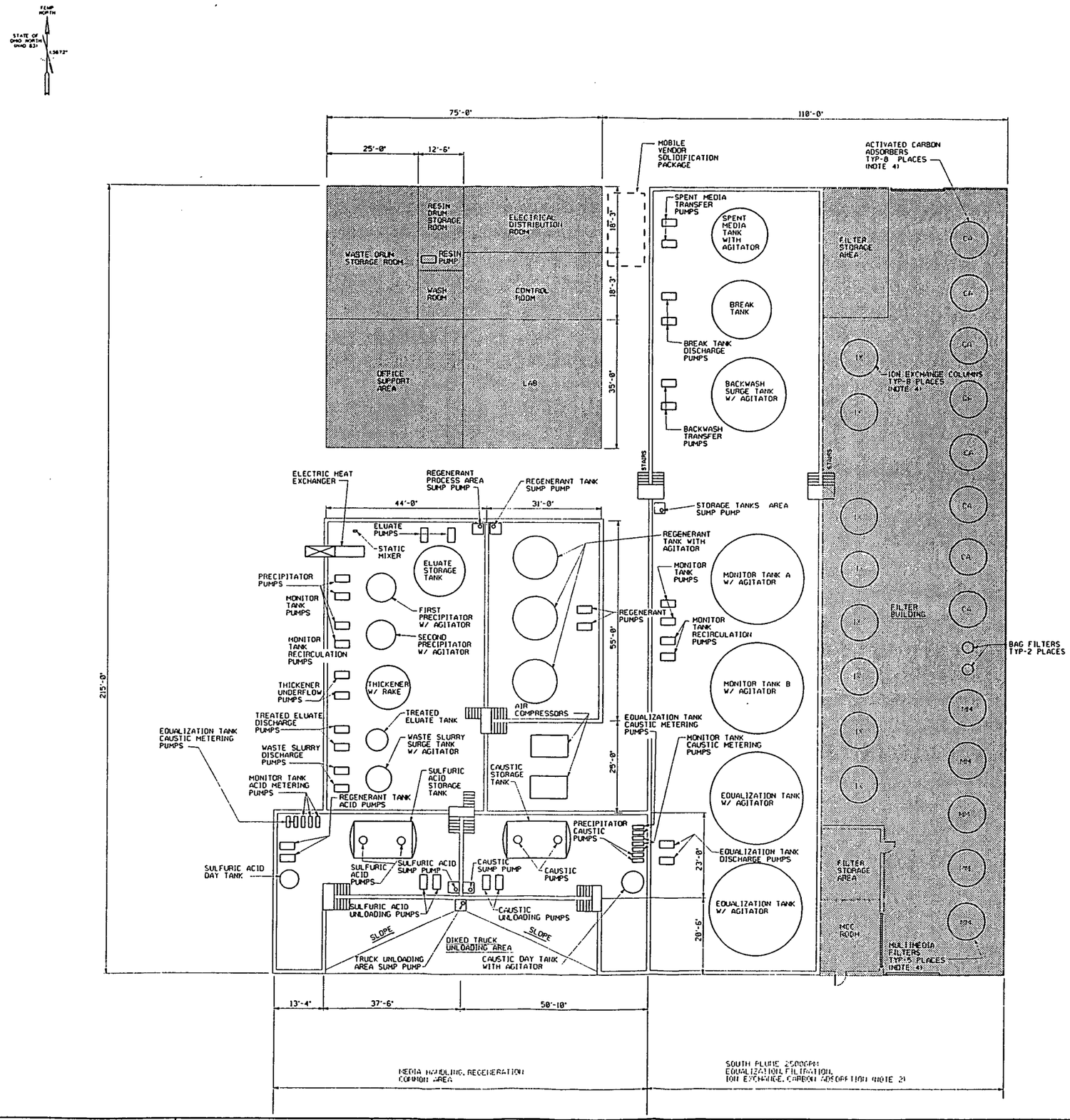
PLANT/BLDG. NO. | FLOOR | SCALE: NONE | CLASS

SUBMITTED FOR APPROVAL | FERNCO CRU APPROVAL | A-E DATE | DATE

A-E PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
	WBS 1.1.1.1.5.3.1 00-90701	SK-F-02054	F0014	1

PREPARED UNDER PARSONS PROJECT ORDER NUMBER
CRU5/P069

skm01585.m(6243.ws422) p069@ws422. Thu Sep 1 15:21:21 EDT 1994



NOTES

1. THIS DRAWING IS TO BE USED FOR COST ESTIMATING PURPOSES ONLY.
2. EQUIPMENT IN THIS AREA IS ARRANGED OPPOSITE HAND OF EQUIPMENT IN SOUTH PLUME FILTRATION AREA. SOME TEXT WAS OMITTED FOR CLARITY.
3. SEE SK-M-02099 FOR PHASE III AND IV COMBINED LAYOUT.
4. LEGEND: IX= ION EXCHANGE COLUMN
   CA= ACTIVATED CARBON ADSORBER
   MM= MULTIMEDIA FILTER
5. FOR PROCESS FLOW DIAGRAMS SEE DRAWINGS SK-F-01251, SK-F-01252, SK-F-01253, SK-F-01254, SK-F-01255, SK-F-01256, SK-F-02047, SK-F-02048, SK-F-02049, SK-F-02050, SK-F-02051, SK-F-02052, SK-F-02053 AND SK-F-02054.
6. AREAS INSIDE BUILDINGS ARE SHOWN SHADED.

- 7348

000087

REF DWG NO.	DRAWING TITLE
SK-M-02099	EQUIPMENT LAYOUT SHEET 2
SK-F-01251	PFD - EQUALIZATION - SOUTH PLUME
SK-F-01252	PFD - FILTRATION - SOUTH PLUME
SK-F-01253	PFD - CARBON ADSORPTION - SOUTH PLUME
SK-F-01254	PFD - ION EXCHANGE - SOUTH PLUME
SK-F-01255	PFD - REGENERATION TREATMENT
SK-F-01256	PFD - MEDIA HANDLING
SK-F-02047	PFD - EQUALIZATION - EAST PLUME
SK-F-02048	PFD - FILTRATION - EAST PLUME
SK-F-02049	PFD - CARBON ADSORPTION - EAST PLUME
SK-F-02050	PFD - ION EXCHANGE - EAST PLUME
SK-F-02051	PFD - EQUALIZATION - WASTE PITS PLUME
SK-F-02052	PFD - FILTRATION - WASTE PITS PLUME
SK-F-02053	PFD - CARBON ADSORPTION - WASTE PITS PLUME
SK-F-02054	PFD - ION EXCHANGE - WASTE PITS PLUME

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	DATE
1	ISSUED FOR DCR			
0	ISSUED FOR FINAL EECER			

INITIALS AND DATE

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
GROUNDWATER REMEDIATION

DRAWING TITLE
PIPING/PLANT DESIGN
EQUIPMENT LAYOUT SHT 1
PHASE III

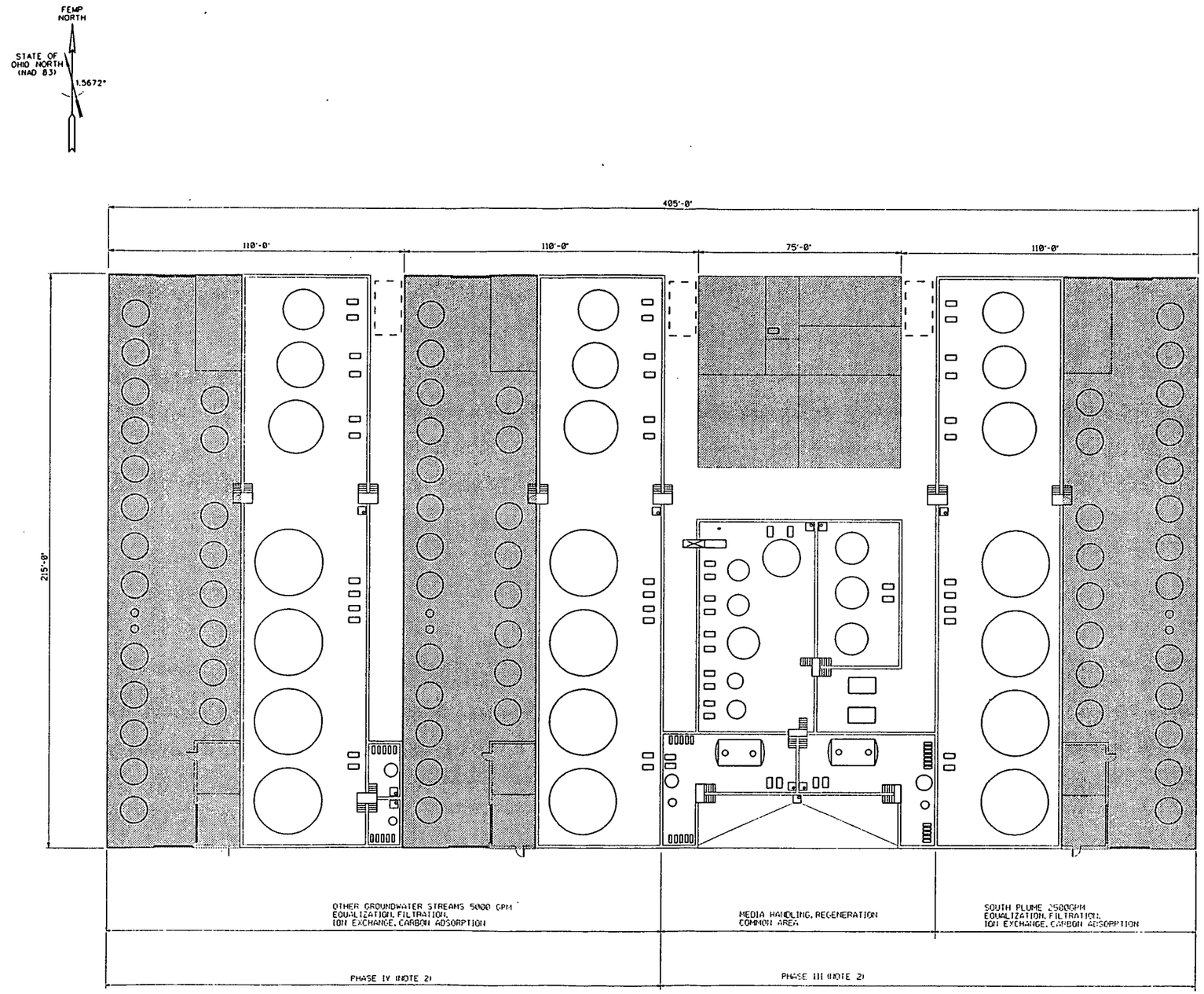
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
D. ROSENE	8-17-93	J.A.TABB	9-28-93	J. HERRING	9-16-93

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL: A-E DATE
FERNCO CRU APPROVAL: DATE

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	TEMP PROJECT NO.	DRAWING FEET CODE NO.	SHEET NO.	REV. NO.
CRU5/P069		WBS 1.1.1.1.5.3.1 00-90701	SK-M-01585	M0001	1

sk.m02099.m(6244.ws422) po69@ws422. Thu Sep 1 15:24:30 EDT 1994



NOTES

1. THIS DRAWING IS TO BE USED FOR COST ESTIMATING PURPOSES TO SIZE FACILITY BUILDINGS AND ENCLOSURES AND IS NOT INTENDED TO BE USED FOR EQUIPMENT LAYOUT.
2. THIS IS A REDUCED DRAWING. EQUIPMENT TEXT WAS OMITTED FOR CLARITY. SEE SK-M-01585 FOR EQUIPMENT TITLES.
3. AREAS INSIDE BUILDINGS ARE SHOWN SHADED.

F-7343

000038

REF DWG NO.	DRAWING TITLE
SK-M-01585	EQUIPMENT LAYOUT SHT 1

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	DATE
1	ISSUED FOR DCR			
0	ISSUED FOR FINAL EECER			

INITIALS AND DATE

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
GROUNDWATER REMEDIATION

DRAWING TITLE
PIPING/PLANT DESIGN
EQUIPMENT LAYOUT SHEET 2
PHASE III AND IV

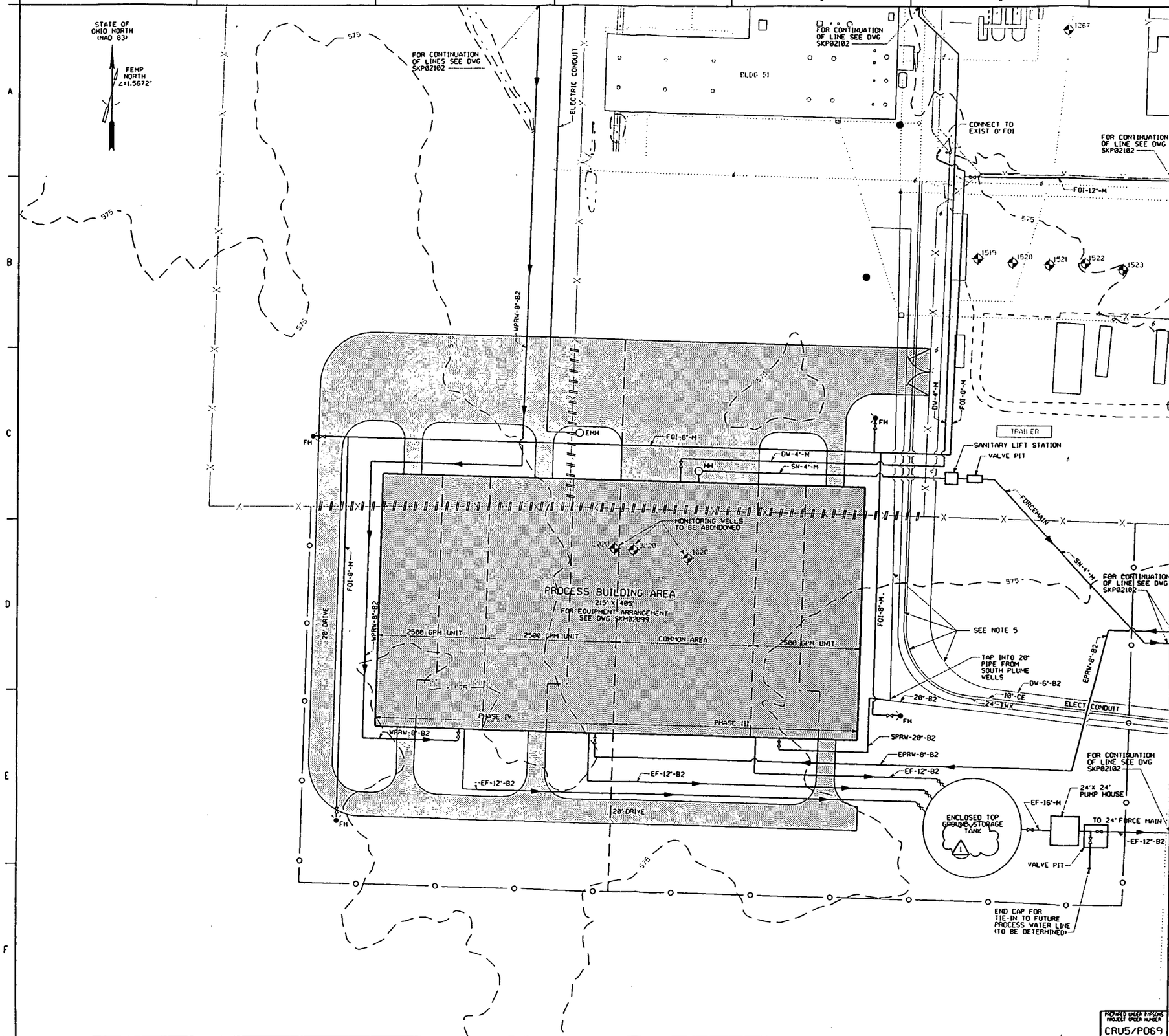
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
D. ROSENE	8-17-93	J.A.TABB	9-28-93	J. HERRING	9-16-93

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL — A-E — DATE
FERNCO CRU APPROVAL — DATE

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING FILE CODE NO.	SHEET NO.	REV. NO.
CRU5/P069		WBS 1.1.1.1.5.3.1 00-90701	SK-M-02099	M0002	1

skg02101.m(7317.ws317) po69@ws317. Thu Sep 8 13:38:36 EDT 1994



NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.

   EXISTING SITE DATA SOURCE (IN PLANT FILES)
   PARSONS TOPOGRAPHY, 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
2. ⚠
3. ASSUMES SUFFICIENT PRESSURE FROM SOUTH PLUME WELLS IS PRESENT TO DELIVER FLOW TO BUILDING.
4. APPROXIMATE SIZES OF SANITARY FORCE MAIN, FIRE WATER LINE, AND DRINKING WATER LINE. ACTUAL SIZE TO BE DETERMINED.
5. THESE UTILITY LINES ARE PROPOSED FOR CONSTRUCTION IN OTHER PROJECT ORDERS.

7343

LEGEND

EXISTING		PROPOSED
1020	MONITORING WELL	
575	MAJOR CONTOUR	
	ROADWAY	
	FENCE	
	VALVE	
	FIRE HYDRANT	FH
	TO BE REMOVED	
	PIPELINE	
	PIPELINE CROSSING	
	ELECTRICAL MANHOLE	EMH
	VG PIPE WITH FLOW DIRECTION INDICATED	

ABBREVIATIONS

UTILITY
- EPRW - EAST PLUME RECOVERY WELL
- WPRW - WASTE PIT RECOVERY WELL
- SPRW - SOUTH PLUME RECOVERY WELL
- FOI - FIRE LINE
- SN - SANITARY SEWER LINE
- DW - POTABLE WATER
- EF - PROCESS EFFLUENT

MATERIAL
- M - DUCTILE IRON
- B2 - HIGH DENSITY POLYETHYLENE PIPE

UTILITY TYPE (SEE ABBREV) — FOI - 8" - M — PIPE MATERIAL (SEE LIST) — PIPE SIZE

REF DWG NO.	DRAWING TITLE
SK-P-02102	UTILITY PLAN
SK-M-02099	EQUIPMENT LAYOUT SHEET 2

PRELIMINARY
NOT FOR CONSTRUCTION

000089

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	DATE
1	REMOVED NOTE 2 AND ISSUED FOR DCR			
0	ISSUED FOR FINAL EECER			

INITIALS AND DATE

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
GROUNDWATER REMEDIATION

DRAWING TITLE
CIVIL SITE PLAN

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
RM LINDGREN	08/09/93	D. REED	08/27/93	K. GERARD	08/27/93

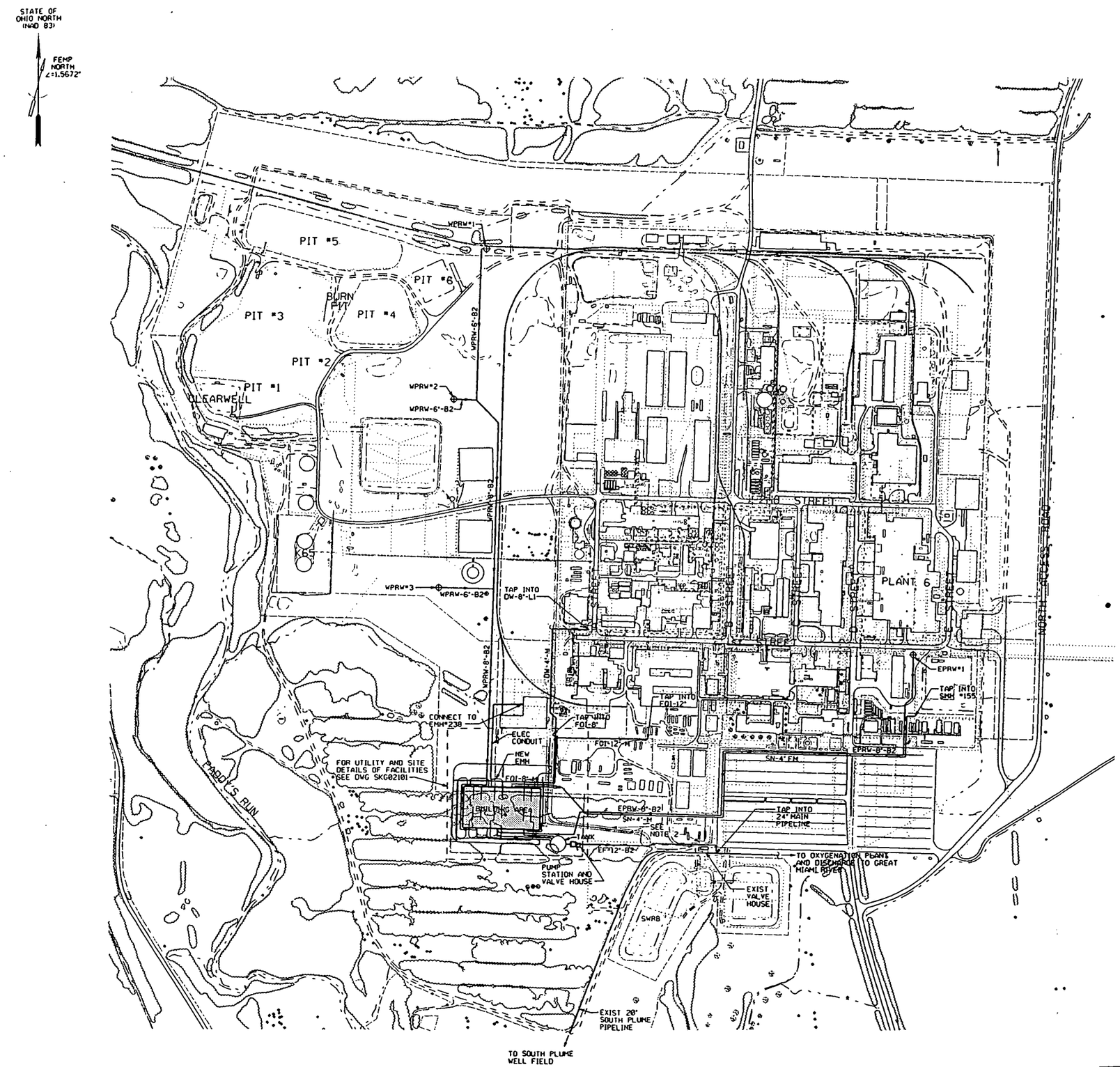
PLANT/BLDG. NO. | FLOOR | SCALE 1"=30' | CLASS

SUBMITTED FOR APPROVAL | FERNCO CRU APPROVAL

A-E CODE PROJECT NO.	DATE	FEMP PROJECT NO.	DATE	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
		VBS 1.1.1.1.5.3.1 00-90701		SK-G-02101	G0001	1

PREPARED UNDER PARSONS PROJECT ORDER NUMBER CRU5/P069

skp02102.m(7484.ws317) po69@ws317. Fri Sep 2 08:42:41 EDT 1994



NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.

   EXISTING SITE DATA SOURCE (IN PLANT FILES)
   PARSONS TOPOGRAPHY, 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS

2. THESE UTILITY LINES ARE PROPOSED UNDER ANOTHER PROJECT ORDER.

3. ALL PROPOSED UTILITIES SHALL HAVE A MINIMUM OF 3.5' COVER.

7343

LEGEND

EXISTING		PROPOSED
	UTILITY LINES	8" FOI
	TREE LINE	
	DITCH	
	FENCE	
	RECOVERY WELL	
	TO BE REMOVED	

ABBREVIATIONS

UTILITY
- EPRW - EAST PLUME RECOVERY WELL
- WPRW - WASTE PIT RECOVERY WELL
- SPRW - SOUTH PLUME RECOVERY WELL
- FOI - FIRE LINE
- SN - SANITARY SEWER LINE
- DW - POTABLE WATER
- EF - PROCESS EFFLUENT
- SMH - SANITARY MANHOLE

MATERIAL
- LI - CAST IRON-CEMENT LINING
- M - DUCTILE IRON
- B2 - HIGH DENSITY POLYETHYLENE PIPE

UTILITY TYPE (SEE ABBREV) — PIPE MATERIAL (SEE LIST)
FOI - 8" - M
PIPE SIZE

REF DWG NO.	DRAWING TITLE
SK-G-02101	SITE PLAN

000030

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNFD	DATE
1	ISSUED FOR DCR			
0	ISSUED FOR FINAL EECER			

INITIALS AND DATE

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
GROUNDWATER REMEDIATION

DRAWING TITLE
CIVIL
UTILITY PLAN

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
RM LINDGREN	08/09/93	D. REED	08/27/93	K. GERARD	08/27/93

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1"=200'	

SUBMITTED FOR APPROVAL | FERNCO CRU APPROVAL

A-E PROJECT NO.	DATE	FEMP PROJECT NO.	DATE	DRAWING REF CODE NO.	SHEET NO.	REV. NO
		VBS 1.1.1.1.5.3.1 00-90701		SK-P-02102	G0002	1

PREPARED UNDER PARSONS PROJECT ORDER NUMBER: CRU5/P069

APPENDIX C

PARSONS REVIEW COMMENT FORMS

PARSONS
ERA PROJECT

REVIEW COMMENT FORM

F-7343

DOCUMENT NUMBER:	REV. NO.	REV. DATE	TITLE:	CRU NO.: 5
	A	June 1994	Design Criteria Report for the Advanced Wastewater Treatment Facility, Phases III and IV	

REVIEWER:	DIST. DATE:	COMMENTS DUE TO:	COMMENTS DUE:	DOCUMENT STATUS:
FERMCO				

Comment Coordinator Signature:	Date:
Richard Brettin, Project Engineer, CRU-5	September 1994

NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
1	Title: Title should be "Design Criteria Report for Operable Unit 5 Groundwater Remediation"	Changed title to "DCR for the Groundwater Treatment Facility".
2.	General: Rename treatment facilities "Groundwater Treatment Facility" - Phases I & II".	AWWT Phases III and IV renamed GTF Phases I and II.
3.	General: The DCR shall also include the recovery well systems.	Design Criteria for the extraction well systems will be prepared under PO-126 per direction of J. Hughes.
4.	General: Include a section to describe the characteristics of the recovered groundwater to set the basis for the groundwater treatment process.	Provided a new Section with a description based on groundwater data available to PARSONS and identify additional data required for Title design.
5.	General: Explain the rationale for the design and construction of the phases (ie, funding, flow quantity determinations, etc.)	Section 3.1 revised to include rationale for phases.
6.	Section 3.1.1.1 a. One equalization tank is sufficient. Define criteria for residence time. In fact, line pressure from recovery well systems may be sufficient to consider no equalization tank. Recycle and backwash functions probably need such as tank.	Two equalization tanks are provided to insure continuity of operations. Also, the redundant tank will be used to receive the off-spec groundwater from monitor tanks for recycling through the system. A residence time of 40 minutes is provided, which is considered adequate for pH adjustment and equalization. Backwash water will be the treated water and will be provided by the monitor tanks.

NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
	b. Provide rationale for influent pH adjustment; we do not believe it is necessary; the South Plume Interim Treatment (SPIT) performs well without it.	The pH adjustment is included to provide the flexibility to treat groundwater streams which may be high in metals. Groundwater characterization data for the entire site should dictate the need or otherwise of the pH adjustment step. If SPIT project operating data is the sole guide, the pH adjustment could be eliminated.
	c. Without pH adjustment, agitation is not required.	The need for redundant equalization tanks and pH adjustment will be evaluated during Title I Design of the GTF.
7.	Section 3.1.1.2 a. Explain criteria for filtration.	Remove particulates of 10 micron size and larger for efficient operation of IX units as required by DOWEX 21K resin manufacturer.
	b. Based on review of the SPIT multi-media filter supplier's literature, the filter is probably capable of removing particles >3-5 microns (we should investigate and specify the better performance standard.	Different vendors may have different media in the multimedia filters that are capable of different performances. In general, multimedia filters remove particulates as small as 10 microns in size with a 90 percent removal efficiency. Based on design criteria for IX units (see 7a above), removal of TSS of 10 micron size and larger is adequate.
8.	Section 3.1.1.3 a. Explain criteria, with respect to organics concentrations for adsorption.	Trichlorethylene (TCE) is the predominant organic contaminant in the groundwater. TCE's maximum contaminant level (MCL) in drinking water is 5 microgram/liter (μg/l). Although the specific groundwater cleanup criteria will not be available prior to issuance of ROD, it is reasonable to assume that EPA would require organic contaminant cleanup to its corresponding MCL. Carbon adsorption can reduce the TCE level in the effluent to <5 μg/l. Additional groundwater characterization is required to fully define organic concentrations. This will be accomplished during Title I Design of the GTF.
	b. Explain why in-process methods of regenerating activated carbon are not feasible.	The activated carbon would not be regenerated because it will be radioactively

NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
		contaminated and activated carbon vendors, who routinely regenerate the exhausted carbon in high temperature furnaces for resale to the users, would not accept it due to the potential for cross-contamination. This issue will be further evaluated during Title I Design of the GTF. Industrial experience shows carbon regeneration systems to be complicated, expensive, and relatively hazardous (i.e., very high regeneration temperatures). Equipping these regeneration systems for radioactive applications would only complicate the issue further.
9.	Section 3.1.1.4 a. The Ion Exchange column arrangement as presented is not very clear. Also, the more conventional "carousel" (3 IX units in series) arrangement is preferred since this has become a site standard and will simplify training, SOPs, and operator understanding. Also, the carousel arrangement is inherently a more flexible system that allows more than one column to be off line at any one time.	Both arrangements, i.e., two IX units in series (Lead/Lag operation - proposed) and the 3 IX units in series (currently in operation), will meet the project requirements. The IX column arrangement will be evaluated on a cost basis and a final arrangement selected during Title I Design.
	b. Explain that ion exchange using DOWEX 21K is the uranium removal step and has been demonstrated as a viable technology for FEMP groundwater treatment.	Added words about DOWEX 21K's demonstrated effectiveness at the FEMP.
10.	Section 3.1.1.5 Explain rationale for effluent monitoring tanks, we do not believe they are necessary.	Effluent monitoring tanks will serve the following functions: - Monitor effluent prior to discharge to the Great Miami River. - Adjust pH within the required limits - Provide backwash water for the operation. - In case there is a process upset (off-spec groundwater: pH variation or high uranium concentration) redundant tank can be put into service and groundwater returned to equalization tank for reprocessing. Otherwise either the off-spec groundwater will have to be discharged to the Great Miami River or the well field will have to be shut down.

NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
11.	Section 3.1.2.1 State the capacity of existing AWWT acid and caustic storage tanks will be evaluated to determine if feed from AWWT to GTF can be implemented.	Added statement about integration with AWWT.
12.	Section 3.1.2.2, 3rd sentence Add "if required" after "stabilized".	Added as requested.
13.	Section 3.1.2.2, 4th sentence Change "underflow" to "overflow"	Changed as requested.
14.	Section 3.1.2.3 We believe that an eductor system would be more effective and require less connections. The educator will require only connection to a water supply for loading resin. We suggest one central unloading station equipped with hard piped water supply to an eductor.	Diaphragm pump is considered more appropriate for loading large quantities of resin into IX vessels received via tank truck. An eductor, one for each 2500 gpm module, is also suitable for unloading resin drums.
15.	Section 3.1.2.6 a. Explain rationale for spent media stabilization.	Spent media can be stabilized using cementation prior to disposal or alternatively it can be dried in the AWWT Slurry Dewatering Facility prior to packaging and disposal. Both the options are viable for spent media handling and will be further evaluated during Title I Design.
	b. Delete "vendor-supplied" adjective. We may or may not have to rely on a vendor.	Deleted as requested.
16.	Section 3.2.2, 1st paragraph Explain rationale for the list of processes; see comments above.	List will be modified, based on resolution of above comments.
17.	Section 3.2.2, 3rd paragraph Explain... We believe that removal of iron and manganese should be considered.	NPDES permit for outfall 001 (see enclosed) does not impose any restrictions on the concentrations of iron and manganese in the effluent wastewater. Therefore, removal of iron and manganese (Fe: 6.3 mg/l and Mn: 0.7 mg/l - average in South Plume Groundwater based on preliminary characterization) from groundwater is not considered necessary at this stage.
18.	Section 3.2.2, 4th paragraph See comment #8	See response to comment #8.

NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
19.	Section 3.2.2, 5th paragraph Delete 3rd sentence; "rented vendor-supplied" unit is speculation.	Deleted as requested.
20.	Section 3.2.2, 6th paragraph Delete specific reference to NTS; just state that wastes will be prepared for on-site or off-site disposal.	Deleted as requested.
21.	Section 3.2.4, 4th paragraph The site is flat to sloping towards Building 51 where a diversion curb was installed under Removal Action 16 to intercept runon. To state that "the SWRB will not be able to add the runoff" should be reconsidered. The need for additional stormwater management facilities is therefore potentially unwarranted.	A review of Building 51 design drawings and a subsequent field visit was made. Two catch basins exist to the south of the diversion curb. The outfall pipe from the catch basins discharges to a ditch that is south of the K-65 silos, which drains into Paddys Run. The proposed GTF Phase I and II is not, at present, a part of the site's SWM system. Based on an evaluation performed by PARSONS in January 1993 (Reference PARSONS ID#: 05:069:100:041-93 dated January 26, 1993), PARSONS determined that the existing SWRB capacity was not adequate to accommodate a 25 year storm event. Therefore, PARSONS assumed that the additional GTF area would also overload the existing SWRB during the 25 year design storm event, and modifications to existing basin would not be cost effective. This should be assessed as part of Title I design. We will change sentence to state "The existing Stormwater Retention Basin's (SWRBs) capacity should be evaluated to determine if there is available storage. The need for modifications or new facilities should also be evaluated. Existing calculations of the site's SWM system with hydrologic analysis should be provided by FERMCO."
22.	Section 3.2.5, 2nd paragraph Change "filter" building to "process" building.	Changed as requested.
23.	Section 3.2.6, 2nd paragraph NPDES is overseen by the Ohio EPA; effluent monitoring will be performed downstream of Manhole 176B at the Parshall Flume chamber.	Changed to reflect NPDES is overseen by Ohio EPA and that monitoring will be done at the Parshall Flume Chamber.

NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
24.	Section 3.2.7 What is the basis for the backup diesel generator and UPS; we believe a UPS for the control system only is necessary.	A diesel generator allows critical processes to be maintained during loss of electrical power. (i.e. maintain tank agitation and slurry line flows to prevent solidification) An Uninterruptible Power Supply (UPS) system provides continuous operation of the control system, allowing an orderly safer shutdown of the process.
25.	Section 4.4 Identify design criteria that addresses facility emergency preparedness (emergency lighting, exit signs, process safety, etc., etc., etc.)	Added "Plan must include instructions (or a procedure) for shutting down the process under emergency conditions. The following electrical systems have been provided for emergency planning: - quartz and emergency lighting - Backup generator for orderly process shutdown and maintaining critical loads - Uninterruptible power supply for control system - Fire Alarm and Evacuation Alarm Systems - Redundant Power Source."
26.	Section 4.5 Identify design criteria.	Replaced with: "Telephone connections for Groundwater Treatment Facility shall be made at existing manhole TMH453 or TMH454. Installation of telephone lines will route through the existing underground conduit system. As noted in Section 3.2.7, design of the GTF telephone system shall be provided by the local telephone company."
27.	Section 4.7 Backwash and recovered uranium solids (what is this???) should be combined with sludge (slurry?) for dewatering.	Text modified for clarity.
28.	Section 4.10 The facility design should incorporate materials and components that are easily dismantled and easily decontaminated, etc. etc.	Comment added to section.

NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
29.	Section 5.1.1 - Filtration See comment #7.	See response to comment #7.
30.	Section 5.1.1, C Adsorp. Removal efficiency should be 99.9%; may need to consider a lead/lag unit arrangement.	Removal efficiency of minimum 99% will be revised to 99.9%. Lead/lag arrangement for VOC removal will double the cost and is not considered necessary for removal of low concentrations of VOCs from the groundwater.
31.	Section 5.1.1, IX Why is regeneration done "manually"?? Effluent uranium concentration for, design purposes, should be <5 ppb and expected to be <1 ppb.	Regeneration of the lead IX unit will be initiated manually, when U leakage is detected in the lag IX unit of a pair. After manual initiation, regeneration can proceed through various steps automatically. Manual initiation is necessary since instruments are not available for on-stream detection of uranium leakage at low concentrations (ppb range). Consistent with IAWWT and SPIT projects, uranium concentrations of <20 ppb for design purposes is considered in order. However, effluent uranium concentrations of <5 ppb are achievable and can be controlled during operations.
32.	Section 5.1.1, Effluent Monitoring We do not believe that tank or pH adjustment is necessary.	pH adjustment in the monitor tank can be eliminated if the groundwater characterization data indicates that pH adjustment is not necessary. Monitor tanks are still required to supply backwash water for the process. Also see response to comment #10.
33.	Section 5.1.7 Identify NPDES and FFCA requirements, as a minimum.	Current NPDES Permit discharge limitations are identified in Section 5.12. FFCA requirements are programmatic in nature, not design-specific. However, remedial actions must comply with FFCA requirements.

NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
34.	Section 5.1.1, Equalization Identify equalization criteria.	A residence time of 40 minutes is considered adequate for pH adjustment and equalization.
35.	Section 5.1.1, Ancillary Identify design criteria.	No data has been made available to PARSONS regarding the removal efficiency of uranium from eluate using sodium hydroxide. This data (removal efficiency of uranium from eluate) will be included as the design criteria, when available.
36.	Section 5.5.3 Explain the relationship of the "Administration Building's wash room and lab area" to this project.	Deleted "Administration Building's".
37.	Section 5.8 See comments #15 and 19.	See responses to comments #15 and #19.
38.	Section 5.9.3 Identify and explain which process streams are required to be double-contained.	All streams will require secondary containment per DOE Order 6430.1A. As the text currently states, only pipes that leave areas with secondary containment will be double-walled. Per M. Griffin, FERMCO, the FERMCO Regulatory Group will interpret and provide guidance on the need for secondary containment during Title I Design.
39.	Section 5.10.3 Define requirement for diesel generator; we do not believe it is required.	See comment response #24.
40.	Section 5.11.1 Do not rule out integration of GTF control system with the AWWT Facility DCS.	No change. Integration of GTF control system with AWWT will require either purchasing the system from the same manufacturer (sole source) or extensive and difficult programming to interface the two systems. The AWWT facility and GTF will operate independently and the GTF will continue to operate for years after the AWWT is shut down. However, integration of the GTF and AWWT Control systems will be further evaluated during Title I Design.

NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
41.	Section 5.12.1 There may be gaseous emissions to be concerned with; submittal of air permitting (or equivalent) information is likely. Waste IX and carbon media are solid discharges.	Agree that air discharges may be possible; however, there is not sufficient characterization of the incoming wastewater streams to determine what air discharges may be generated. This issue will be evaluated further during Title I Design. Waste IX and carbon media are not discharges. A "discharge" includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying, or dumping of material (per 40 CFR 300.5). This excludes discharges in compliance with a permit. Waste IX and carbon media will require handling, treatment (stabilization/dewatering), and disposal. They do not constitute discharges.
42.	SK-M-02099 Additional process modules should have same orientation as the original; not mirror image. This is better for design and for construction.	Will change module orientation during Title I Design.
43.	SK-P-02012 Delete 750,000 gallon water recycle tank and associated equipment from this design effort. This may be implemented in a separate, future effort.	A tank is needed at this location to provide some storage and to save on continuous pump operation. Suggest we delete 750,000 gallon size, and show a smaller tank without any capacity rating. Capacity will be determined during Title I design.
44.	SK-G-02101 This site plan encroaches on the AWWT Facility South Containment area.	The existing conditions shown on this drawing were referenced from the FEMP CADD Grid Utility File. Unfortunately, these files do not show the AWWT South Containment Area, which is presently under construction. A review of SK-G-02101 and building 51 design drawings reveal that GTF construction could cause a curb relocation and a storm drainage realignment. The road pavements from South Containment and GTF could be aligned to match, which would lower road

NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
		costs and maximize space usage between the two facilities. Unknown construction changes at South Containment could alter this. Suggest we keep facility at present location for the DCR, and further refine the project site plan during Title I Design.
45.	General Not sure that this system allows for an orderly shutdown. All of the redundant features of the design provide only about an hour of time for corrective actions within the unit. If a situation cannot be corrected within that time frame, the operator must either shut down the well field or manually bypass the treatment system. A rapidly operable means of bypassing the treatment system is needed. Remote stop/start of the well field from the control room should be considered.	Will comply. Title design will consider remote stop/start of the well field from the control room. A rapidly operable means of bypassing the treatment system may not be acceptable as there is a potential for discharging large quantities of untreated groundwater to the Great Miami River.
46.	General Design should encourage off-site fabrication as much as possible to provide ease of on-site installation. The design should attempt to minimize on-site welding operations.	Will identify that vessels, tanks, and pumps are to be skid-mounted and ready for piping hook-ups to the extent possible.
47.	Section 3.1.2.1 The Phases I and II use 20% caustic also. In that system, all outside pipelines and pumps are electrically traced and insulated. That system is designed to recirculate the outside storage tank contents through a heat exchanger to keep the tank contents warm. 20% caustic has a solidifying point of about -15F; 15% caustic solidifies at about -3F; 25% caustic solidifies at about 10 F; 50% caustic solidifies at about 52F. Only very infrequently will we see temperatures such that equipment containing 20% caustic could freeze or stay frozen. If the caustic dilution system were to fail or drift away from 20% concentration, we could have a real freeze up problem with uninsulated/unheated equipment. Trying to thaw or clear equipment containing caustic is a real safety concern. Need to carefully consider the design of this system.	The solidifying temperature of 20% NaOH is -26° C (-15° F) (see attached curve). However, as a precautionary measure all outside piping and equipment handling 20% NaOH will be insulated and heat traced to take care of any operational drifts in NaOH concentration. Requirement for electrical process heating can be added to heat trace criteria, Section 5.9.7.
48.	Section 3.1.2.6 Explain rationale and criteria for spent media storage tanks. Spent media may also be adequately prepared for waste management at the AWWT Dewatering Facility.	Spent media storage tank is a process requirement and will be sized to handle slurry produced by removing material from two activated carbon adsorbers. Spent media can then be transferred to AWWT Slurry Dewatering Facility for further treatment and disposal. Cement stabilization is another option for spent media disposal.
49.	Section 3.2.5 What "exhaust stack"??	Deleted sentence.

NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
50.	Section 5.1.5 Explain requirement to use electric heat exchanger...steam should also be available.	Both electric heating and steam can be used. However, steam is not expected to be available for the entire life of the project.
51.	Section 5.11.1 Explain why one CRT is designated for alarm conditions...this should not be a frequently alarming facility.	Alarm conditions will have priority over other data displayed on one CRT.
52.	Section 4.6 Define design criteria that allows for ease of maintenance activities (i.e., isolation and bypass valving, equipment spacing, etc., etc., etc.)	The GTF design will take into account all aspects of operation and maintenance per DOE Order 6430.1A.
53.	Section 4.3 All systems shall be designed to accommodate energy control. Subsystems and components shall be able to be isolated with lockable valves, switches, and other devices.	Standard health and safety electrical codes have been listed in Section 5. Jim Kerl of FERMCO indicated that no additional site specific standards exist at the site. Electrical starters and circuit breakers will be specified with capability of lockout in the title design specifications.
54.	Section 4.3 Any control equipment shall be so designed as to protect any electrical connection over 30 volts from accidental contact during service, adjustment, or any other activity that may occur when a person accesses the "back side" of a control panel or other similar equipment.	Comment added as requested.
55.	Section 4.3 The construction of the facility shall also meet 29 CFR 1926.	29 CFR 1926 referenced.
56.	Section 5.10 Due to this being a water (wet) processing facility, all 15 and 20 amp 120 volt receptacle circuits shall be protected by GFCI. Office and other like areas will not be required to meet this requirement.	This item has been covered in the listed references. Comment is a design consideration which will be addressed during title design.
57.	General Human factors should be considered in the design.	Part 5.11.6 1) covers human factors for control systems. This item has been covered in the listed references. (If desired, minimum mounting heights and spacing can be provided for each type of equipment [i.e. for receptacles, disconnect switches, panelboards, etc.].) Human factor considerations will be fully addressed during title design.

NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
58.	Section 3.2.3 Access for handicapped persons to some ares should be required.	Will comply for control room, lab, and wash rooms.
59.	Section 5.10.5 Specify illumination requirements.	Add to beginning of paragraph: Illumination levels for the Groundwater Treatment Facility shall be designed in accordance with the Illumination Engineering Society Handbook. As a minimum, process areas shall maintain a lighting level of 30 footcandles and office areas shall maintain a lighting level of 50 footcandles.
60.	General The design effort should consider the integration of the AWWT Facility with the GTF. There are several significant areas where AWWT components/systems can support the GTF.	Integration is a Title I design activity which will be evaluated under PO-126.
61.	SK-F-01253 Can the number of vessels be reduced by using larger vessels?	Theoretically, yes. However, 10 foot diameter vessels were considered for the Engineering Evaluation and Cost Estimate Report (PO-69). These vessels will be fully assembled skids with face piping and valving and overall dimension will be approximately 12 feet. Normally 12 feet diameter tank (without attachments) is the limit for road transport. Therefore, in practical terms, the real answer is no.
62.	Section 3.2.7 Verify adequacy of AWWT communication systems to be extended to the new facilities.	As indicated in PARSONS Trip Report PARSONS ID#: 03:020:145:0057-93, the existing Building 51 fire and evacuation systems can support the additional GTF phases. Removed "communication, " from the paragraph. See resolution to comment 26.
63.	Section 4.6 Isolation valves are required on nearly all instrumentation. Isolation valving and bypass piping is required for flow control valves and some in-line components.	See Comment #52 resolution.

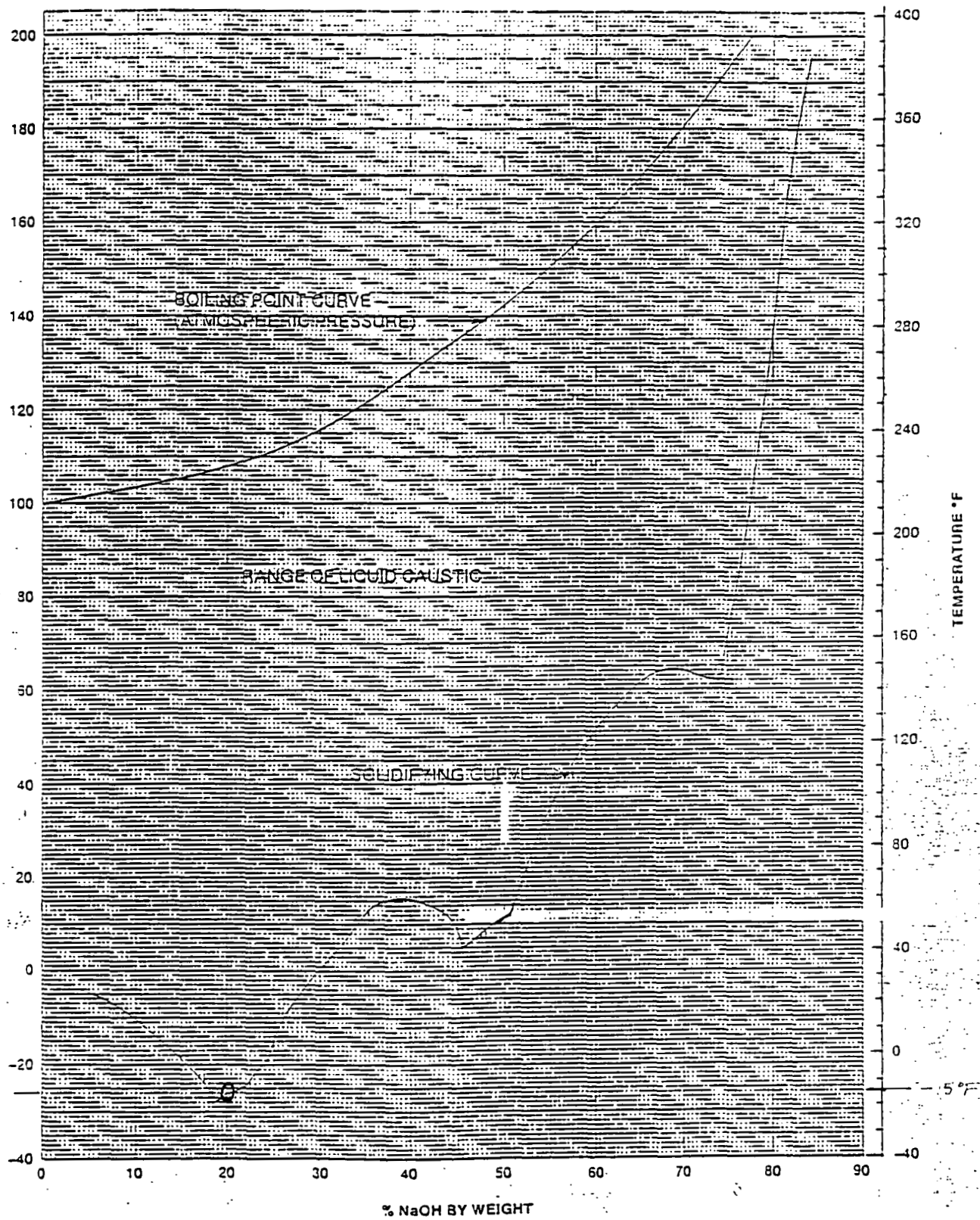
NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
64.	Section 4.7 Delivery of chemicals through REMIA and through former production area is required for the AWWT; the same routing may be required for the GTF.	It is assumed that REMIA and the former production area will be D&D'd. However, this is an operational issue - not a design criteria.
65.	Section 4.10 The use of interior liner panels, for example, will likely be required to isolate contamination.	The need for covering interior insulation will be evaluated during Title I/II Design.
66.	Section 5.5 Steam and breathing air should be further considered as project requirements.	Steam - see response to Comment 50. Breathing air will be considered during Title I/II Design.
67.	SK-F-01251 Need to consider provisions for handling chemical spills, possibly returning spills to storage tanks.	Will comply. Title I/II design will consider returning chemical spills to storage tanks after proper verification.
68.	SK-M-01585 Drawing does not indicate spill containment.	All process areas are contained within dikes. This drawing does not show that level of detail. See Section 3.2.5.
69.	SK-G-02101 Need to consider emergency access road completely around facility.	Will revise during Title I Design.
70.	Section 5.11.4 Need to consider electrical outlets for contamination monitors and telecommunication outlets for badge access computers.	Telecommunication requirements have been defined in Section 4.5. Added as last line of first paragraph: "Air and personnel monitors shall operate at 120V, single phase."
71.	Section 5.3.4 Importance of waterstop design/installation must be emphasized.	Waterstop design will be included in Title II Design.
72.	Section 5.4.2 Use energy efficient double-spaced windows; aluminum framed are not energy efficient.	Window glazing requirements will be determined during Title II Design. Aluminum frames are as energy efficient, and easier to decontaminate than wood frames.
73.	Section 5.7.1 Clarify use of top-mounted agitators versus side-mounted.	Side mounted agitators are more efficient but tend to be more costly and have more sealing requirements than top entry units. With top-mounted units the leakage danger is avoided which is an important

NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
		consideration in this application. Top entry agitators are effective on tanks of the size in this project and their use is recommended.
74.	Section 5.9.12 Consider manual override, where applicable, on non-manual valves.	This is a detailed design consideration which will be addressed during Title II design.
75.	Section 5.2.1 Location planning needs to consider interference with site meteorological tower.	Added, "Impacts to other FEMP facilities caused by GTF construction during Title I Design will be assessed."
76.	SK-F-01251 Verify requirement for in-line heater in caustic recirculation loop.	See response to comment #47.
77.	Section 3.1, 2nd sentence Typo; change "pgm" to "gpm".	Sentence deleted.
78.	Section 3.1, 2nd para, 1st sentence Add "for future phases" to end of sentence.	Complied.
79.	Section 3.1 Briefly discuss the other (than South Plume) potential recovery systems.	No change. This DCR does not apply to groundwater recovery systems. They will be defined in PO-126.
80.	Figure 3-1 Spent media handling should be inside the dash-lined box.	Complied.
81.	Figure 3-2? Suggest adding a figure to show the facility location (in addition to attached drawing)	No change. Does not identify design criteria.
82.	Section 3.2.4 Please clarify that facility will not be constructed over contaminated perched water.	Section 3.2.4 revised. See last 3 paragraphs.
83.	General Text uses psi units for pressure; drawings uses feet of water. Please be consistent.	Complied.

NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
84.	General Since this is a CERCLA site a discussion of the possible presence of soil and groundwater contamination should be added to this section. Contamination could impact construction costs and worker safety during construction. It may also be necessary to excavate more soil for remediation than would be required for construction on a clean site. There may be perched groundwater contamination under the site as well which could require installation of a pumping system during construction or over excavation to remove the perched groundwater and the water bearing zone.	Complied. See revised Section 3.2.4.
85.	Section 4.6 Define criteria measurement that indicates IX resin is spent.	Resin is considered spent when regeneration is no more economical. At start of operations the resin has the highest capacity in terms of gallons/number of bed volumes of water treated before exhaustion or uranium leakage. After regeneration the treatment capacity of the resin is substantially restored but with progressive regeneration the capacity is gradually reduced. Reduction in resin capacity is also due to chemical degradation and attrition accompanied by carry over of resin during backwash. The amount of water treated by DOWEX 21K resin before exhaustion varies widely. It has been estimated at 10,000 bed volumes but needs to be confirmed by actual operating data. In practice, when the resin has deteriorated to such an extent that capacity (gallons of water treated) after regeneration is extremely low, and requires frequent and uneconomical regeneration, the resin is considered spent and needs replacement by fresh resin.
86.	T. Tomes - 3.1.1.5 & 5.1.1 Is monitoring and release planned to be done on a batch basis?	No. pH will be monitored continuously on stream. Since no instruments are available for continuous on stream monitoring of such low concentrations of uranium, samples will be taken periodically for uranium analysis. Sampling and testing details will be worked out during Title I/II design. Release of treated groundwater will be continuous.

NO.	REFERENCE AND COMMENTS	COMMENT RESOLUTION
87.	T. Tomes - 3.1.2.2 last sentence. Should the overflow, not underflow, be sent to the equalization tanks?	Yes, overflow should be sent to the equalization tanks.
88.	T. Tomes - 5.4.4 For design purposes the references to control devices, such as horns and alarms, need not be considered. This level of design is not necessary for the radioactive material and radiation levels present.	Deleted "conspicuous visual and/or audible alarms".
89.	T. Tomes - Section 5.11.4 The air monitoring requirement 3) as stated is incorrect, however, I am unsure of the intent of the statement. I suggest deleting the statement or call for clarification.	Item 3 deleted.
90.	T. Tomes - 5.11.4 last paragraph The location of personal contamination monitors will not necessarily be placed at the entrance to the facility. The design should consider (possibly in Section 3.7) how this facility should interface with the rest of the radiologically Controlled Area, i.e., a separate area or incorporate into the larger controlled Area (which is planned for Building 51). After these considerations, acquisition of needed monitoring equipment should be included.	Changed "facility" to "controlled area".

Chart No. 4 Boiling & Solidifying Temperatures of Aqueous Caustic Soda Solutions



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