JE JACOBS

5003

APPENDIX F
FIRE HAZARD ANALYSIS

Document No. 40430-PL-0006
August 13, 2003
Revision 2

FERNALD
Environmental Management Project

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

Revision	Prepared by:	Reviewed by:	Approved by:	Date:	Pages Affected:
0	CF	CS	RL	5/16/02	All
1	SL	KE	KE	3/14/03	All
2	Scott Fabry	Kenneth J. Eger	Kenneth J. Eger	8/13/03	See Revision Sheet

THIS PAGE INTENTIONALLY BLANK

Revision Sheet			
Revision	**Date**	**Pages Affected**	**Reason for Revision**
0	5/16/02	All	Issued for internal review.
1	3/14/03	All	Issued for development of NHASP with current design.
2	8/12/03	Cover, F-iii, Fv, F-2, F-5, F-7, F-10, F-11, F-13, F-14, F-15, F-16, F-21, F-25	Revised to accommodate a reduction in the number of trailers from two to one.

THIS PAGE INTENTIONALLY BLANK

TABLE OF CONTENTS

ACRONYMS vii

EXECUTIVE SUMMARY ix

F-1.0 INTRODUCTION 1

F-1.1 PURPOSE 1
F-1.2 APPROACH AND ASSUMPTIONS 1
F-1.3 FACILITY USE, FUNCTION, AND OCCUPANCY 1
F-1.4 GENERAL SITE FIRE PROTECTION 3

F-2.0 CONSTRUCTION 5

F-2.1 TYPE OF CONSTRUCTION 5
F-2.2 FIRE BARRIER SEPARATION 5
F-2.3 INTERIOR FINISHES 5

F-3.0 LIFE SAFETY 7

F-3.1 OCCUPANCY CLASSIFICATION 7
F-3.2 MEANS OF EGRESS 7
F-3.3 EMERGENCY LIGHTING AND EXIT LIGHTS 7
F-3.4 SECURITY INTERACTION 7
F-3.5 RADIATION AND CONTAMINATION CONTROL 7

F-4.0 FIRE HAZARDS 9

F-4.1 WASTE CHARACTERIZATION 9
F-4.2 AUXILIARY SYSTEMS 9
F-4.2.1 Utilities 9
F-4.2.2 Process Equipment 9
F-4.2.3 Operations Support And Change Trailer 10
F-4.3 ANALYSIS OF POTENTIAL FIRE SCENARIOS 10
F-4.3.1 Fire Area 1 –Process, Excavator, And Cargo Container Buildings 10
F-4.3.2 Fire Area 2 – Operations Support Area 10
F-4.4 EXPLOSIVES 11
F-4.5 POTENTIAL FOR RADIOLOGICAL, BIOLOGICAL, OR TOXIC INCIDENT 11
F-4.5.1 Radiological Hazards 11
F-4.5.2 Biological Hazards 11
F-4.5.3 Chemical And Toxic Hazards 11
F-4.6 FIRE PROTECTION WATER RUN-OFF 11
F-4.7 NATURAL HAZARDS (EARTHQUAKE, FLOOD, AND WIND) 12

F-5.0 FIRE PROTECTION 13

F-5.1 WATER SUPPLY 13
F-5.2 FIRE SUPPRESSION 13
F-5.3 PROTECTIVE SIGNALING SYSTEM 14

F-5.3.1 Fire Detection 14
F-5.3.2 Fire Alarm System 14
F-5.3.3 Smoke Detection System 14
F-5.3.4 Heat Detection System 14
F-5.4 FIRE DEPARTMENT RESPONSE 14

F-6.0 FACILITIES, EQUIPMENT, AND PROGRAM PRESERVATION 15

F-6.1 ESSENTIAL SAFETY CLASS SYSTEMS 15
F-6.2 VITAL AND CRITICAL PROGRAM 15
F-6.2.1 Vital Program Impact 15
F-6.2.2 Primary Equipment 15
F-6.3 HIGH-VALUE EQUIPMENT 15
F-6.4 FACILITY FIRE LOSS POTENTIAL 16
F-6.4.1 Maximum Credible Fire Loss 16
F-6.4.2 Maximum Possible Fire Loss 16
F-6.5 EMERGENCY PLANNING 16

F-7.0 CONCLUSION 17

F-8.0 REFERENCES 19

F-9.0 ATTACHMENTS 21

ACRONYMS

DOE	U.S. Department of Energy
EPDM	ethylene propylene diene monomer
ERT	emergency response team
FCP	Fernald Closure Project
HVAC	heating, ventilation, and air conditioning
IBC	International Building Code
MCFL	maximum credible fire loss
MPFL	maximum possible fire loss
NFPA	National Fire Protection Association

THIS PAGE INTENTIONALLY BLANK

EXECUTIVE SUMMARY

The purpose of this document is to establish the design and operating features necessary to manage the risk of fire associated with operation of the systems within the Silo 3 Process Facility. The descriptions and conclusions are based on the preliminary design documentation. The Silo 3 Project will be supported by the FCP infrastructure including fire protection, water supply, and emergency response.

Potential fire scenarios were analyzed for the Silo 3 Process Facility, including the maximum credible fire loss and the maximum possible fire loss. It was determined that fire suppression systems are not required for the Silo 3 Process Facility. Areas subject to contamination shall be provided with a fire detection system to detect a fire in the incipient stage to alert personnel and Emergency Response Team (ERT) and fire fighting units, thus controlling the spread of fire. Fire detection and fire alarm systems will be provided throughout the facility. The *DOE Order 1066-99, Section 6.2.5* (Ref. 1), requires that the hose runs from hydrants to all exterior portions of protected buildings are no more than 300 ft. The Silo 3 Project has areas of the Silo 3 Project that exceed the 300 ft hose run requirement from the closest hydrants.

Water supplies, fire reporting, and designated ERT will likely change over the next few years during operation of the facility. Known changes include the demolition of the elevated water tank used for firewater and the replacement of the site Fire Department with contracted services. Neither of these changes should jeopardize the level of protection required for the facility. Generally, except for the loss of the elevated tank, water supplies should be more abundant as existing sprinkler-protected facilities are demolished at the site. However, this document will require updating prior to facility operation to ensure that all changes are adequately addressed and that the level of protection is not diminished. Any change in the response times between the contracted services will be reviewed and evaluated, as required during service procurement.

The conclusion of this Fire Hazards Analysis is that the fire risk of the Silo 3 Process Facility are low to moderate and will be adequately controlled by the fire detection/alarms design and operating features provided. The objective of protecting the public and the environment from fire-induced releases is met. The objective of protecting employees from fire is accomplished with detection, notification, and means of egress. The property damage and project downtime risks are acceptable for the duration of this project.

THIS PAGE INTENTIONALLY BLANK

F-1.0 INTRODUCTION

The following fire hazard analysis was prepared to satisfy DOE requirements for the proposed project. This effort was based on performing a fire hazards analysis as required by DOE Order 420.1 - Facility Safety (see Ref. 2); and DOE Order 440.1A - Worker Protection Management for DOE Federal and Contractor Employees (see Ref. 3). The subject project is located at the DOE FCP at Fernald, Ohio.

The intent of this analysis was to review the proposed project in accordance with the proposed design documents and determine what, if any, design modifications, enhancements, etc., would be necessary to the fire safety and life safety elements of the project.

The purpose of a fire hazards analysis is to comprehensively and qualitatively assess the risk from fire within individual fire areas in a DOE facility to ascertain whether the DOE fire safety objectives, which are delineated in Order 420.1(Ref. 2) and Order 440.1A (Ref.3) are met.

This document should be revised as the design process is continued and completed. The fire hazards analysis and other design documents are dependent on each other, and thus must be coordinated. Recommendations in the fire hazards analysis should be implemented in the design and all design features and changes should be acknowledged and evaluated in the fire hazards analysis.

F-1.1 PURPOSE

The purpose of this document is to establish the design and operating features necessary to manage the risk of fire associated with operation of the Silo 3 Process Facility for the retrieval and packaging of the Silo 3 material.

The potential fire hazards associated with the processes, structures, facilities, and equipment are identified, and the fire prevention and protection strategies are outlined.

F-1.2 APPROACH AND ASSUMPTIONS

The descriptions and conclusions in this document are based on the preliminary design documentation. The Silo 3 Process Facility will be supported by the FCP infrastructure including fire protection, water supply, and emergency response. The fire protection for the Silo 3 Project will be dependent upon and integrated with the FCP Fire Protection Program.

F-1.3 FACILITY USE, FUNCTION, AND OCCUPANCY

The Silo 3 Facility is to receive, transfer, and package material from Silo 3 for shipment to an off-site disposal facility. The material is received as a powder and then is bagged for

shipment and final disposal. The new facilities for which construction, operations, and maintenance activities will be performed include:

- Process Building
- Cargo Container Building
- Excavator Building
- Silo Enclosure Building
- Operations Support and Change Trailer
- Electrical Equipment Building

The Silo 3 Process Facility has been divided into four contamination zones to classify the probability of contamination:

Zone 1: High Contamination Areas, Silo 3 and the Excavator Room of the Excavator Building: where radioactive material is exposed to air.

Zone 2: Contamination Areas, Excavator Service Area of the Excavator Building and portions of the DOFF Area of the Process Building, which provide access to Zone 1 space: potential radioactive contamination.

Zone 3: Buffer Area, portions of the DOFF Area, Corridor, Bagging Room, and Unloading Areas of the Process Building: normally occupied general working areas for operations and maintenance.

Zone 4: Controlled Areas, Cargo Container Building, Operations Support and Change Trailer, and the Electrical Equipment Building: where radioactive contamination is prohibited.

These contamination zones are shown on the Jacobs Safety and Health Drawings 94X 3900-M-01407 thru 94X-3900-M-01409 (Refs. 5, 6, and 7).

A more detailed description of the strategy and equipment to be used to remove the material contained in Silo 3 is found in the project *Access and Retrieval Strategy for the Silo 3 Project*, Document No. 40430-PL-0002 (Ref. 8) and in the *Process Description for the Silo 3 Project*, Document No. 40430-RP-0003 (Ref. 9).

Jacobs Drawing, 94X-3900-M-01461 (Ref. 10), shows the General Arrangement Plot Plan for the Silo 3 project.

The Silo 3 Process Facility is planned to operate 12 hours per day, 4 days per week from its initial operation throughout the duration of the project. When necessary the work schedule will change as required in order to meet the site and project objectives.

F-1.4 GENERAL SITE FIRE PROTECTION

The Silo 3 Project facilities are located on the western side of the FCP site. Water for fire protection will be available from the FCP site from two automatically initiated centrifugal pumps; each rated to deliver 1,250 gallons per minute (gpm) at 123 pounds per square inch gauge (psig) taking their suction from a 400,000 ground level tank. The FCP Fire Protection Engineering Department conducted a flow test on the fire hydrant, HFH-165, for the Silo 3 area on November 18, 2000. The test showed that the hydrant, HFH-165, is capable of a capacity of 1,890 gallons per minute at 92 psig to support fire suppression activities. A FCP-designated ERT will provide fire emergency response.

The Silo 3 Civil Utility Plan, Drawing No. 94-X-3900-G-01299 shows a site plan for the project and the fire hydrant, HFH-165, location. See the Attachments Section for the drawing.

THIS PAGE INTENTIONALLY BLANK

F-2.0 CONSTRUCTION

F-2.1 TYPE OF CONSTRUCTION

The Silo 3 Process Facility is designated as Type IIB Construction.

The process facility will be designed with approximately 5,700 ft^2 first floor areas, which includes the packaging and processing areas, as well as, the cargo container loading area. The exterior of the areas shall be constructed using an insulated metal panel system on metal girt or furring channels. The interior walls in the Process Building shall be the interior metal liner of the exterior siding. The roof system shall consist of a single-ply ethylene propylene diene monomer (EPDM) roofing system with insulated boards on metal roof deck. The height of the roof elevations of the packaging and processing areas ranges from 24 ft high to 50 ft high.

Exterior and interior personnel doors shall be insulated, 14-gauge and exterior-coiling doors shall be insulated flat metal slats. Radiation shielding is not required for the interior and exterior coiling doors.

A tension frame fabric structure will enclose Silo 3 to provide weather protection. This enclosure will have a footprint of approximately 10,000 ft^2. The height of the roof elevations for the enclosure will range from 36 ft high up to 49 ft high.

The Excavator Room and Excavator Service Area walls shall be poured-in-place concrete.

A trailer will be used for Operations Support and a Change Room.

An uninsulated metal building for will be used for the Electrical Building.

F-2.2 FIRE BARRIER SEPARATION

The corridor is designed to meet 1-hour fire-resistive construction. The access corridor shall be constructed as gypsum board on a shaft wall system of metal studs and rated gypsum board.

F-2.3 INTERIOR FINISHES

Interior finishes for all occupied facilities shall meet the requirements of the National Fire Protection Association (NFPA) 101, "Life Safety Code."

THIS PAGE INTENTIONALLY BLANK

F-3.0 LIFE SAFETY

An architectural code review (Ref. 11) has been prepared for the facility that evaluates the life safety issues discussed below. Summary statements are included in the following sections as appropriate.

F-3.1 OCCUPANCY CLASSIFICATION

The Silo 3 Process Facility will have an occupancy classification of Factory Industrial Occupancy F-2 (Low Hazard).

F-3.2 MEANS OF EGRESS

The number of exits, the exit width, travel distance, and exit locations will be in accordance with NFPA 101, "The Life Safety Code," and the Occupational Safety and Health Administration 29 *Code of Federal Regulations* 1910, Subpart E.

Because of the requirements for containment walls and necessary rapid evacuation in case of uncontrolled material releases the Silo 3 facility will be made handicapped accessible only in the cargo container area and the Operations Support and Change Trailer.

F-3.3 EMERGENCY LIGHTING AND EXIT LIGHTS

Emergency lighting will be provided in accordance with NFPA 101 and the International Building Code (IBC) 2000. Exit lights marking the means of egress will be provided in accordance with NFPA 101. Emergency lighting locations are noted on Jacobs Electrical Drawing No. 94X-3900-E-01585 (Ref. 12).

F-3.4 SECURITY INTERACTION

Existing security provisions for these facilities will not impede the safe evacuation of the facilities or emergency response.

F-3.5 RADIATION AND CONTAMINATION CONTROL

Existing health physics and radiation protection features will not impede the safe emergency evacuation.

THIS PAGE INTENTIONALLY BLANK

5003

F-4.0 FIRE HAZARDS

F-4.1 WASTE CHARACTERIZATION

The material in Silo 3 is primarily metal oxide salts and is classified as 11(e)(2) byproduct material under the Atomic Energy Act of 1954. It consists of dried metal oxide salts produced from a calcining operation. Because of the evaporation and calcination of this material, the water content is very low, ranging between 3.7 and 10.2 percent. In one test, approximately 90 percent (by weight) of the material passed through a 200-mesh sieve (0.074 mm), indicating the presence of submicron particles. The density of the Silo 3 material ranges from approximately 29 lb/ft^3 to 58 lb/ft^3. Based on the *Design Basis and Requirements Document for the Silo 3 Project*, Document No. 40430-DC-0001, the material is not combustible or explosive because it is a metal oxide. See Figure 1 of the attachment section for a cross section of the silo.

F-4.2 AUXILIARY SYSTEMS

F-4.2.1 Utilities

Electrical power will be provided from the Electrical Equipment Building, which will be located approximately 14 ft to the northwest of the Process Building. There will be a transformer, motor control center, and an uninterruptible power supply.

The electrical system will be designed to meet NFPA 70, "National Electrical Code."

No fuel-fired equipment (e.g., boilers, kilns) is used for the Silo 3 Project within the Silo 3 Process Facility.

The packaged air conditioning units for the Process Building and the Cargo Container Bay Air Handling Unit shall have smoke detectors installed in their supply air plenums. The air conditioning units and air-handling unit will be shut down when a fire is detected by the fire detection system by a signal sent from the fire detection system. The Silo Enclosure and the Process Building will have exhaust fans that will also be shutdown when a signal is received from the fire detection system. Motorized fire dampers will be located in the ductwork for the corridors and the air locks. See Section 4.5.1: Radiological Hazards a description of a fire-induced radiological dispersal description. A detailed description of the strategy and equipment used for the heating, ventilation and air conditioning (HVAC) of the facilities is described in Refs. 13 and 14.

F-4.2.2 Process Equipment

A detailed description of the strategy and equipment used to remove the material contained in Silo 3 is found in the project *Access and Retrieval Strategy for the Silo 3 Project*, Document No. 40430-PL-0002 (Ref. 8) and the *Process Description for the Silo 3 Project*, Document No.40430-RP-0003 (Ref. 9). From a fire protection standpoint, none of the processes or equipment used contains large quantities of combustible materials.

The Process and Excavator Buildings contain process equipment, including pumps and motors that create a low risk of a localized fire. The buildings also contain hydraulic, pneumatic, and electrical systems, creating a small potential for localized fires. The hydraulic oil is a combustible liquid with a flash point of 350°F or greater. An electric motor could fail and become an ignition source for other combustibles including hydraulic fluids. However, the likelihood of an ignition of hydraulic oil is low because of the high ignition energy required and the need for a second failure (motor failure). No other significant ignition sources (e.g., heated surfaces) are in proximity of the hydraulic systems. An electrical or hydraulic fluid fire would render the affected equipment inoperative until repairs could be made. The amount of combustible materials is not adequate to create a fire capable of causing structural damage to the buildings.

F-4.2.3 Operations Support and Change Trailer

The Operations Support and Change Trailer presents a moderate fire risk due to the electronic equipment located in the Control Room in the northeast corner and storage in the southwest corner. Walls of the trailer are fabricated using combustible materials. The Change Room in the northwest corner is standard light hazard occupancy and presents no significant fire risk. This area (Fire Area 2) is separated from the Silo 3 Process Building by an enclosure of approximately 14 ft by 25 ft dimensions. The enclosed area is an extended exit corridor from the Silo 3 Building. The trailer is positioned 3 ft 9 in away from the tension frame fabric structure over Silo 3. Per G. Evans, Fluor Fernald, the trailer is a temporary structure (having non-rated walls and being unsprinklered) and therefore does not need to meet Table 600 of the Ohio Building Code for fire separation. The fabric on the tension structure is flame retardant, self-extinguishing, and does not propagate flame. The structure design also allows the self-venting release of heat.

F-4.3 ANALYSIS OF POTENTIAL FIRE SCENARIOS

F-4.3.1 Fire Area 1 –Process, Excavator, and Cargo Container Buildings

The Process, Excavator, and Cargo Container Buildings shall be constructed of noncombustible materials and they will contain a very limited amount of combustible materials. The worst-case fire in this building would be in the packaging/filling area of the process building due to the presence of packaging materials, conveyors, and motors in proximity to each other. An uncontrolled fire in this area could create significant damage to the equipment and the building, thus impacting the operation of the facility.

F-4.3.2 Fire Area 2 – Operations Support Area

The fire scenario in this area involves the Operations Support and Change Trailer, which is considered to have a moderate hazard occupancy. A fire could do significant damage to the trailer because of the equipment inside. Building materials for stairs and decks that meet applicable codes are used to minimize the potential for a fire to propagate from the trailer to the process building. The enclosed area between the trailer and Process Building shall be rated for one-hour construction.

A fire in the Operations Support and Change Trailer might propagate to the tension support structure covering Silo 3. However, structure ventilation, a flame retardant fabric, fire alarms, and the time required for a fire to breach the Operations Support and Change Trailer's outer envelope would provide for sufficient worker safety and minimize equipment damage.

F-4.4 EXPLOSIVES

None of the materials handled or used in the Silo 3 Process Facility Project in any measurable quantities create an explosive hazard based on the *Hazard Category Calculation*, Document No. 40430-RP-0006 (Ref. 15).

F-4.5 POTENTIAL FOR RADIOLOGICAL, BIOLOGICAL, OR TOXIC INCIDENT

F-4.5.1 Radiological Hazards

The major radiological hazard from a fire would be the potential release of radon from the packaging area. The calculation of the worst-case dose to a worker or a member of the public in the event of a spill of material from equipment failure due to a fire is based on the assumed complete release of the radon present in the spilled material. Radon in the spilled material void spaces, radon generated over the next 24 hours, and some of the solids are released to the ventilation system. The filter system fails to remove the material and all materials are passed through the ventilation system and released from the 125 ft stack. The calculated dose at 350 m downwind was found to be 12 mrem. Therefore, a fire in the packaging area of the process building should not be considered to be "safety-significant." Other fire scenarios involve radioactive materials but do exceed the cases shown in the *Silo 3 Accident Analysis*, Document No. 40430-RP-0005 (Ref. 16).

F-4.5.2 Biological Hazards

There are no biological hazards created by any fire scenario.

F-4.5.3 Chemical and Toxic Hazards

Chemical hazards in the processing area are minimal. With the detection/alarm systems provided, none of the fire scenarios should involve the release of hazardous or toxic chemicals.

F-4.6 FIRE PROTECTION WATER RUN-OFF

Water for fire fighting would only be used in the noncontaminated areas of the facility. Therefore, this should not create a contaminated water run-off problem greater than normal storm water run-off, since no breach of contaminated areas would occur.

F-4.7 NATURAL HAZARDS (EARTHQUAKE, FLOOD, AND WIND)

Wind is the only natural hazard that could exacerbate a fire by allowing a fire to propagate between the trailer and the Process Building (Section 6.4.2). Earthquake and flood potentials do not affect the fire risks.

F-5.0 FIRE PROTECTION

F-5.1 WATER SUPPLY

An adequate fire-protection water supply is available from the FCP site (Section 1.4). The responding FCP site ERT will suppress fires in areas that cannot be handled with portable fire extinguishers. The attached Silo 3 Civil Utility Plan, Drawing No. 94-X-3900-G-01299, outlines the site plan and the fire hydrant locations.

F-5.2 FIRE SUPPRESSION

The Implementation Guide for DOE Orders 420.1 and 440.1 (paragraph 9.7) (Ref. 4) states that DOE has an obligation to provide protection for its facilities so that a fire will not result in an unacceptable program delay or property loss. Consequently, DOE considers any facility in excess of 5,000 ft^2 in ground floor area and any facility with a maximum possible fire loss (MPFL) of $1 million ($10 million approved at FCP via DOE memorandum, DOE-0320-99, J. Craig to G.L. Denver, January 22, 1999, "Change in Maximum Possible Loss Criteria at the Fernald Environmental Management Project") as warranting protection by an automatic fire suppression system. The packaging area of the Silo 3 Process Building has a ground floor area of 5,700 ft^2 and Occupancy Classification of Group F-2 (Low Hazard). Group F-2 Occupancies do not require that an automatic sprinkler system be provided. A fire detection and alarm system shall be installed throughout the Silo 3 facility to assure occupant notification of emergencies. Fire extinguishers shall be provided throughout the Silo 3 facility, they will be located external to the fire hazard areas and near access ways so that incipient fires can be extinguished. The ventilation system will also be used control incipient fires by isolating the areas and reducing the supply of oxygen to the fire.

Fire suppression for the trailer will emphasize manual fire fighting. Normally occupied areas will be provided with fire detection and alarm systems to assure prompt notification of emergencies to both occupants and the ERT. Portable fire extinguishers will be provided in accordance with NFPA 10, "Standard for Portable Fire Extinguishers." Because of the lack of continuity of combustibles and the provisions of the fire detection system (see Section 5.3), credible fires will be incipient in nature and can be suppressed using portable extinguishers. Because of the limited size and low or moderate hazard use, no automatic sprinkler protection is required. A trailer fire that is not controlled with portable extinguishers will require hose lines operated by the ERT. The water supply distribution system to the Silo 3 area is a dead end run hydrant. This dead end run hydrant is within 290 ft of the supply tie-in point. Also, there are parts of the Silo 3 Project that exceed the maximum hose run distance of 300 ft distance from a hydrant as specified in *DOE Order 1066-99, Section 6.2.5*. The parts of the facility that fall outside this required hydrant support area are the Operations Support and Change Trailer, and the north and northwest sides of the Silo 3 Enclosure.

F-5.3 PROTECTIVE SIGNALING SYSTEM

F-5.3.1 Fire Detection

The Silo 3 Process Facility will be provided with fire detection and alarm systems to assure prompt notification of fire emergencies to both building occupants and emergency responders.

Detectors will be installed in accordance with NFPA 72, "National Fire Alarm Code," and will be connected to the Silo 3 Process Building Fire Alarm Control Panel.

F-5.3.2 Fire Alarm System

The fire alarm system will have a central Fire Alarm Control Panel in the Silo 3 Process Building. A fire or trouble alarm will be sent to the Savannah River Facility Communication Center, which will relay the alarm to the appropriate ERT for the FCP site. Manual pull boxes will be installed in accordance with NFPA 72 and the IBC. Notification devices will be horns and strobes and will be installed in all areas in accordance with NFPA 72.

F-5.3.3 Smoke Detection System

Photoelectric spot type smoke detectors should be installed in the Cargo Container Bay, Packaging Area, Storage Area, Waste Water Area, Electrical Building, Operations Support and Change Trailer, Corridors, Air Locks, supply air plenums for the air conditioning units and the Cargo Container Bay Air Handling Unit. Linear Beam type smoke detectors will be provided for the Silo Enclosure. Each will be wired to a fire alarm control panel. Automatic notification will be sent to the communication center. Activation of any smoke detector will sound a general alarm throughout the facility.

F-5.3.4 Heat Detection System

Combination rate-of-rise/fixed temperature type heat detectors will be installed above rubber belt conveyors, within the air handling system, and in the Excavator Room. Each heat detector will have a discrete address, and will sound a general alarm, and automatically notify the communication center when activated.

F-5.4 FIRE DEPARTMENT RESPONSE

Fire pre-plans will be developed for each fire area to outline the fire-fighting strategies and precautions required for the Silo 3 Process Facility. These pre-plans will be developed by FCP. Silo 3 Process Facility project employees will receive incipient fire training regarding portable extinguishers and the alarm system.

F-6.0 FACILITIES, EQUIPMENT, AND PROGRAM PRESERVATION

F-6.1 ESSENTIAL SAFETY CLASS SYSTEMS

No systems are considered essential safety class systems for this project as determined per the *Silo 3 Accident Analysis*, Document No. 40430-RP-0005 (Ref. 16).

F-6.2 VITAL AND CRITICAL PROGRAM

F-6.2.1 Vital Program Impact

A major fire in the Process Building would impact the Silo 3 Project schedule, but the fire detection devices and alarms provided in these areas would reduce potential damage and minimize downtime.

F-6.2.2 Primary Equipment

All components involved with the retrieval, conveyance, and packaging of silo material are primary equipment. The fire detection system will reduce the significance of a fire involving any of these components.

F-6.3 HIGH-VALUE EQUIPMENT

The values were obtained from estimates and procurements to date.

- Inclined conveyor: $125,000
- Packaging system bag loaders: $400,000
- Package heat sealers: $320,000
- Excavator: $450,000
- Pneumatic Retrieval - Vacuum Blower Skid: $100,000
- Pneumatic Retrieval Collector: $60,000
- Motor control centers: $125,000
- 480-volt feeder: $81,000
- Control System in trailer: $200,000
- Continuous emissions monitor: $150,000
- Personnel contamination monitors: $90,000
- Tennelec counting systems: $90,000

F-6.4 FACILITY FIRE LOSS POTENTIAL

The maximum credible fire loss (MCFL) and MPFL potential in each fire area includes the cost of property loss, recovery, cleanup, and replacement.

F-6.4.1 Maximum Credible Fire Loss

Fire Area 1 – Process, Excavator, and Cargo Container Buildings, and Silo 3 Enclosure

The MCFL is a fire in the packaging area of the Process Building that would result in damage to one of the two Container Management and Packaging Systems. The property damage would be approximately $800,000. Because of the redundant container management and packaging systems this MCFL would have little programmatic impact on the project.

Fire Area 2 – Operations Support Area

The MCFL is a fire in the Operations Support and Change Trailer. An electrical fire could do significant damage to the trailer and control systems because of the trailer's frame construction. The property damage would be approximately $900,000. This MCFL would have a programmatic impact on the project.

F-6.4.2 Maximum Possible Fire Loss

Fire Area 1 –Process, Excavator, and Cargo Container Buildings, and Silo 3 Enclosure

The MPFL is a fire in the packaging area of the Process Building that would result in the loss of the Container Management and Packaging Systems, as well as all ancillary equipment. The property damage would be approximately $2,500,000. This MPFL would have a programmatic impact on the project because the majority of the equipment is not readily replaceable.

Fire Area 2 – Operations Support Area

The MPFL is an unmitigated fire in the trailer during high wind conditions and is the same as the MCFL for this area. The resulting damage would include the trailer with similar property damage of approximately $900,000. This MPFL would have a programmatic impact on the project, but these facilities and associated equipment are more readily replaceable than those associated with Fire Area 1.

F-6.5 EMERGENCY PLANNING

The Silo 3 Process Facility Project emergency planning will be integrated with the FCP Emergency Plan.

F-7.0 CONCLUSION

The conclusion of this Fire Hazards Analysis is that the fire risk of the Silo 3 Process Facility are low to moderate and is adequately controlled by the fire detection/alarms design and operating features provided. The objective of protecting the public and the environment from fire-induced releases is met. The objective of protecting employees from fire is accomplished with detection, notification, and means of egress. The property damage and project downtime risks are acceptable for the duration of this project.

A small, localized fire in the contamination areas, see Section 1.3, will be detected in the incipient stage and can be controlled with portable fire extinguishers and/or the ventilation system to isolate the areas, thus reducing the supply of oxygen to the fire.

THIS PAGE INTENTIONALLY BLANK

F-8.0 REFERENCES

1. DOE Standard, DOE-STD-1066-99: *Fire Protection Design Criteria*.

2. DOE Order, DOE O 420.1: *Facility Safety*.

3. DOE Order, DOE O 440.1A: Worker Protection Management for DOE Federal and Contractor Employees.

4. DOE, G-420.1/B-0, G440.1/E-0, Implementation Guide for Use with DOE Orders 420.1 and 440.1, Fire Safety Program, September 1995.

5. General Arrangement Equipment Arrangement Plan First Floor Contamination Zones Silo 3. Drawing 94X-3900-M-01557. Revision 0, Jacobs Engineering Group Inc., Oak Ridge, TN.

6. General Arrangement Equipment Arrangement Plan Second Floor Contamination Zones Silo 3. Drawing 94X-3900-M-01558. Revision 0, Jacobs Engineering Group Inc., Oak Ridge, TN.

7. General Arrangement Equipment Arrangement Plan Third Floor Contamination Zones Silo 3. Drawing 94X-3900-M-01559. Revision 0, Jacobs Engineering Group Inc., Oak Ridge, TN.

8. Access and Retrieval Strategy for the Silo 3 Project, Document No. 40430-PL-0002, Revision 0, Jacobs Engineering Group Inc., Oak Ridge, TN, July 2002.

9. Process Description for the Silo 3 Project, Document No. 40430-RP-0003, Revision 0, Jacobs Engineering Group Inc., Oak Ridge, TN, July 2002.

10. Mechanical General Arrangement Plot Plan. Drawing 94X-3900-M-01461. Revision 0, Jacobs Engineering Group Inc., Oak Ridge, TN.

11. Code Review for the Silo 3 Project, Document No. 40430-RP-0007, Revision 0, Jacobs Engineering Group Inc., Oak Ridge, TN, March 2003.

12. Electrical Lighting Layout First Floor Plan. Drawing 94X-3900-E-01585. Revision 0, Jacobs Engineering Group Inc., Oak Ridge, TN.

13. HVAC Sequences of Systems Operation for the Silo 3 Project, Drawing 94X-3900-H-01692, Revision 0, Jacobs Engineering Group Inc., Oak Ridge, TN.

14. HVAC Sequences of Systems Operation for the Silo 3 Project, Drawing 94X-3900-H-01693, Revision 0, Jacobs Engineering Group Inc., Oak Ridge, TN.

15. Hazard Category Calculation, Document No. 40430-RP-0006, Jacobs Engineering Group Inc., Oak Ridge, TN.

16. Accident Analysis, Document No. 40430-RP-0005, Jacobs Engineering Group Inc., Oak Ridge, TN.

F-9.0 ATTACHMENTS

- Figure F-1. Cross Section View of Silo 3.
- Figure F-2. Civil Site Plan: Drawing No. 94X-3900-G-01297, Revision 6.

THIS PAGE INTENTIONALLY BLANK

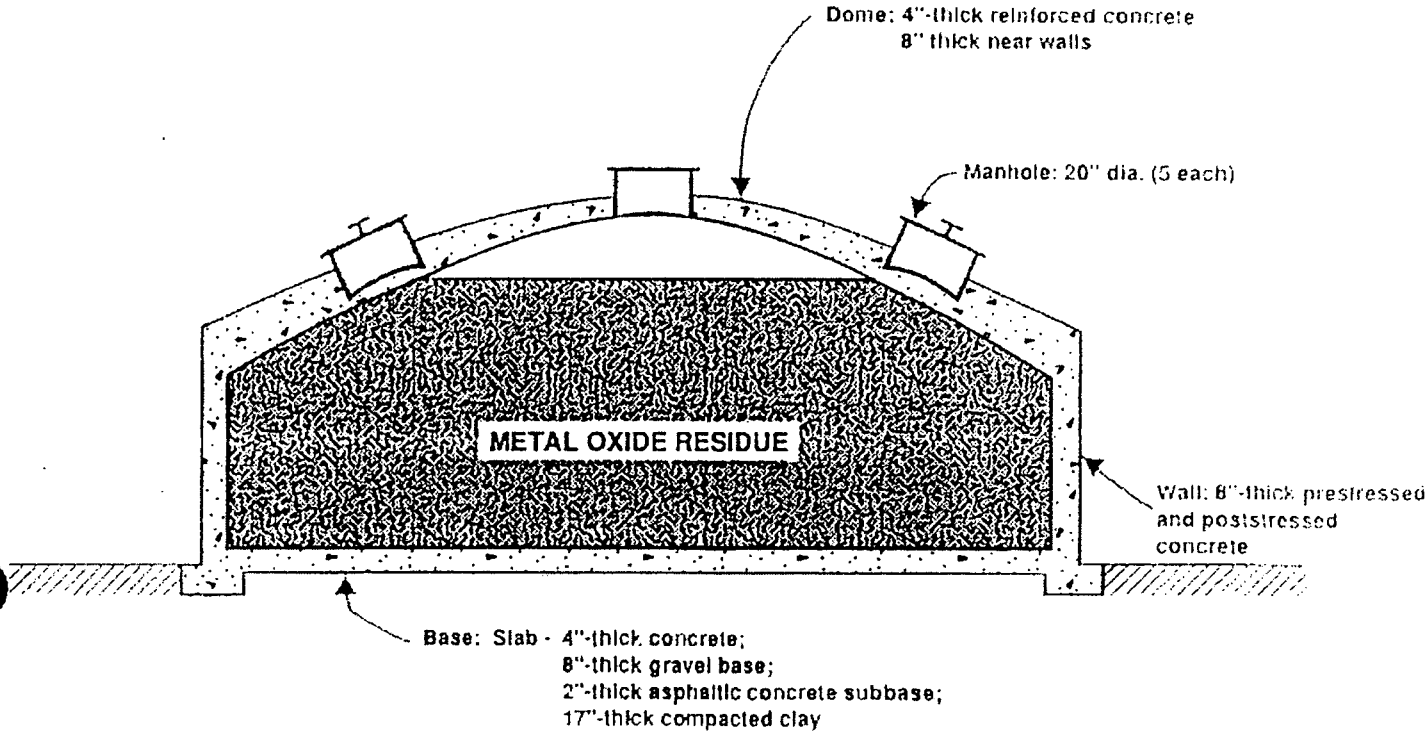

Figure F-1: Cross Section View of Silo 3

THIS PAGE INTENTIONALLY BLANK

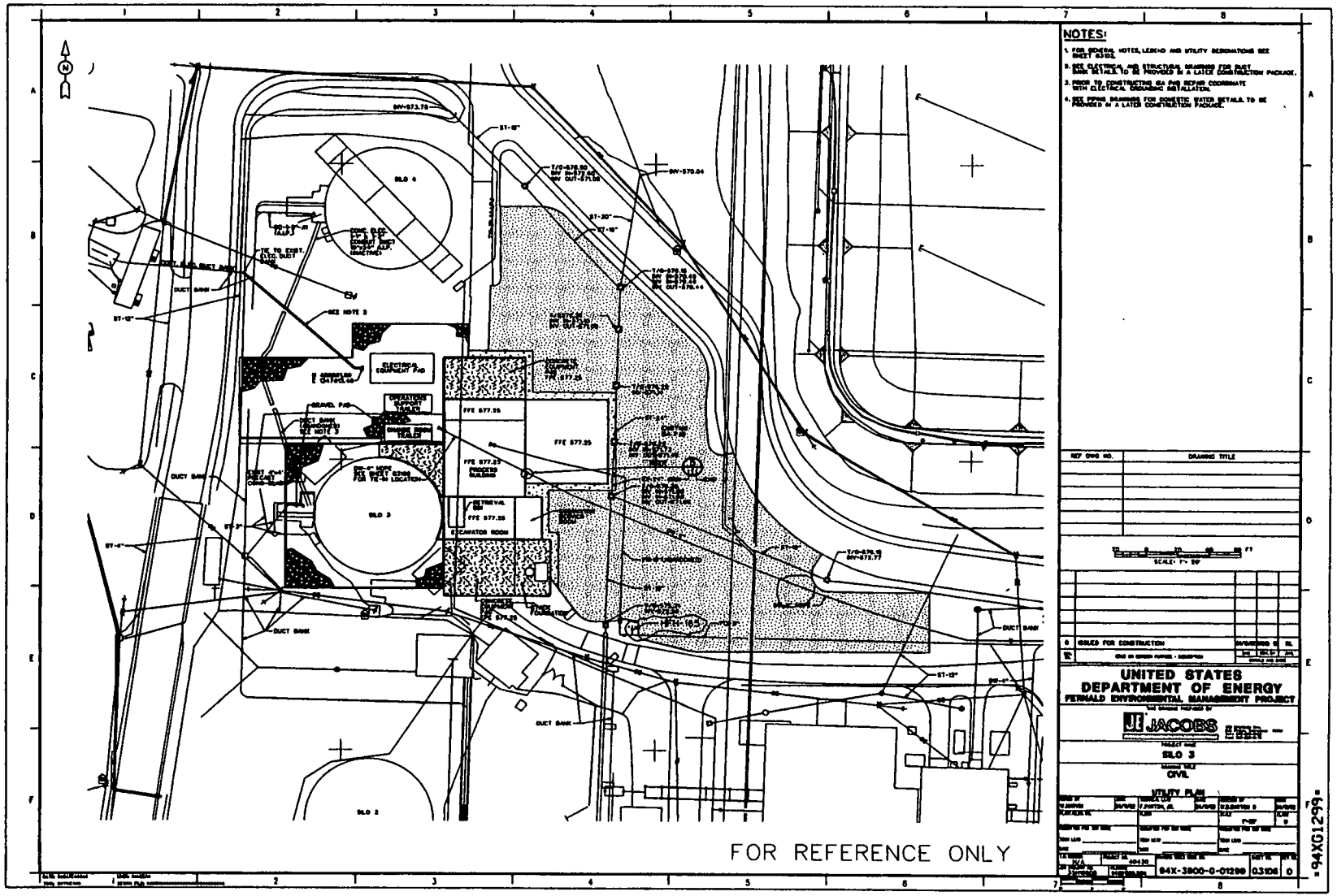

FIGURE F-2. Silo 3 Site Map

000035

5003

THIS PAGE INTENTIONALLY BLANK