COMPLETE

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 629542

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	3a. USQ Required?	4. Date
Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	JB Sepahpur, WHC Fire Prot. Pgrm., B1-10, 372-3303	[] Yes [X] No	01/31/96
	5. Project Title/No./Work Order No. W-058	6. Bldg./Sys./Fac. No. Cross-Site Transfer	7. Approval Designator SQ
	8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-W058-FHA-001, Rev. 0	9. Related ECN No(s). NA	10. Related PO No. NA

11a. Modification Work	11b. Work Package No.	11c. Modification Work Complete	11d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 11b) [X] No (NA Blks. 11b, 11c, 11d)	NA	NA Cog. Engineer Signature & Date	NA Cog. Engineer Signature & Date

12. Description of Change

Section 6.0: Revised document to indicate that SC1 components will not be located in the structures. **Section 11.2(1)**: Provided additional information to support the justification for not installing a standpipe system in the buildings. **Section 11.3(1)**: Provided additional information to support the justification for not installing a hydrant around the buildings. **Section 12.0**: The last paragraph of the section was added to describe the methodology that was used to develop the MPFL values. The MFPL estimates were revised to reflect the described methodology. **Section 12.1**: Revised the section based to eliminate the discussion about 1-hr doors in 2-hr walls. The doors will be upgraded to a 2-hr rating. **Section 13.0**: Cited the basis for the values that were used for the exposure calculation. **Section 20.0**: This section was added to summarize the acceptable design deviations for the project. **Attachment 2**: This attachment was added. **All Sections**: Editorial changes, and reformat paragraphs.

13a. Justification (mark one)

Criteria Change	[X]	Design Improvement	[]	Environmental	[]	Facility Deactivation	[]
As-Found	[]	Facilitate Const	[]	Const. Error/Omission	[]	Design Error/Omission	[]

13b. Justification Details

The document was revised to reflect significant changes that are being made to the design. Changes were made to support a DOE 6430.1A deviation request that is needed for the project.

14. Distribution (include name, MSIN, and no. of copies)

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JR Bell	B1-10	1
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A-7900-013-1

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1) 629542

15. Design Verification Required	16. Cost Impact				17. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION			
[] Yes	Additional	[] $	Additional	[] $	Improvement	[]
[X] No	Savings	[] $	Savings	[] $	Delay	[]

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision

20. Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog. Eng. JB Sepahpur	2-1-96	PE	
Cog. Mgr. JR Bell	2/14/96	QA	
QA LR Hall	2/1/96	Safety	
Safety HL Wedlick	2-2-96	Design	
Environ.		Environ.	
Other NF Barilo	2-1-96	Other	
C. Van Katwijk	2-1-96		
		DEPARTMENT OF ENERGY	
		Signature or a Control Number that tracks the Approval Signature	
		ADDITIONAL	

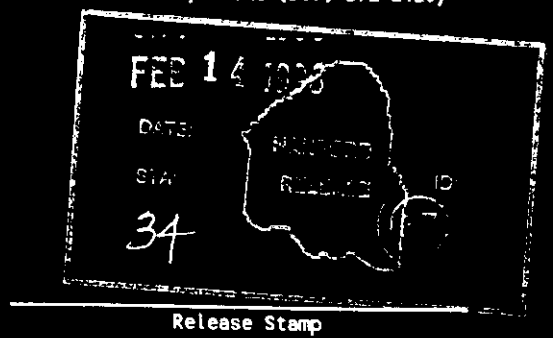
Fire Hazards Analysis for the Replacement Cross-Site Transfer System, Project W-058

J. B. Sepahpur
WHC, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

EDT/ECN: 629542 UC: 2030
Org Code: 31C00 Charge Code: N58DR
B&R Code: EW3130010 Total Pages: ~~39~~ 38

Key Words: Project W-058, Cross-Site Transfer System, Fire Hazards Analysis

Abstract: The fire hazards analysis assess the risk from fire and determines compliance with the applicable criteria of DOE 5480.7A, DOE 6430.1A, and RLID 5480.7.



Release Approval 2/14/96 Date

Release Stamp

Approved for Public Release

RECORD OF REVISION	(1) Document Number WHC-SD-W058-FHA-001, Rev. 1	Page 1

(2) Title
Fire Hazards Analysis for the Cross-Site Transfer System, Project W-058

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
	(7) The changes cited below were made to Revision 0 of the subject document. The original document was issued on 11/13/95 under EDT 140021.	JB Sepahpur	JR Bell
1	**Section 6.0:** Revised document to indicate that SC1 components <u>will not</u> be located in the structures.	John Sepahpur	J R Bell 2/14/96
1	**Section 11.2(1):** Provided additional information to support the justification for not installing a standpipe system in the buildings.	John Sepahpur	J R Bell 2/14/96
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1 RS	**All Sections:** Editorial changes, and reformat paragraphs.	John Sepahpur	J R Bell 2/14/96

WHC-SD-W058-FHA-001 Rev. 1

FIRE HAZARDS ANALYSIS FOR THE

Replacement Cross-Site Transfer System
Project W-058

Westinghouse Hanford Company

February, 1996

Prepared by

J. B. Sepahpur

Fire Protection Programs

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TABLE OF CONTENTS

ABBREVIATIONS, AND ACRONYMS

ALARA	As Low As Reasonably Achievable
cfm	Cubic foot per minute
cm	centimeters
DOE	U.S. Department of Energy
FHA	Fire Hazards Analysis
FM	Factory Mutual
ft	feet or foot
ft^2	square feet
HFD	Hanford Fire Department
in.	inch or inches
L	liters
m	meters
MCF	Maximum Credible Fire
MCFL	Maximum Credible Fire Loss
MPF	Maximum Possible Fire
MPFL	Maximum Possible Fire Loss
NFPA	National Fire Protection Association
RLID	Richland Operations Implementing Directive
UBC	Uniform Building Code
WHC	Westinghouse Hanford Company

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1.0 INTRODUCTION

Current Hanford waste volume projections identify a need to use the tank farms beyond the year 2000. Project W-058 will provide encased pipelines to connect the SY Tank Farms in 200 West Area with the tank farms in 200 East Area via an interface with the 244-A lift station. The new piping system will cover a distance of approximately 10.5 kilometers (6.5 miles). The system will replace the existing cross-site transfer system which is nearing the end of its useful life. The function of the cross-site transfer system will be to transfer radioactive waste from the SY Tank Farm to treatment, storage, and disposal facilities in 200 East Area. The system will be an integral part of the Hanford Site cleanup.

The facilities to be provided by Project W-058 will correlate with moving liquid waste from 200-West Area to the 200-East Area for treatment. The 10.5 kilometers (6.5 miles) of piping will be provided with at least 0.9 meters (3 ft) of cover. Pumps in a diversion box will allow the waste to be moved to the 200-East locations without settling out. A vent station, located at the high point of the system, will act as a vacuum breaker if the pipeline needs to be drained. Pump control and maintenance support functions will be provided in support buildings.

2.0 PURPOSE

The purpose of this **preliminary** fire hazards analysis (FHA) is to demonstrate that the level of fire safety designed into the W-058 project meets the fundamental requirements of U.S. Department of Energy (DOE) Orders 5480.7A and 6430.1A. In addition, this FHA is intended to demonstrate that the level of fire safety prescribed by RLID 5480.7 has been incorporated in to the project. The key objectives of the FHA are summarized below.

- Evaluate the proposed design for conformance to DOE fire protection design criteria.
- Provide recommendations to ensure that the level of protection is commensurate with the expected fire hazards.
- Provide justifications for appropriate deviations from the DOE design criteria.

3.0 SCOPE

The scope of this document is limited to an evaluation of fire hazards within and adjacent to Diversion Box 6241-A and Vent Station 6241-V. The process control support buildings attached to the 6241-A and 6241-V structures are also addressed by this FHA.

Systems and components installed by the W-058 project, but excluded from this FHA include; 1) process water system components located out-of-doors, and 2) the buried cross-site transfer piping. These features are excluded from the FHA, because they do not contribute to the fire loading within a structure and they do not create an exposure hazard to other structures at the site.

4.0 SUMMARY AND CONCLUSIONS

The potential consequences of a fire have been substantially mitigated through the use of heavy noncombustible construction features, and the limited fire loadings inherent with the function of the facilities. Adequate control of fire hazards has been achieved by the confinement and separation of fuel packages and ignition sources. The need for fire suppression systems in and around the facilities was reviewed. The examination concluded that fire suppression features were not needed to mitigate the consequences of design basis accidents, or limit property damage to the levels prescribed by the DOE.

Because of its potential for the accumulation of transient combustibles, the personnel access area was considered to be the most significant fire hazard at the facilities. However, the hazards likely to be present in access area would not pose a significant threat to the health and safety of the public, the environment, or site personnel.

Necessary enhancements to the life safety aspects of the facilities have been identified by this FHA. Also, justifiable deviations from the DOE Orders have been identified and evaluated by this FHA. Section 20.0 of this FHA lists the deviations that have been justified by this FHA. Section 21.0 of this FHA identifies recommendations for resolving the life safety issues.

5.0 FIRE AREA DESCRIPTION

The facilities addressed by this FHA are depicted in Attachment 1 of this document. Each facility is considered to be a separate fire area based upon its spatial separation from other hazards at the Hanford Site. A description of the construction features for the fire areas is summarized below.

5.1 Diversion Box 6241-A

The diversion box facility will be located in the southeast quadrant of the 200 West Area. There are no other structures within close proximity to the diversion box facility. However, a flush water tank and pump will be located on the north side of the support building structure. The facility will consist of an underground diversion box connected to a support structure on the grade level.

The design of the walls, floor, and ceiling for the diversion box is cast in place concrete, with a minimum thickness of 27.9 cm (11 in.). Table 2 of Factory Mutual (FM) data sheet 1-21 indicates that 14.0-16.5 cm (5.5-6.5 in) of reinforced concrete will provide a fire resistance rating of two hours. Table 43-B of the Uniform Building Code (UBC) indicates that a five inch thick siliceous aggregate concrete wall system is capable of providing a fire resistance rating of two hours. As indicated by Reference 5, the doorway to the diversion will be protected by a 1-1/2 hour rated fire door. The fire door rating conforms with Section 504.6.2 of the UBC. The fire stop system for pipe and conduit penetrations is non-shrink grout, with the fill depth equal to the barrier thickness.

A 6-inch diameter, cast in place, pipe will be used for ventilating the diversion box. A HEPA filter will be attached to the pipe outside of the building. A valve will be provided in the pipe line, between the HEPA filter and the exterior wall, to facilitate the replacement and isolation of the HEPA filter. A fire damper will not be needed in the in ventilation pipe since the vent opening is not located in a fire wall separating two fire areas.

The diversion box will be connected to the support structure by a cast in place concrete corridor/stairway. A 1-hr rated fire wall separates the portion of the corridor/stairway that communicates with the support building. The design of the exterior walls for the support building consists of 24.1 cm (9.5 in.) thick, prestressed, concrete panels. Concrete construction is also utilized for the floor and ceiling of the structure. The support building is segregated into three compartments. The compartments are defined by interior walls consisting of 20.3 cm (8 in.) precast concrete panels. The three compartments do not communicate with each other. Access to the compartments is accomplished via doors in the exterior walls.

5.2 Vent Station 6241-V

The vent station facility will be located about midway between the 200 East and 200 West areas. There are no other structures within close proximity to the vent station facility. The facility will consist of a vent station structure connected to a support structure. A portion of the vent station will be located below grade, and the support building will be located at grade level. The design of the walls, floor, and ceiling for the vent station is cast in place concrete, with a minimum thickness of 27.9 cm (11 in.). Table 2 of Factory Mutual (FM) data sheet 1-21 indicates that 14.0-16.5 cm (5.5-6.5 in) of reinforced concrete will provide a fire resistance rating of two hours. Table 43-B of the Uniform Building Code (UBC) indicates that a five inch thick siliceous aggregate concrete wall system is capable of providing a fire resistance rating of two hours. As indicated by Reference 5, the doorway to the vent station box will be protected by a 1-1/2 hour rated fire door. The fire door rating conforms with Section 504.6.2 of the

UBC. The fire stop system for pipe and conduit penetrations is non-shrink grout, with the fill depth equal to the barrier thickness.

The vent station is connected to the support building by a cast in place concrete corridor/stairway. A 1-hr fire rated wall separates the portion of the corridor/stairway that communicates with the support building. The design of the support building is identical to the support building for Diversion Box 6241-A.

6.0 ESSENTIAL SAFETY CLASS SYSTEMS

The diversion box and vent station structures will be designated as Safety Class 1 for the purpose of withstanding a design basis seismic event. The facilities will not contain Safety Class 1 systems or components (Reference 5).

Safety Class 2 components will be located within the diversion box and vent station structures. The support buildings will not contain any Safety Class 2 areas or equipment.

7.0 CRITICAL PROCESS EQUIPMENT

For this FHA, critical process equipment is defined as equipment that is not classified as Safety Class 1, but is an essential support system to a Safety Class 1 system or component. In other words, failure of the critical process equipment (i.e., non-safety support system) would prevent the Safety Class 1 system from performing its intended function during a design basis fire. The diversion box and vent station will not contain Safety Class 1 equipment, therefore, the buildings can not contain the critical process equipment defined in this FHA.

8.0 HIGH VALUE PROPERTY

For this FHA, high value property is defined as equipment having a value of more than $1 million. Project W-058 does not install any individual pieces of equipment valued over $1 million.

9.0 LIFE SAFETY CONSIDERATIONS

In accordance with the National Fire Protection Association (NFPA) 101 Life Safety Code, the diversion box (Bldg. 6241-A) and vent station (Bldg. 6241-V) facilities have an occupancy classification of Special Purpose Industrial (Chapter 28). The provisions of Chapter 30 for Special Structures also apply to the underground portions of the facilities. Both facilities have instrumentation rooms on-grade, along with a personnel access area for entry into the below grade diversion box and vent station. The life safety design for the facilities on-grade comply with the applicable provisions of NFPA 101.

For the below grade portions of the facilities, Chapter 28 restricts the common path of travel in unsprinklered Industrial Occupancies to 50 feet. The diversion box and vent station areas are both served by a single stair. The stair serving the diversion box has a 1 hour fire rated enclosure. These areas are normally unoccupied except during maintenance activities. The purpose of these rooms is similar to a mechanical equipment, boiler, or furnace room from a hazard standpoint. Section 5-12 of the Code allows a common path of travel of 100 feet in these type of rooms if sprinkler protection is provided throughout, or if there is no fuel-fired equipment present. Neither the diversion box or the vent station has fuel-fired equipment, hence the increased distance may apply. Giving consideration to the increased travel permitted by Section 5-12, the diversion box room has a common path of travel (in this case the travel distance to the single exit stair enclosure) of approximately 75 feet, and the vent station room has a common path of travel of approximately 55 feet, which are both in compliance with Section 5-12. However, door 4 in the Diversion Box support building must be upgraded to a 1-hour rating in order for the stairwell to be classified as an exit enclosure.

Section 30-7.2.2 requires underground structures to be provided with emergency lighting. Since the diversion box and vent station are normally unoccupied areas, it may not be appropriate to install emergency lights. If the lights are provided, monthly and annual testing would be necessary which would require entry into these areas that are otherwise unoccupied. Due to the lack of occupancy, the benefit gained by installing and maintaining the emergency lights is questionable. A means of emergency lighting could be administratively controlled by requiring all personnel entering the diversion box and vent station to be equipped with battery pack lanterns. This would ensure that emergency lighting is provided when the space is occupied, and avoid unnecessary entries into these spaces solely for emergency light testing.

The means of egress are identified in accordance with Section 28-2.10 of the Life Safety Code. If the exit components are maintained as designed and the means of egress is kept clear, personnel will not be exposed to any undue life safety hazards. The only condition identified that requires special consideration (i.e., DOE-RL approval) from a life safety standpoint pertains to the possible use of administrative controls in lieu of permanently installed emergency lighting. Section 21.0 of this FHA cites the necessary life safety upgrades.

10.0 DESCRIPTION OF FIRE HAZARDS

10.1 Diversion Box

Cable insulation is the primary in-situ combustible material. The cables are routed in metal conduit or a solid bottom, covered, cable

tray. Short lengths of cables are exposed at their termination points. Additional combustibles could include grease on motor bearings or valve actuators, and plastic terminal blocks. The in-situ combustibles are considered to be a negligible hazard due to their limited quantity, lack of continuity between the combustibles, and their placement in noncombustible enclosures.

While the facility is operating, transient combustibles will not accumulate in the diversion box because access to the room will be prohibited. Transient combustibles will only accumulate in the diversion box when the cross-site transfer system is shutdown for maintenance activities. Maintenance on the cross-site transfer system is expected to occur once per year, and last for about seven days. The expected transient combustibles include plastic tarp, dirty anti-contamination clothing, dirty rags, and decontamination materials. Since the area will be radiological controlled, the accumulation of materials in the area will be rigorously supervised and minimized. Under operating conditions, potential ignition sources are limited to a pump or motor bearing failure, or the failure of an electrical component. During maintenance activities, possible ignition sources include portable lights, portable fans, power tools, or hot work activities.

10.2 Vent Station

The vent station is essentially free of exposed combustible materials. The most prevalent in-situ combustibles consist of sparse amounts of cable in metal conduit. The in-situ combustibles are considered to be a negligible hazard due to their limited quantity, lack of continuity between the combustible material, and placement in noncombustible enclosures.

While the facility is operating, transient combustibles will not be introduced in to the vent station, because access to the area will be prohibited. Transient combustibles will only accumulate in the vent station when the cross-site transfer system is shutdown for maintenance activities. Maintenance on the cross-site transfer system is expected to occur once per year, and last for about seven days. The expected transient combustibles include plastic tarp, dirty anti-contamination clothing, oily rags, and decontamination materials. Since the area will be a radiological controlled area, the accumulation of materials in the area will be rigorously controlled and minimized.

Under operating conditions, potential ignition sources are limited to the failure of an electrical component. During maintenance activities, possible ignition sources include portable lights, portable fans, power tools, or hot work activities.

10.3 Diversion Box and Vent Station Support Buildings

The primary combustibles consist of control panels and instrument racks. The in-situ combustibles will be confined to the electrical and instrumentation room, or the compressor room. An appreciable amount of transient combustibles could be situated in the personnel access room. The anticipated transient combustibles include anti-contamination clothing, contamination control materials, dirty laundry, and trash. The personnel access room is expected to contain the highest concentration of combustibles within each facility.

11.0 FIRE SUPPRESSION FEATURES

This section examines the need to provide fire suppression systems in and around the facilities. The applicable design requirements of the DOE Orders have been identified, and the basis for compliance with the orders is provided in following subsections.

11.1 Automatic Suppression

(1) Automatic suppression is required by DOE Order 6430.1A, Section 1530-2.3.2, and DOE Order 5480.7A, Section 9.b.3.(b) when the MPFL exceeds $1,000,000, or the building is larger than 5000 square feet.

Automatic fire suppression system is not needed for the facilities since the area of the structures is less than 5000 square feet and the maximum possible fire loss (MPFL) is less than $1,000,000. The basis for the MPFL values is discussed in section 12.0 of this document.

(2) An automatic suppression system is required for non-reactor nuclear facilities per DOE Order 6430.1A, Section 1530-99.0[16].

Automatic suppression systems are not needed, because other conditions in the facilities are sufficient to mitigate the consequences of a fire. The consequences of a fire have been substantially mitigated through the use of heavy noncombustible construction features, and the limited fire loadings inherent with the function of the facilities. Additionally, automatic fire suppression features are not needed to mitigate the consequences of design basis accidents, or limit property damage to the levels prescribed by the DOE. Adequate control of fire hazards has been achieved by the confinement and separation of fuel packages and ignition sources. Further explanation on this issue is provided in section 12.0 of this FHA.

11.2 Manual Suppression

(1) RLID 5480.7, Section 8.1.e, requires a standpipe system for the containment/confinement portions of the facilities (i.e., the diversion box area).

The purpose of the standpipe is to allow fire fighters to make an interior attack without having to block open confinement barriers with fire hoses. Compliance with the RLID criteria would require that standpipe systems be installed in small, one room, single story, structures. This type of arrangement jeopardizes the safety of the fire fighters, because the structures are not large enough to provide a smoke free staging area within the confinement/containment boundary. In order to utilize a standpipe in the structures, the fire fighters would have to enter the fire compartment and then hook up fire hoses. Attempting to connect fire hoses in a dark, smoke filled, room would delay manual suppression efforts, increase fire damage, and increase any occupational exposures that the fire fighters may encounter. Due to the small size of the containment structures, and thus a lack of staging areas, standpipe systems would not provide the level of fire safety intended by the RLID. Additionally, manual fire fighting efforts will not be required for the purpose of limiting property damage to the levels dictated by DOE orders. Finally, as discussed in Section 11.3 of this FHA, a water supply will not be provided around the facilities; therefore, a standpipe would not significantly enhance fire safety at the facilities.

The transfer system will be flushed and isolated prior to the start of maintenance activities. When the transfer system is shutdown for maintenance the diversion box and vent station structures will not be required to function as confinement barriers. Thus, a standpipe will not be required for the purpose of maintaining the integrity of the barriers.

11.3 Water Supply and Distribution

(1) Fire hydrants must be installed within 300 feet of the structures per DOE Order 6430.1A, Section 0266-4[9].

Fire hydrants are not needed around the facilities because other factors at the facilities are sufficient to mitigate the consequences of a fire. During a cross-site transfer operation, manual suppression efforts will not be required for the prevention of a radioactive or toxic release to the environment. Additionally, manual fire fighting efforts will not be required for the purpose of limiting property damage to the levels dictated by DOE orders. The consequences of a fire at the facilities have been substantially mitigated through the use of heavy noncombustible construction features, and the limited fire loadings inherent with the function of the facilities. An adequate degree of fire safety has been achieved by the confinement and separation of fuel packages and ignition sources. Therefore, the installation of fire hydrants around the buildings would not significantly increase the level of safety at the facilities.

The buildings erected by the W-058 project will be located in undeveloped areas of the site where fire water supplies are not provided. The buildings will be situated more that 1000 feet from existing water distribution lines. The 200 Area fire station provides five minute response time to the buildings, and the pre-fire plan will call for a pumper truck with an on-board water supply on the first response. During warm weather conditions, a dedicated tanker truck can also be requested to shuttle water to the buildings if deemed necessary. During cold weather conditions a tanker truck would not be available for a response to the structures. This additional risk during cold weather is not considered to be significant, since the buildings are segregated into small, noncombustible, compartments that typically do not require voluminous water flows for fire fighting.

(2) A water supply with two way flow is required by RLID 5480.7, Section 8.1.c, if the MPFL exceeds $1,000,000.

The cited system is not needed for the facilities since the maximum possible fire loss (MPFL) is less than $1,000,000. The basis for the MPFL values is discussed in section 12.0 of this document.

12.0 FIRE DAMAGE POTENTIAL

DOE Order 5480.7A defines maximum possible fire loss (MPFL) as the value of the property, excluding land, within a fire area, unless a fire hazards analysis demonstrates a lesser (or greater) loss potential. This assumes the failure of both automatic fire suppression systems and manual fire fighting efforts.

DOE Order 5480.7A defines maximum credible fire loss (MCFL) as the property damage expected from a fire, assuming that all installed fire protection systems function as designed and that the effect of emergency response is omitted except for post-fire actions such as salvage work, shutting down water systems, and restoring operation. The MCFL event is enveloped by the MPFL event, because the W-058 project does not include automatic or manual fire suppression features.

The applicable fire scenarios for the buildings are a fire occurring during facility operations or a maintenance outage. The fire scenario during a transfer operation is characterized by its limited ignition sources, low combustible loadings, and the potential for a radiological release within the pit structures. Conversely, the maintenance related fire scenario is characterized by its prevalent ignitions sources, elevated combustible loadings, and a negligible radiological release potential.

The MPFL values stated in following subsections are based upon labor and materials costs obtained from a W-058 project estimate. The clean

up and disposal estimates are based upon Attachment 2 of this document. The estimate for the fire department response is an arbitrary value intended to account for any fire department property that might be damaged during the MPFL event. A 100% contingency is added to the summation of the previously described costs to derive the MPFL totals.

12.1 MPFL - Diversion Box or Vent Station Operating

Since the diversion box and vent station must function as a confinement barrier during a transfer-related accident, the building enclosure must conform with the requirements of DOE Order 6430.1A, section 0110-99.0.6. The DOE order stipulates that a confinement structure have a fire resistance rating of at least two hours. As discussed in sections 5.1 and 5.2 of this document, the construction of the structures will be more substantial than a typical 2-hr, fire rated, wall system. Also, the penetrations through the walls will be filled with non-shrink grout. The seal doors for the structures will be upgraded to a 1-½ hour fire resistance rating; this rating exceeds the design requirements of the UBC and the NFPA 80 standard.

The possibility of a fire involving transfer system leak has been minimized by the use of guarded pipe with welded fittings. The transfer system motors are protected by sheet metal enclosures; consequently, spray from a broken pipe will not directly impinge on the hot surfaces of the motors. System interlocks are provided to automatically shutdown and drain the cross-site transfer system if leak occurs. The transfer system components are designed to fail in the safe position. The combination of guarded piping, motor enclosures, and system interlocks provide an appropriate method for controlling the adverse consequences of system leak.

Fixed fuel packages (e.g., cable insulation) in the diversion box and vent station structures are contained in noncombustible enclosures, and they are sparsely distributed throughout the area. In addition, the majority of the fixed combustibles are located below the steel shield floor. Since personnel will not be allowed to enter the structures during a transfer operation, transient combustibles will not be present to increase the consequences of a fire that might occur. During operating conditions, potential ignition sources are limited to a pump or motor bearing failure, or the failure of an electrical component. Again, the prohibition on personnel access to the areas minimizes the likelihood of an ignition source other than a failed electrical component. The absence of exposed, concentrated, combustibles in the vicinity of ignition sources provides a reasonable degree of assurance that a rapid burning, high heat release rate, fire will not occur. The slow burning type of fire that is likely to occur will not threaten the integrity of the process systems in the structures, and the fire will not present a serious challenge to the building structural components.

The estimated loss due a fire during a transfer operation is less than $550,000. The estimate is based upon the assumption that all electrical related components will have to be replaced. The estimate is also based upon material and labor costs extracted from the W-058 project estimate. A summary of the estimate is itemized below.

Materials	75000
Construction Labor	80000
Fire Department Response	25000
Clean Up and Disposal	86800
Subtotal	266800
100% Contingency Factor	266800
MPFL Total	533600

12.2 MPFL - Diversion Box or Vent Station Shutdown

Maintenance activities increase the possibility of a fire due to the introduction of transient combustibles and ignition sources into the area. A shutdown related fire could cause more property damage than a fire during a transfer operation because of the amount of heat released by plastic contamination control materials. The consequences of fire originating in transient combustibles, and subsequently damaging facility equipment, are mitigated by the use of noncombustible covers around the in-situ combustible materials.

Toxic and radiological consequences are not significant issues during a shutdown, because the transfer system must be flushed and isolated before personnel work on the equipment. Nevertheless, the MPFL estimate for a shutdown associated fire, versus an transfer operation related fire, utilizes the clean up costs for a fire during a transfer operation. Additionally, higher replacement costs are included in the MPFL estimate.

The loss estimate for the described fire scenario is about $584,000. The estimate is based upon the assumption that all electrical related components will have to be replaced. The estimate is also based upon material and labor costs extracted from the W-058 project estimate. A summary of the estimate is itemized below.

Materials	90000
Construction Labor	90000
Fire Department Response	25000
Clean Up and Disposal	86800
Subtotal	291800
100% Contingency Factor	291800
MPFL Total	583600

12.3 MPFL - Support Buildings During Operations

The quantity of combustibles in the structures is expected to be higher when the transfer system is shutdown for maintenance. Therefore, the MPFL during a shutdown is the bounding event for the support buildings.

12.4 MPFL - Support Buildings During Shutdown

The MPFL for this area is based on a fire starting from an electrical equipment failure or from sparks produced during a maintenance operation in the personnel access area. A fire originating in the personnel access area could cause smoke and heat damage in the adjacent rooms because the walls between the rooms are not fire rated and they may include unsealed penetrations. However, the exit pathway from the diversion box would not be affected because it is protected by a 1-hr fire-rated wall.

Based upon a review of the cost estimate for the W-058 project, the MPFL would be about $627,000. The loss estimate is based upon the assumption that all of the equipment in the area will be damaged by heat or smoke. The estimate also includes clean up costs for the potential minor release described in Section 16 of this FHA. A summary of the estimate is itemized below.

Materials	80000
Construction Labor	80000
Fire Department Response	25000
Clean Up and Disposal	128600
Subtotal	313600
100% Contingency Factor	313600
MPFL Total	627200

13.0 FIRE EXPOSURE POTENTIAL

The support buildings, diversion box, and vent station for this project are remote from other facilities as related to fire exposure potential. However, a natural cover fire could expose the support buildings, diversion box, and vent station.

The facility was reviewed in accordance with NFPA 80A for exposure hazards. The NFPA 80A standard recommends separation distances to protect a structure exposed to the radiative heat produced by a fire at an adjacent structure. The support structure was selected for the review since it the largest exposure at the facilities, and it has some unprotected openings. Based upon a conservative application of the NFPA standard, other buildings on the Hanford Site must be located 28.5 meters (93.5 ft) away from the support structures. The diversion box and vent station facilities are located more than 30 m (100 ft) away

from other structures at the Hanford Site. The calculation used to determine the required separation distance is summarized below.

Width (w) of Support Building - 9.8 m (32 ft)
Height (h) of Support Building - 3.0 m (10 ft)
w/h ratio - 9.8/3.0 (32/10) = 3.3
Severity - Moderate
Openings - 75% (based upon section 2-2.3 of NFPA 80A)
Guide Number - 3.0 (based upon Table 2-3 of NFPA 80A, and the assumption that hydrants will not be provided around the structures.)
Ineffective Fire Fighting Factor - 3 (based upon sec. 2-3 of NFPA 80A, and the fact that the building construction is heavy noncombustible but unrated)
Required Separation Distance - 3.0 X 3 X 3.0 m (10 ft) + 1.52 m (5 ft) = 28.5 m (93.5 ft)

The diversion box and vent station facilities are setback from indigenous vegetation in accordance with NFPA 299. Therefore, they are not exposed by a potential wildland fire.

14.0 FIRE DEPARTMENT RESPONSE

The diversion and vent station facilities are situated at locations that are accessible by fire department apparatus. The gravel access roads are suitable for travel during the weather conditions expected at the Hanford Site.

Proposed Hanford Fire Department reorganization may result in future response changes. Currently, the standard response to an alarm condition in the 200-East Area is from the 200 Area fire station. According to the Hanford Fire Department fire marshall, response time around the 200 Area ranges from 5 to 7 minutes following the initial alarm notification. Simultaneously, a crew is dispatched from the 100 Area fire station with an estimated response time of 12 to 14 minutes.

15.0 RECOVERY POTENTIAL

Based on the building construction, the design of the equipment, and low combustible loadings, fire would not result in a loss of function of the diversion box or vent station. Operation of the pumps can be performed at the local panel or at the remote control station. Procurement and reconstruction of the damaged areas would constitute full recovery and take 3 to 6 months to complete.

16.0 POTENTIAL FOR TOXIC, BIOLOGICAL, AND/OR RADIOLOGICAL RELEASE

The diversion box and vent station are designed to contain a spill resulting from a design basis accident. As indicated in section 12.1 of this document, the integrity of the confinement barriers will not be jeopardized by the anticipated fire events. A fire in the diversion box or vent station will not cause an unacceptable release of contamination or hazardous materials.

The support buildings may contain low level radioactive materials in the form of contaminated work clothing, step-off pads, and trash. The contamination is assumed to accumulate on the protective clothing and step-off pads through worker contact with any residue in the system piping. During the course of a maintenance outage, the quantity of residue that could accumulate on the clothing and step-off pads is assumed to be less than one liter; this assumption is considered to be very conservative since any appreciable mass (spills) of radioactive liquid in the work area would be contained, stored, and disposed of separately from the laundry. A fire involving the contaminated laundry and step-off pads could release radioactive materials into the support building. The radioactive material would then be released to the environment when the fire fighters accessed the structure to extinguish the fire. The small quantity of airborne contamination would rapidly dilute as it discharged from the structure. Soot from the fire would most likely be deposited on the exterior of the building and the area immediately adjacent to the building.

The potential consequences of a release involving a small quantity of contaminated clothing, step-off pads, etc. are negligible when compared to the releases analyzed in the safety analysis report (SAR). As previously mentioned, the cross-site transfer system must be flushed and drained before work can be conducted on the system, therefore, the quantity of radioactive material available for distribution during maintenance work is substantially less the release volumes considered in the SAR. Thus, the accidents analyzed by the SAR provide bounding consequences for a fire involving minimal quantities of radioactive materials that could be present in the support buildings.

17.0 EMERGENCY PLANNING

Emergency planning for the facility will be part of the 200 Areas and sitewide emergency plans. Pre-fire plans will be developed by the Hanford Fire Department.

18.0 SECURITY AND SAFEGUARDS CONSIDERATIONS

The support buildings, diversion box, and vent station will not contain any sensitive or special nuclear material that would require special security considerations.

19.0 NATURAL HAZARDS IMPACT ON FIRE SAFETY

19.1 Floods

The 200 Areas are situated on a plateau of such elevation that the buildings and other facilities located there are not susceptible to even a "probable maximum flood" of the Columbia River Basin, as postulated by the U.S. Army Corps of Engineers (ERDA 1975). There is no flood hazard to the support buildings, diversion box, or the vent station.

19.2 High Winds

The diversion box structures are considered Safety Class 1 structures for seismic criteria only. The facilities will not contain Safety Class 1 systems or components; therefore, they are not susceptible to damage by wind generated missiles.

19.3 Earthquake

According to the Uniform Building Code (UBC), eastern Washington is in seismic zone 2B which indicates a region of low-to-moderate seismicity. A strong enough earthquake would have the potential to destroy the structures, but this magnitude of earthquake is extremely unlikely. Buildings are designed for a high hazard facility use category, or Safety Class 1, seismic event in accordance with UCRL 15910 and SDC 4.1, Rev 12. Major building damage from an earthquake is not expected.

19.4 Lightning

A direct lightning strike to a building could cause structural damage to the point of impact and could also cause a voltage surge through the structural frame of the building. This voltage surge could cause substantial damage to electronic components in the structure. A lightning protection review of the facility and surrounding area has been conducted in accordance with NFPA 780, "Lightning Protection." This review shows that the potential for a loss due to lightning is a light to moderate risk. Therefore, the facility does not warrant lightning protection, and damage from lightning is not expected.

20.0 EXEMPTIONS, DEVIATIONS, AND EQUIVALENCIES

20.1 An automatic suppression system will not be provided in accordance with DOE Order 6430.1A, Section 1530-99.0[16]. The basis for the deviation is outlined in section 11.1.(2) of this document.

20.2 Fire hydrants will not be provided per the requirements cited in DOE Order 6430.1A, Section 0266-4[9]. The basis for the deviation is outlined section 11.3.(1) document.

20.3 A standpipe system will not be provided in accordance with RLID 5480.7, Section 8.1.e. The basis for the field level exemption is outlined in section 11.2 of this document.

20.4 An alternate arrangement (administrative controls) may be utilized in lieu of permanently installed emergency lighting. The administrative controls provide an equivalent level of safety as required by Section 30-7.2.2 of NFPA 101. The basis for the equivalency is discussed in section 9.0 of this document.

21.0 RECOMMENDATIONS

21.1 The 3/4-hr. rated fire door (Door No. 4) in the diversion box, support structure, corridor needs to be replaced with a 1-hr. rated door in order to satisfy the requirements of NFPA 101.

21.2 Provide an emergency light in the diversion box corridor/stairway, or the entrance procedures for the diversion box and vent station must include a requirement for providing emergency lighting (i.e., flash lights or portable emergency lights) whenever personnel access the structure.

21.3 Request DOE approval to deviate from the automatic suppression system requirements cited in DOE Order 6430.1A, Section 1530-99.0[16]. The basis for the deviation is outlined in section 11.1.(2) of this document.

21.4 Request DOE approval to deviate from the fire hydrant installation requirements cited in DOE Order 6430.1A, Section 0266-4[9]. The basis for the deviation is outlined section 11.3.(1) document.

21.5 Request a field level exemption from the standpipe system requirements cited in RLID 5480.7, Section 8.1.e. The basis for the exemption is outlined in section 11.2 of this document.

21.8 Maintenance procedures for the diversion box and vent station must stipulate that all transient combustibles be removed from the structures when work activities are completed.

21.9 Review and revise this FHA, after the W-058 Project is completed, to ensure that conclusions stated in this document are valid for the as-built conditions at the facilities. Then, submit this document to DOE-RL for approval.

22.0 REFERENCES

1. ICF Kaiser Drawing H-2-822231, Sheets 1 through 3, Revision 0, Architectural Diversion Box 6341-A.

2. ICF Kaiser Drawing H-2-822235, Sheet 1, Revision 0, Architectural Schedules.

3. ICF Kaiser Drawing H-6-13979, Sheets 1 through 3, Revision 0, Architectural Diversion Box 6341-V.

4. *Preliminary Safety Analysis Report*, Cross-Site Transfer System, WHC-SD-W058-PSAR-001, Revision 1, Westinghouse Hanford Company, Richland, Washington.

5. WHC Memorandum 8K240-96-003, Revision 1, dated February 1, 1996 Project W-058, Replacement of Cross-Site Transfer System, Design Revisions Effecting the Fire Hazards Analysis.

6. DOE Order 6430.1A, *General Design Criteria*, 1989.

7. DOE Order 5480.7A, *Fire Protection*, 1993.

8. RLID 5480.7, *Fire Protection*, 1994.

9. NFPA 80A, *Protection From Exposure Fires*, 1993

10. NFPA 101, *Life Safety Code*, 1994

11. NFPA 299, *Protection of Life and Property from Wildfire*, 1991

12. UBC, 1994, *Uniform Building Code*, International Conference of Building Officials, Whittier, California.

13. Factory Mutual System, *Loss Prevention Data Sheets*, Factory Mutual Engineering Corporation, Norwood, MA.

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Attachment 1

BUILDING DRAWINGS
(8 sheets total)

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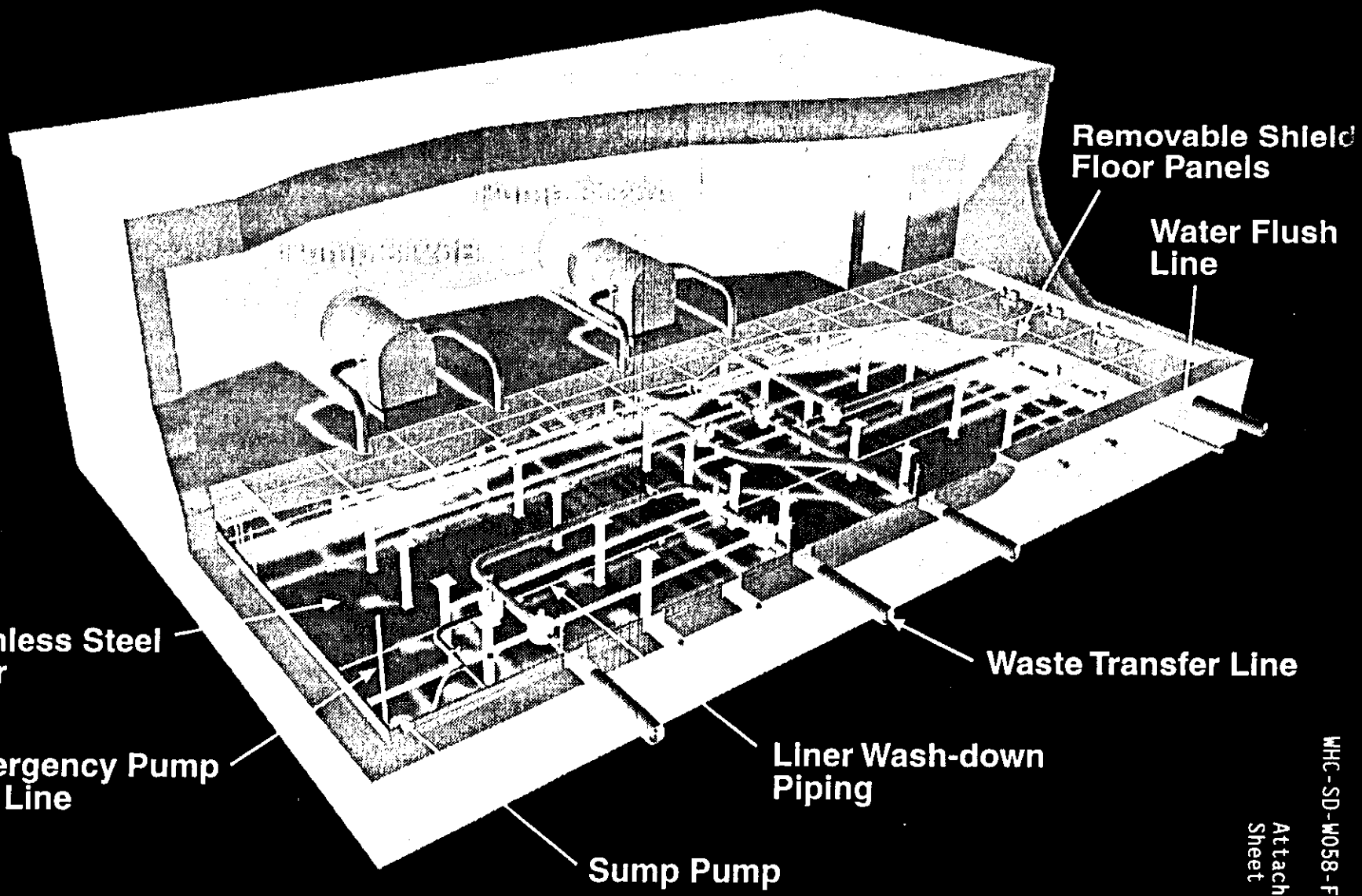
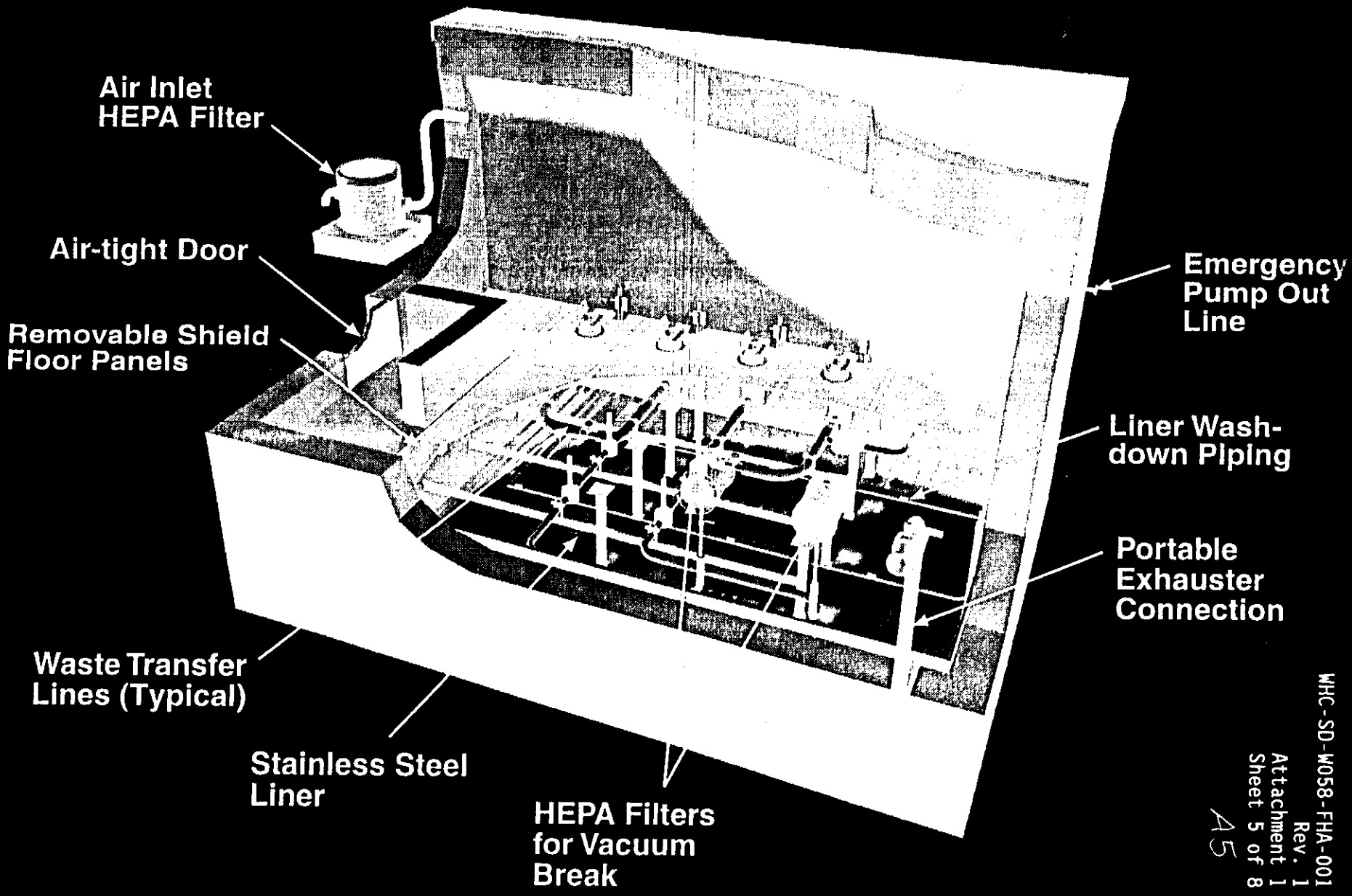
A1

A2

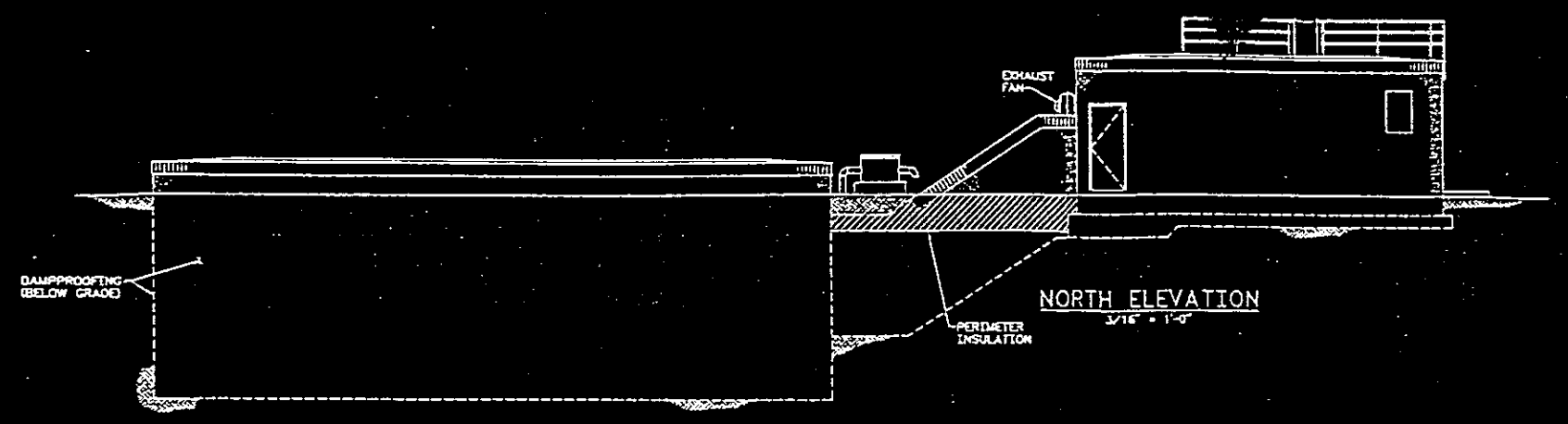
Diversion Box 6241-A



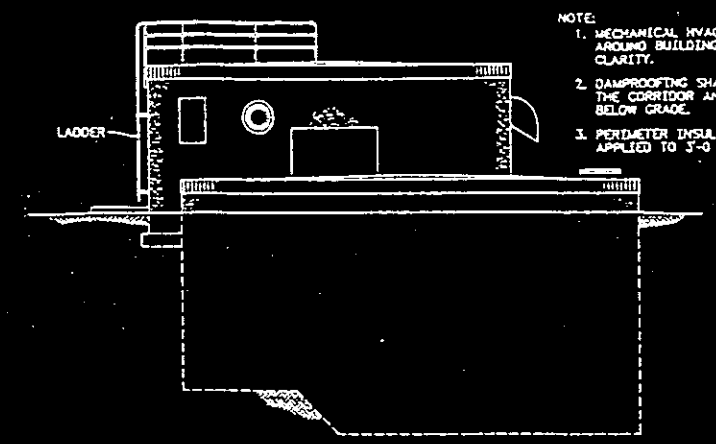
Vent Station 6241-V



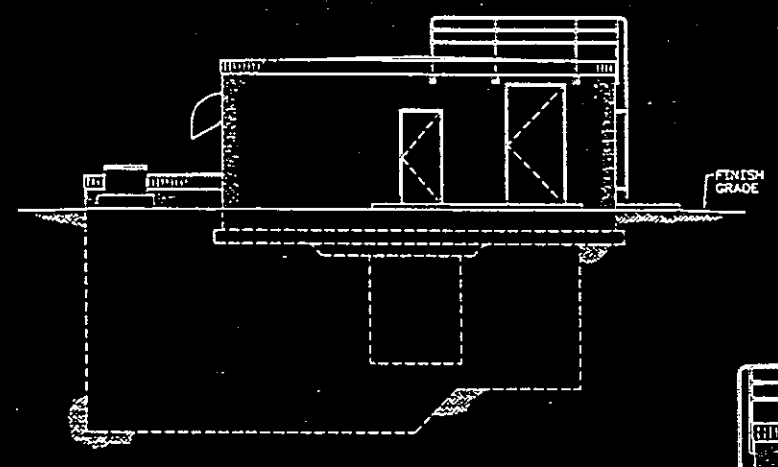
NOTE:
1. MECHANICAL HVAC EQUIPMENT ON OR AROUND BUILDING NOT SHOWN FOR CLARITY.
2. DAMPPROOFING SHALL BE APPLIED TO THE CORRIDOR AND DIVERSION BOX BELOW GRADE.
3. PERIMETER INSULATION SHALL BE APPLIED TO 3'-0 BELOW GRADE.



NORTH ELEVATION
3/16" = 1'-0"



EAST ELEVATION
3/16" = 1'-0"



WEST ELEVATION
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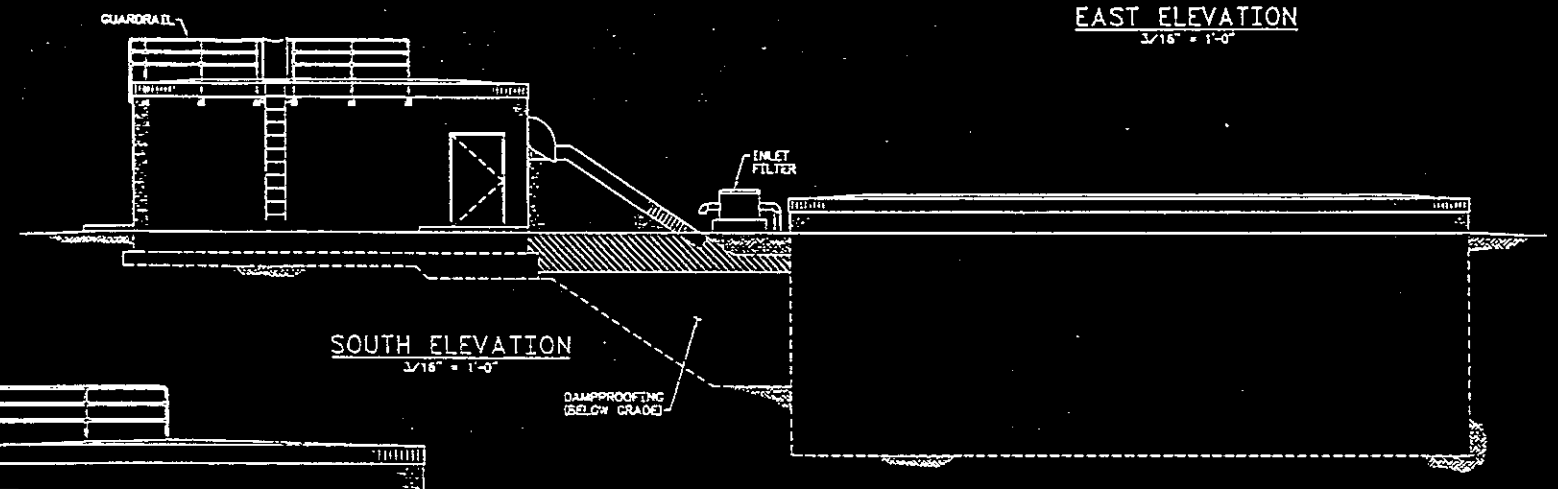

SOUTH ELEVATION
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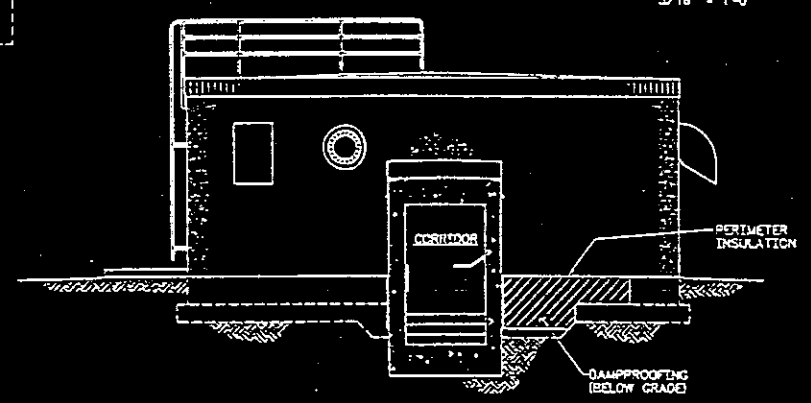
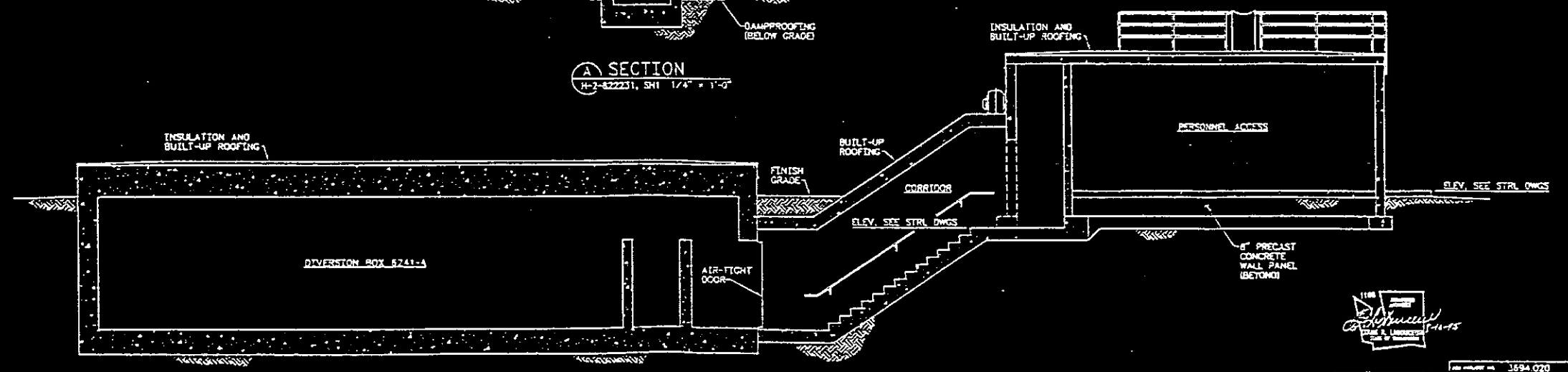


A SECTION
H-2-822231, SH1 1/4" = 1'-0"



B SECTION
H-2-822231, SH1 1/4" = 1'-0"

H-2-822200 DRAWING LIST

822231C	3:19PM AUG 12, 2015

OL GARLAND	CONSTRUCTION
SEE DRAFT FORM	
SEE DRAFT FORM	
SEE DRAFT FORM	
KEH	

U.S. DEPARTMENT OF ENERGY
RICHLAND OPERATIONS OFFICE
TOC KAISER HANFORD COMPANY

ARCHITECTURAL
DIVERSION BOX 6241-A
ELEVATIONS AND SECTIONS

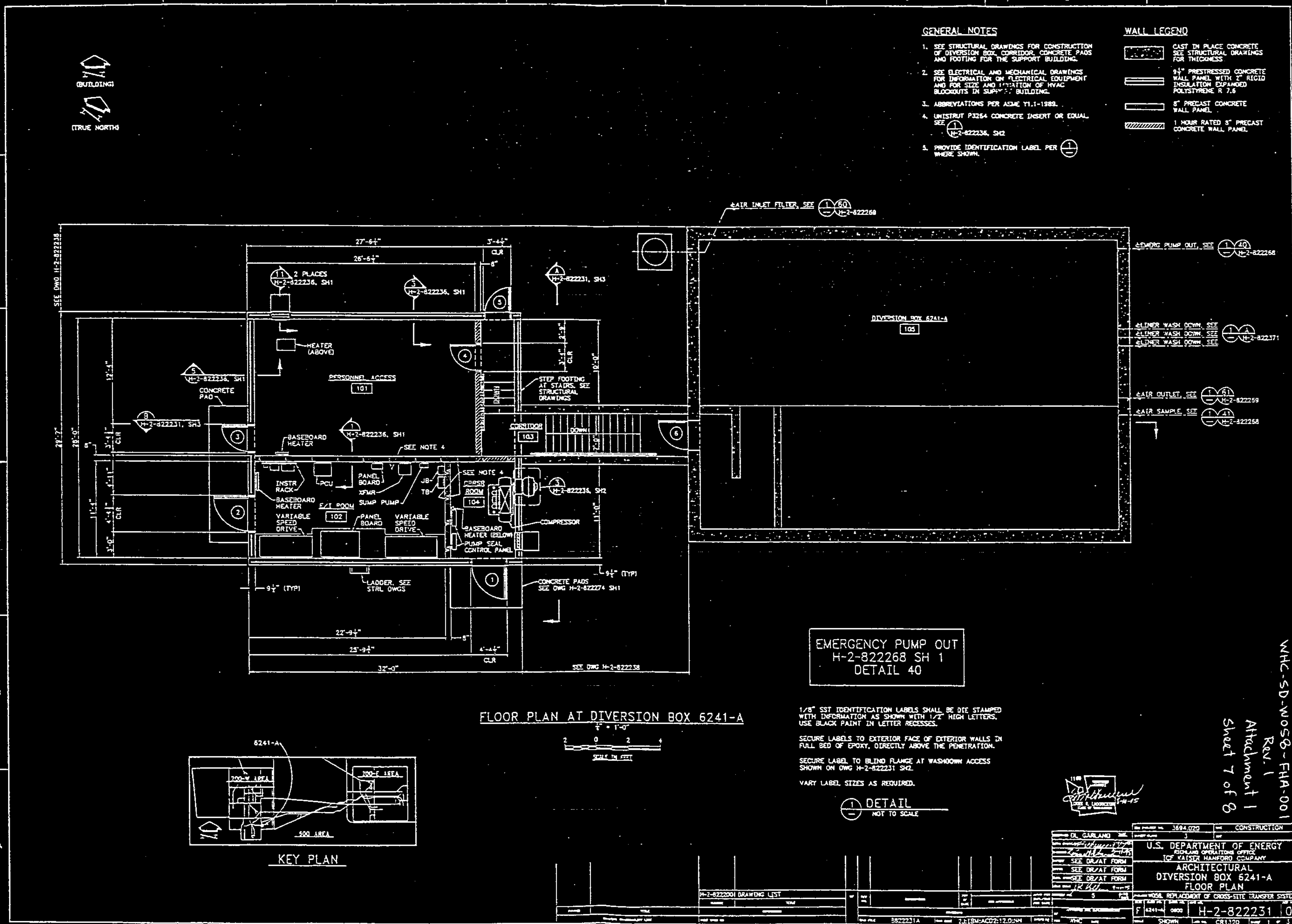
MODULAR REPLACEMENT OF CROSS-SITE TRANSFER SYSTEM

F	6241-A	0801	H-2-822231 0
SCALE	SHOWN	CAD NO.	CR1320 SHEET 3 OF 3

PLOT SCALE: 1=48 | KEHCAD

WHC-SD-W058-FHA-001
Rev. 1
Attachment 1
Sheet 6 of 8

A6



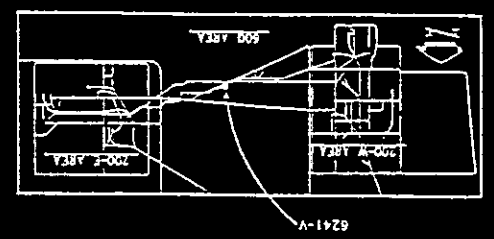
WHC-SD-W058-FHA-001
Rev. 1
Attachment 1
Sheet 7 of 8
GENERAL NOTES
1. SEE STRUCTURAL DRAWINGS FOR CONSTRUCTION OF DIVERSION BOX, CORRIDOR, CONCRETE PADS AND FOOTING FOR THE SUPPORT BUILDING.
2. SEE ELECTRICAL AND MECHANICAL DRAWINGS FOR INFORMATION ON ELECTRICAL EQUIPMENT AND FOR SIZE AND [illegible] OF HVAC BLOCKOUTS IN [illegible] BUILDING.
3. ABBREVIATIONS PER ASME Y1.1-1989.
4. UNISTRUT P3254 CONCRETE INSERT OR EQUAL. SEE H-2-822236, SH2
5. PROVIDE IDENTIFICATION LABEL PER [1] WHERE SHOWN.
WALL LEGEND
CAST IN PLACE CONCRETE SEE STRUCTURAL DRAWINGS FOR THICKNESS
9½" PRESTRESSED CONCRETE WALL PANEL WITH 2" RIGID INSULATION EXPANDED POLYSTYRENE R 7.6
8" PRECAST CONCRETE WALL PANEL
1 HOUR RATED 5" PRECAST CONCRETE WALL PANEL
(BUILDING)
(TRUE NORTH)
AIR INLET FILTER, SEE H-2-822268
EMERG PUMP OUT, SEE H-2-822268
LINER WASH DOWN, SEE
LINER WASH DOWN, SEE
LINER WASH DOWN, SEE H-2-822371
AIR OUTLET, SEE H-2-822259
AIR SAMPLE, SEE H-2-822258
DIVERSION BOX 6241-A
105
PERSONNEL ACCESS
101
CORRIDOR
103
E/I ROOM
102
CPRSR ROOM
104
HEATER (ABOVE)
BASEBOARD HEATER
INSTR RACK
PCU
PANEL BOARD
XFMR
SUMP PUMP
VARIABLE SPEED DRIVE
JB
TB
SEE NOTE 4
BASEBOARD HEATER (BELOW)
PUMP SEAL CONTROL PANEL
COMPRESSOR
CONCRETE PAD
CONCRETE PADS SEE DWG H-2-822274 SH1
STEP FOOTING AT STAIRS, SEE STRUCTURAL DRAWINGS
LADDER, SEE STRL DWGS
DOWN
SEE DWG H-2-822238
27'-6¼"
26'-6¼"
3'-4¼" CLR
22'-9¼"
25'-9¼"
32'-0"
4'-4¼" CLR
9¼" (TYP)
FLOOR PLAN AT DIVERSION BOX 6241-A
¼" = 1'-0"
SCALE IN FEET
EMERGENCY PUMP OUT
H-2-822268 SH 1
DETAIL 40
1/8" SST IDENTIFICATION LABELS SHALL BE DIE STAMPED WITH INFORMATION AS SHOWN WITH 1/2" HIGH LETTERS. USE BLACK PAINT IN LETTER RECESSES.
SECURE LABELS TO EXTERIOR FACE OF EXTERIOR WALLS IN FULL BED OF EPOXY, DIRECTLY ABOVE THE PENETRATION.
SECURE LABEL TO BLIND FLANGE AT WASHDOWN ACCESS SHOWN ON DWG H-2-822231 SH2.
VARY LABEL SIZES AS REQUIRED.
DETAIL
NOT TO SCALE
6241-A
200-W AREA
200-E AREA
500 AREA
KEY PLAN
H-2-822001 DRAWING LIST
CONSTRUCTION
U.S. DEPARTMENT OF ENERGY
RICHLAND OPERATIONS OFFICE
ICF KAISER HANFORD COMPANY
ARCHITECTURAL
DIVERSION BOX 6241-A
FLOOR PLAN
REPLACEMENT OF CROSS-SITE TRANSFER SYSTEM
H-2-822231
CR1320
PLOT SCALE: 1=48
A7

8H

FLOOR PLAN AT VENT STATION 6241-V

SCALE: 1/4" = 1'-0"

KEY PLAN



EMERGENCY PUMP OUT
H-2-822268 SH 1
DETAIL 40

1/8" SST IDENTIFICATION LABELS SHALL BE DIE STAMPED WITH INFORMATION AS SHOWN WITH 1/2" HIGH LETTERS. USE BLACK PAINT IN LETTER RECESSES.

SQUARE LABELS TO EXTERIOR FACE OF EXTERIOR WALLS IN FULL BED OF EPOXY, DIRECTLY ABOVE THE PENETRATION.

VARY LABEL SIZES AS REQUIRED.

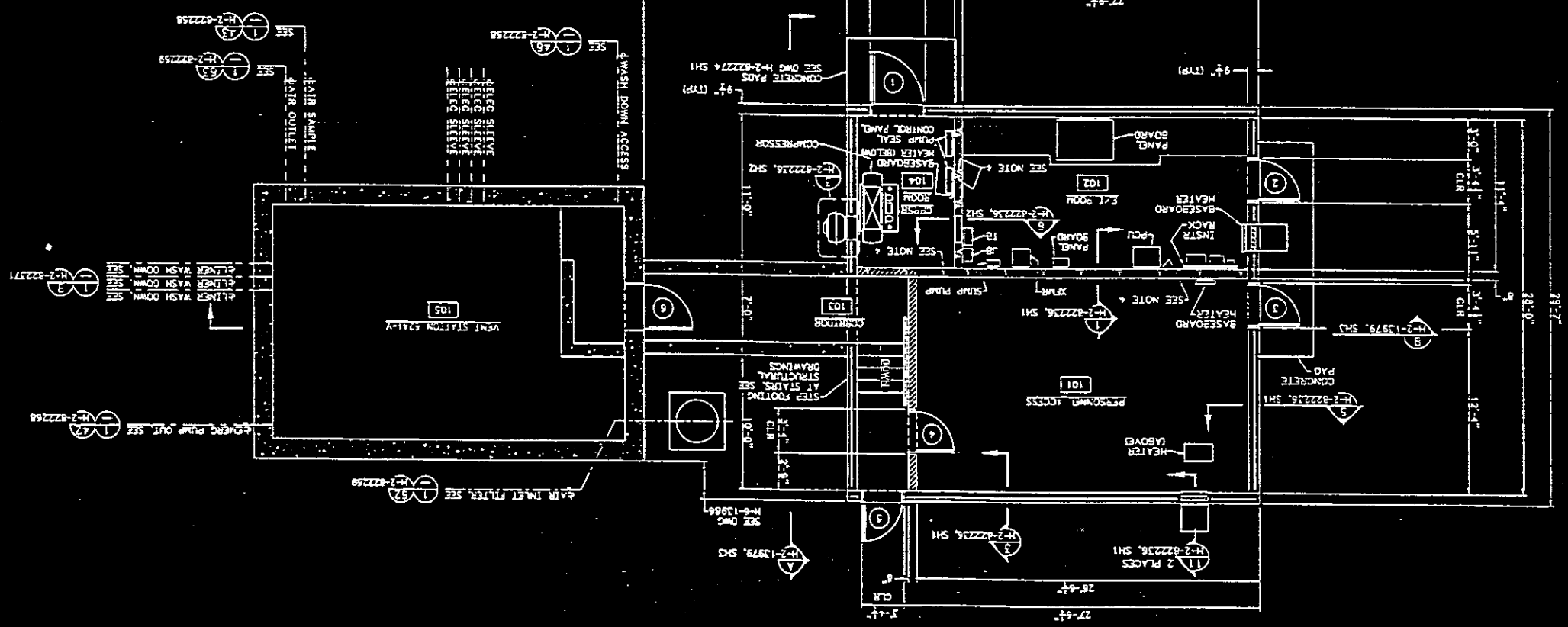
1 DETAIL — NOT TO SCALE

GENERAL NOTES

1. SEE STRUCTURAL DRAWINGS FOR CONSTRUCTION OF VENT STATION, CORRIDOR, CONCRETE PADS AND FOOTING FOR THE SUPPORT BUILDING.
2. SEE ELECTRICAL AND MECHANICAL DRAWINGS FOR INFORMATION ON ELECTRICAL EQUIPMENT AND FOR SIZE AND LOCATION OF HVAC DUCTWORK IN SUPPORT BUILDING.
3. ABBREVIATIONS PER ASME Y14.1-1989.
4. UNISTRUT P1264 CONCRETE INSERT OR EQUAL. SEE H-2-822236, SH2
5. PROVIDE IDENTIFICATION LABEL PER (1) WHERE SHOWN.

WALL LEGEND

- CAST IN PLACE CONCRETE SEE STRUCTURAL DRAWINGS FOR THICKNESS
- 9½" PRESTRESSED CONCRETE WALL PANEL WITH 2" RIGID INSULATION COMPOSED POLYSTYRENE R 7.5
- 8" PRECAST CONCRETE WALL PANEL
- 1 HOUR RATED 8" PRECAST CONCRETE WALL PANEL



Attachment 2

DECONTAMINATION CALCULATIONS
(2 sheets total)

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B1

Input

1. Labor rates and disposal costs are based upon discussions with WHC and BHI employees involved in clean up and D&D activities.

2. The interior surface area of the diversion box is approximately 5000 square feet.

3. The interior surface area of the vent station is approximately 2000 square feet.

4. The interior surface area of the support buildings is approximately 4000 square feet.

5. Decontamination calculations are based upon twice the interior surface area of the structures. This was done to account for the decontamination of the contents in the structures.

6. The contaminated materials will be disposed of as solid waste.

7. The disposal cost for solid waste is $18 per cubic foot.

Assumptions

1. Decontamination activities will be performed by a two person crew, and a support staff of three people.

2. The average labor rate for the clean up crew is $50.00 per hour.

3. The work crew can decontaminate an average of 400 square feet per day.

4. Decontamination activities outside of the support building will limited to an area of 3000 square feet.

5. Approximately $15,000 in consumable materials will be utilized during the clean up effort.

6. The amount of compacted, solid, waste will not exceed 100 cubic feet.

Calculation Formulas

Decon Cost = (5 people)($50/hr/person)(8hr/day)(day/400 sq. ft.)(contaminated area)

= ($5/sq. ft.)(contaminated area)

Disposal Cost = (100 cubic feet)($18/cubic foot)

= $1,800

B2

Calculation Results for Decontamination

Diversion Box

($5/sq. ft.)(10,000 sq. ft.) = $50,000

Vent Station

($5/sq. ft.)(4,000 sq. ft.) = $20,000

Support Building (inside)

($5/ sq. ft.)(8,000 sq. ft.) = $40,000

Support Building (outside)

($5/sq. ft.)(3,000 sq. ft.) = $15,000

Clean Up and Disposal Totals

Area	Survey & Planning	Decon	Consumable Materials	Disposal	Total
Diversion Box	20000	50000	15000	1800	**86800**
Vent Station	20000	20000	15000	1800	**56800**
Support Building Interior	20000	40000	15000	1800	**76800**
Support Building Exterior	20000	15000	15000	1800	**51800**