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1	/	Design Authority: EV Weiss	EV Weiss	1-30-97	T5-50	1	/	Vault Operations: JL Mejia	JL Mejia	1-30-97	T5-08
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1	/	Cog. Mgr.: TE Huber	T.E. Huber	2/3/97	T5-50	1	/	Process Engr.: MW Gibson	MW Gibson	1/30/97	T5-55
1	/	QA: HE Rew	HE Rew	1/31/97	T4-15	1	/	Security Progs: TW Campbell	TW Campbell	1-30-97	S2-46
1	/	Safety: JM Held	JM Held	1/31/97	T5-11	1	/	Projects: GA Johnston	GA Johnston	1/30/97	T5-50
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Conceptual Design Report, Plutonium Stabilization and Handling, Project W-460

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U.S. Department of Energy Contract DE-AC06-96RL13200

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Abstract: Project W-460, Plutonium Stabilization and Handling, encompasses procurement and installation of a Stabilization and Packaging System (SPS) to oxidize and package for long term storage remaining plutonium-bearing special nuclear materials currently in inventory at the Plutonium Finishing Plant (PFP), and modification of vault equipment to allow storage of resulting packages of stabilized SNM for up to fifty years. This Conceptual Design Report (CDR) provides conceptual design details for the vault modification, site preparation and site interface with the purchased SPS. Two concepts are described for vault configuration; acceleration of this phase of the project did not allow completion of analysis which would clearly identify a preferred approach.

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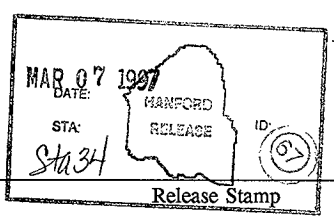

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Conceptual Design Report

Plutonium Stabilization and Handling

Project W-460

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

Conceptual Design Report, Plutonium Stabilization and Handling, Project W-460

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CONCEPTUAL DESIGN REPORT

PLUTONIUM STABILIZATION AND HANDLING

PROJECT W-460

Prepared for

B&W Hanford Company

January 1997

Prepared by

Fluor Daniel Northwest
Richland, Washington

W460CDR

W460CDR

CONCEPTUAL DESIGN REPORT

FOR

PLUTONIUM STABILIZATION AND HANDLING

PROJECT W-460

APPROVED

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U.S. Department of Energy

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APPENDICES

ABBREVIATIONS

AABC	Associated Air Balance Council
ACD	advanced conceptual design
ACGIH	American Conference of Governmental Industrial Hygienists
ALARA	as low as reasonably achievable
AMCA	Air Movement and Control Association, Inc.
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
AWS	American Welding Society
BIFMA	Business and Institutional Furniture Manufacturer's
BNFL	British Nuclear Fuels Limited, Incorporated
CDR	conceptual design report
CFR	Code of Federal Regulations
DA	destructive assay
DCS	distributed control system
DMS	data management system
DNFSB	Defense Nuclear Facilities Safety Board
DPC	differential pressure controller
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ESH	Environmental, Safety, and Health
FCP	fire control panel
FDC	Functional Design Criteria
FHA	Fire Hazard Analysis
FMEC	Factory Mutual Engineering Corporation
FS	Federal Specifications
HEPA	high-efficiency particulate air
IAEA	International Atomic Energy Agency
IEEE	Institute of Electrical and Electronics Engineers
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
LOI	loss-on-ignition
MCC	motor control center

ABBREVIATIONS (cont'd)

NDA	nondestructive assay
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NMSTG	Nuclear Materials Stabilization Task Group
OAK	U.S. Department of Energy, Oakland Office
PFP	Plutonium Finishing Plant
PHMC	Project Hanford Management Contractor
PIV	physical inventory verifications
PLC	programmable logic controller
PPCS	plutonium packaging control system
PRV	pressure relief valve
PSCS	plutonium stabilization control system
PuSAP	plutonium stabilization and packaging
PuSH	Plutonium Stabilization and Handling
PVC	polyvinyl chloride
QAPP	Quality Assurance Program Plan
RFETS	Rocky Flats Environmental Test Site
RLID	RL Implementing Directives
SAS	Safeguards and Security
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SNM	special nuclear material
SPS	stabilization and packaging system
SRS	Savannah River Site
UBC	Uniform Building Code
UL	Underwriters Laboratories
UPS	uninterruptable power supply
VSIS	vault safety and inventory system

CONCEPTUAL DESIGN REPORT

PLUTONIUM STABILIZATION AND HANDLING

PROJECT W-460

I. INTRODUCTION

The U.S. Department of Energy (DOE) Hanford Site has completed its production mission and is now executing a new mission of environmental restoration. Part of the new mission is to stabilize and suitably store or dispose of all remaining plutonium-bearing special nuclear material (SNM). Remaining inventories of SNM are housed in the Plutonium Finishing Plant (PFP) complex, a facility which formerly produced plutonium in metal shapes and oxide powder for defense purposes. The majority of the SNM inventory at the PFP consists of plutonium oxides or plutonium/uranium oxides of varying degrees of purity, stored in sealed packages in secure vault storage.

Congress chartered the Defense Nuclear Facilities Safety Board (DNFSB) to oversee safety-related issues. The DNFSB generated Recommendation 94-1, dated May 26, 1994, which calls for plutonium SNM stabilization and storage actions to be expedited. As part of response commitments, the DOE chartered the Nuclear Materials Stabilization Task Group (NMSTG) to manage the multiple tasks required to have all remaining fissile materials at DOE sites in safe storage by May 2002.

The NMSTG formed several task teams of technical staff from all affected DOE sites; each task team is charged with solving a specific technical problem associated with the safe storage effort. One team compiled DOE Standard DOE-STD-3013-94, which contains technical guidelines for the stabilization and packaging of SNM containing greater than 50% by weight plutonium to be placed in long-term interim storage. The specific stabilization parameters and packaging configurations discussed in the standard have been a subject of much

technical discussion; a major revision of the standard (DOE-STD-3013-96) was issued to address key changes determined necessary by users.

The Plutonium Stabilization and Packaging (PuSAP) task team was chartered to implement 3013 via a common DOE procurement of stabilization and packaging equipment as well as the packaging materials themselves. The PuSAP task team is led by staff from NMSTG with members from the Rocky Flats Environmental Test Site (RFETS), the Savannah River Site (SRS), the Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), and Hanford. The DOE Oakland Office (OAK) is acting as the contracting office for the procurement. Using a consensus approach, the team established requirements for a stabilization and packaging system (SPS). Procurement documents were issued via OAK, and a contract was awarded (DOE Contract DE-AC03-96SF20948, more commonly the PuSAP contract) to a team headed by British Nuclear Fuels Limited (BNFL) and Raytheon Engineers and Constructors. The contract includes design, construction, and installation of a prototype in the 707 Building at RFETS; plus very similar SPSs in the 371 Building at RFETS, at SRS, and at Hanford; and, initial procurement of package components.

Although the PFP has an active program for stabilizing remaining inventories of SNM, it does not have the capability to package stabilized SNM into the welded containers called for by 3013. In addition, the containers are larger than those used at the PFP and they will not physically fit into the storage fixtures in secure vault storage at the PFP.

Project W-460, "Plutonium Stabilization and Handling (PuSH)," encompasses several related actions which will implement the provisions of 3013 for SNM inventories of plutonium and plutonium/uranium oxides at the PFP. The project will comply with DNFSB Recommendation 94-1 to stabilize and package remaining SNM by May 2002. The "3013 packages" will be placed in safe, secure storage for up to 50 years.

The project will provide consolidate stabilization, packaging, and storage functions into a single location within the PFP facility, the 2736-Z Complex. This will allow eventual deactivation of other PFP facility areas no longer needed while maintaining all functions required for safe storage.

Space will be made for the SPS within the 2736-ZB Building via rearrangement of functions within the building and the addition of some office space external to the permanent buildings. One SPS will be procured and installed in conjunction with the national procurement DOE Contract DE-AC03-96SF20948. Storage fixtures and associated equipment will be modified to accommodate the number of 3013 packages needed to house existing PFP inventory in the 2736-Z storage vault building.

Nondestructive assay (NDA) capability will be updated to accommodate the physical size and bulk of the 3013 packages plus anticipated requirements for contents radiography. The project will upgrade utilities and support services to allow safe operation of the SPS and the storage vaults.

The cost estimate and conceptual project schedule are in Appendices C and D, respectively.

II. SUMMARY

Project W-460 will provide the equipment and plant modifications to enable the Plutonium Finishing Plant (PFP) to meet Defense Nuclear Facility Safety Board Recommendation 94-1.

The 2736-ZB Building will be modified to provide space for a stabilization and packaging system (SPS). The modifications will include combining rooms 641 and 642 into a single room. A new process exhaust filtration system will be installed and connected to the existing building stack. An airlock will be installed to provide pressure zone separation between room 641/642 and the rest of the building. Additional airlocks will be installed at the entrance to the

2736-ZB Building and in the corridor outside the nondestructive assay (NDA) laboratory to alleviate existing problems with the 2736-ZB Building heating, ventilating, and air-conditioning (HVAC) system.

The layout of the interior offices in the 2736-ZB Building will be rearranged to accommodate the installation of the SPS. These changes will include relocating the International Atomic Energy Agency (IAEA) equipment from room 642 to rooms 635 and 636. The offices along corridor 625 will be reconfigured to provide space for SPS operators, shift custodian, and an enlarged office for the radiological control technicians (RCT). The NDA laboratory will be enlarged to include two offices for laboratory technicians. The security checkpoint located in corridor 625 will be relocated to the entrance of the 2736-ZB Building. The security checkpoint will become a remotely monitored station.

The 2736-Z Building vault will be modified to store a new container that complies with the requirements of U.S. Department of Energy 1996 draft standard DOE-STD-3013, "Criteria for Preparing and Packaging of Plutonium Metals and Oxides for Long-Term Storage." Two storage concepts were studied during conceptual design and one will be chosen for further development during advanced conceptual design (ACD). The vault concept study is not complete, pending completion of independent dose and thermal analysis. The conceptual design report (CDR) estimate includes the cost for the most expensive concept studied. The ACD will also define the impact of the preferred concept on the HVAC system for the vault. Safeguards requirement will be factored into the design in a cost effective manner to accommodate the IAEA to the extent feasible.

The prototype SPS being designed for RFETS will have an inert nitrogen atmosphere inside the gloveboxes. Traditionally, the PFP has used dry air in the plutonium gloveboxes. The safety issues associated with using dry air versus nitrogen atmosphere are fire related. An automatic fire suppression system will be required in the SPS glovebox. The CDR assumed that the fire suppression

system will be designed and supplied by BNFL as part of their contract for the SPS. A life-cycle cost analysis (LCCA) to compare the cost of a dry air system versus nitrogen system for the PFP SPS showed that the dry air system would be the most cost effective system for the PFP.

The 2731-ZA Building will be modified to house the dry air system. The modifications will consist of adding a partition wall, insulating the walls and roof, installing electrical power and a rollup door.

The SPS will require additional office space for operators, maintenance, and management personnel during the installation and operation. A modular office structure will be located adjacent to the 2736-ZB Building to provide offices, a lunchroom, and changerooms. The structure will contain 6 enclosed offices, 15 office cubicles, 3 secretarial areas, a lunch/conference room, and men's and women's changerooms.

Project W-460 is a fiscal year 1998 Line Item. Total estimated construction costs of the project are $36,600,000; other project costs are $7,500,000. The total project cost is $44,100,000.

III. JUSTIFICATION

Storage of plutonium SNM oxides (greater than 50% by weight plutonium) in a package intended to maintain containment for 50 years is one of the key elements of DOE-STD-3013. Although DOE standards are guidelines rather than compliance documents, the NMSTG has directed compliance with DOE-STD-3013 provisions via the PuSAP contract.

The DOE will coordinate procurement of similar stabilization and packaging equipment for DOE sites containing significant quantities of SNM to ensure that all containers of plutonium SNM to be stored for future disposition will have common outer dimensions and markings. Through the PuSAP contract, a

prototype design has been established for four SPSs: the prototype and a second unit to be installed at RFETS, one unit at SRS, and one unit at Hanford.

The vault storage fixture configuration will be changed because the packaging configuration described in DOE-STD-3013 is larger than the containers being used for plutonium storage at the PFP. The DOE-STD-3013 packages will not fit into current monitored storage pedestals in PFP vaults. In addition, the DOE-STD-3013 package has more robust walls and hence will tolerate a much higher internal pressure than existing Hanford storage packaging, making various existing safety and security equipment less than useful. Project W-460 will focus on an approach that modifies existing storage areas within the PFP secure vaults. Care will be taken to simultaneously satisfy safety considerations along with domestic and international security requirements.

A dose estimate prepared for PFP management has shown that worker radiological exposure will require careful management to remain within current occupational guidelines and to meet facility environmental, safety, and health (ESH) objectives during the stabilization and packaging work remaining at the PFP (ref 4). To minimize manual handling of SNM, automation of as much of the stabilization and packaging function as feasible is needed. Tools and automated approaches will be considered to minimize worker dose during transporting and handling of the DOE-STD-3013 packages. To minimize exposure during local transport within the PFP, the SPS should be located within the same material access area as current and planned SNM storage locations.

International safeguards requirements for PFP storage vaults include: examination of records and reports, annual physical inventory verifications (PIV), monthly interim inspections, and investigations of storage anomalies as they appear. Of these requirements, the PIV are the most significant, both financially and from a personnel radiation exposure perspective. Normally, the PIV include hands-on inspection and opening of containers for destructive assay (DA), with subsequent repackaging, plus significant hands-on work to provide NDA. There

is a strong desire to minimize reopening the plutonium storage packages once they are stabilized and packaged in compliance with DOE-STD-3013. To minimize DA and the hands-on work of inspection and NDA, enhanced security measures are required to satisfy international and domestic safeguard requirements. There is clear benefit to reducing the cost and worker risk associated with the application of domestic and international safeguards.

There is significant world-wide experience of relatively frequent safeguards instrumentation failure. The strong desire to minimize intrusive safeguards inspections once the DOE-STD-3013 packages are implemented, and the low marginal cost of proceeding with redundant safeguards instrumentation, justifies adoption of an additional layer of containment and surveillance design criteria to ensure that adequate protection is maintained continuously.

IV. DESCRIPTION OF PROJECT SCOPE

A. IMPROVEMENTS TO LAND (460)

Minor improvements to land will consist of a small amount of sidewalk construction between the 2736-ZB Building, the new office structures, and the roadway. Roof drainage from the new office structure will be directed to splash pads, and runoff from the sidewalks will be directed to adjacent soil.

B. BUILDINGS (501)

1. 2736-ZB Building

Civil/Structural

Structural modification to the 2736-ZB Building will include providing an opening in the east wall of room 642 sufficient to accommodate the installation of a 6-ft wide doorway for access to rooms 641 and 642 for equipment installation. The wall is 12-in. thick concrete

with reinforcing steel in each face. The reinforcing steel is 5/8-in. bar on 12 in. spacing running both vertical and horizontal. The opening in the wall will be about 12 in. larger in each dimension than the required door opening so that proper end termination of cut rebar can be made.

Existing structural calculations for 2736-ZB Building will be revised to reflect these modifications (ref 6).

A new airlock will be provided on the south side of room 608. New outside construction will be attached to the existing building envelope. The construction will include walls, and roof, along with architectural features.

A roof-accessing stairway will be installed on the west side of the building.

A water meter will be installed on the water line supplying the building with potable water.

Architectural (see sketch ES-W460-A2) (All sketches are located in Appendix M)
The 11,880 ft^2 2736-ZB Building contains existing business and special purpose Industrial Occupancy classifications separated by a 2-hr fire-rated wall, per National Fire Protection Association (NFPA) 101. The construction of the building is Type II (222) per NFPA 220 (1992). The building has reinforced concrete bearing exterior and interior walls, interior columns, and roof. Nonbearing interior partitions consist of fire-rated gypsum board on metal studs. The ceilings in the rest/changerooms and operations rooms are of suspended gypsum board. The lunchroom and offices ceilings are of suspended acoustic panels.

Any modifications planned for the 2736-ZB Building will match the existing noncombustible, fire-resistant type of building construction and conform to existing fire wall separations. New material surface finishes will match existing materials or be appropriate for its intended use. The existing roofing will be repaired and patched as required to accommodate the new work. The need for a complete reroof will be evaluated during definitive design.

No accommodations for the handicapped will be provided in the 2736-ZB Building and the connecting 2736-Z Building. The PFP site restricts access to individuals with any mobility handicap due to emergency response requirements. See Appendix I for the physically handicapped assessment.

The partition wall between rooms 641 and 642 will be removed and the combined space will house the SPS, a new airlock, and a control room. An opening will be provided in the east concrete wall of room 642 to allow access to rooms 641 and 642 for equipment delivery and installation. The opening will be sealed with Class 5 vault doors. The door between rooms 641 and 638 will be temporarily removed including an adjacent section of wall to allow access through rooms 639/640. The floor in room 641/642 will be repaired and patched to match the existing finish.

A new exterior airlock at door 477 of room 641 will be provided. The airlock construction will be similar to that at the front entrance, room 608, and will include concrete steps with pipe railing.

Access to the SPS control room from corridor 625 will be through an existing vault door. A new laser generator room and a new programmable logic controllers (PLC) room will be provided and accessed through the SPS control room.

Rooms 626 through 628 will be combined to provide a new operations office. Existing plumbing fixtures and piping above the floor slab in the decontamination room and the men's and women's restrooms will be removed. Waste piping will be capped and sealed below the slab. The floor slab will be repaired and patched to match the existing floor.

Rooms 629 through 631 will be reconfigured to house a larger office for the Radiological Control Technician (room 631) and the shift custodian (room 630). Room 629 will become a corridor. Rooms 621 and 622 will be combined to house the safeguards files.

The abandoned emergency shower and associated piping in room 639 will be removed and capped above the ceiling. The shower drain and waste line will be capped and sealed. Rooms 639 and 640 will be combined into one room and will contain a high-efficiency particulate air (HEPA) exhaust filter assembly for the SPS. The combined room will be upgraded to provide a 2-hr fire-rated enclosure around the new filter plenum.

An airlock will be installed in existing corridor 633 between the NDA laboratory and the main corridor, 625.

Equipment in the existing NDA laboratory will be rearranged to accommodate three new calorimeters. Rooms 632 and 634, next to the NDA laboratory (room 637), are designated NDA laboratory support offices. The door to room 632 will be replaced by a new door west of the new airlock room 633.

The door for room 635 will be relocated from corridor 633 to corridor 625, and room 635 will become an International Atomic

Energy Agency (IAEA) office. The IAEA video-monitoring equipment will be relocated to this office.

The existing glovebox in room 636 will be removed after the SPS is installed and functioning. The HEPA filter system for this glovebox will remain. Room 636 will then be used for IAEA equipment temporarily relocated in room 638 during construction.

The janitor's closet, room 613, and vestibule 615 will be removed and become a continuation of corridor 609. Room 616 will continue to be used as an airlock between the front offices and the operations area. Room 612 will be used as the janitor/storage room and will include a new service sink and a 50 gal electric water heater. The floor drain pipe in room 613 will be extended to room 612.

The Mardex® security access in room 629 will be moved to the existing main entrance. Rooms 608 and 610 will be combined for this purpose. A new airlock and exterior steel door will be added outside the existing main entry Class 5 vault door. The new airlock will incorporate part of the existing exterior canopy and two supporting steel columns, a new concrete floor slab, and foundation. The walls and ceiling will consist of steel stud framing, thermal insulation, fire-resistant painted gypboard interior surfaces, skid-resistant rubber tile flooring with rubber base, insulated steel door, and prefinished steel siding panels for the three exterior wall surfaces. The existing concrete ramps to the main entrance will be reworked to provide walking surfaces with the same slope. New handrails will be provided if the existing handrails to be relocated are not reusable.

The existing lunchroom, room 620, function will be relocated to an office structure adjacent to the 2736-ZB Building. The existing

counter and appliances will remain in room 620 and will be used for breaks. Two modular office cubicles will be installed in room 620 after the office structure containing the new lunchroom is in place.

Existing corridor 601 is a designated airlock and an emergency exit.

Space for Operations and SPS support staff not accommodated for in the 2736-ZB Building will be provided in an adjacent relocatable office structure.

The existing gas bottle storage station outside the NDA laboratory will be removed and a new storage station will be installed to provide additional storage capacity for the helium used in the SPS.

Fire Protection

Supply air-handling units SF-1 and SF-2, SF-3 and SF-4, and SF-5 and SF-6 in room 602 will be retrofitted with smoke detectors located downstream of the air filters and ahead of branch connections, in accordance with NFPA 90A.

The automatic sprinkler system riser in the 2736-ZB Building will be modified to include a reduced pressure backflow assembly as required by WAC-246-290-490 for backflow prevention. Adequate space is not available at the existing riser location in the building for this modification. The new assembly will be installed in the fire water supply line, outdoors, and in a heated enclosure.

New manual pull stations will be installed as required at existing exterior doors. Exit signs and emergency lighting will be provided as required by NFPA 101.

Doors in the emergency egress path will be evaluated by the FHA during definitive design. If necessary, doors used for emergency egress will be modified or replaced to comply with NFPA 101.

The need for two-hour fire-rated fire dampers in new ductwork penetrating (passing through) existing fire walls and roofing systems that form a secondary confinement barrier will be evaluated by the FHA during definitive design. All new penetrations in existing fire walls will be sealed to a 2-hr fire rating.

The new wall between rooms 619 and 622 will be a 2-hr fire-rated wall.

The walls in rooms 639 and 640 will be upgraded to a 2-hr fire rating. Wall and ceiling penetrations will be sealed to a 2-hr fire-rating. Fire-rated dampers will be installed in all ductwork penetrating this enclosure. Fire doors and fire dampers will be listed with a 1-1/2-hr fire rating.

The existing wet-pipe sprinkler system will be modified to account for architectural changes in accordance with NFPA 13. Automatic sprinkler system piping and supports in rooms 638 through 641 will be analyzed and modified as necessary to comply with seismic requirements for Safety Significant items impact on safety class items (previously Safety Class 3-over-Safety Class 1).

The existing heat detector that serves the glovebox in room 636 will be removed with the planned disposal of this glovebox. Fire zone 7 in this building will be modified to reflect removal of this detector. The two ceiling-mounted heat detectors in room 636 will remain.

The fire control panel (FCP) in the 2736-ZB Building will be replaced with an expanded model capable of taking input from the new supply duct smoke detectors, new glovebox detection and suppression systems, tamper switches on the new backflow preventer, additional area detectors (if necessary), new manual pull stations, and the new air sampling type smoke detection system planned for the 2736-Z vaults.

Heating, Ventilating, and Air Conditioning (see sketches ES-W460-H2 and ES-W460-H5)

The exhaust ventilation system for the SPS will maintain a negative pressure of 3-in. wg where the exhaust duct interfaces with the glovebox manifold. Normal exhaust airflow from the SPS will be approximately 400 cfm when the system is in operation. Approximately 1,000 cfm will be required when the system is opened for maintenance. If both fans EF-1 and EF-2 go out of service, a supplemental exhaust fan will be energized to maintain the required negative pressure within the SPS. The SPS is allowed to go to a static condition with no ventilation if all exhaust fans are off line.

The SPS exhaust ventilation system will connect to the SPS at a manifold provided by BNFL. The manifold will have at most two connection points. The exhaust duct will direct the SPS process exhaust to two testable stages of HEPA filters enclosed in a seismically qualified HEPA filter housing with isolation dampers (valves). A redundant exhaust train will be furnished to allow the SPS process to remain online when the HEPA filters require replacement. The HEPA filter exhaust train and components will conform to American Society of Mechanical Engineers (ASME) N509 and be testable to ASME N510. The HEPA filter exhaust train will be located in room 639/640.

Due to the congested areas within the building and to minimize construction activities, the ductwork from the HEPA-filtered exhaust trains will be routed outside and on the roof. The ductwork will exit the HEPA-filtered exhaust trains and penetrate the roof at room 639/640 and will be routed along the roof of the building.

The ductwork will re-enter the 2736-ZB Building through the roof above the mechanical room 600. The ductwork will divide into two branches. One branch of the ductwork will be connected at the inlet plenum of fans EF-1 and EF-2; the other branch will be connected to the inlet of a supplemental fan located in the mechanical equipment room. The supplemental fan will be mounted on a seismically qualified structural steel platform above the inlet plenum for exhaust fans EF-1 and EF-2. The discharge of the supplemental fan will be connected to the stack plenum just below the roof line, inside the building. Drain points will be provided at low points of the system to remove water.

The supplemental exhaust fan will be rated at approximately 400 cfm at 10-in. wg and will automatically start upon loss of exhaust fans EF-1 and EF-2, or can be manually energized if required. The exhaust fan will conform to ASME N509.

All exhaust ductwork, fittings, and flanges will be schedule 5S stainless steel pipe using standard pipe and fittings unless otherwise specified. All exhaust ductwork will conform to ASME N509 and be testable to ASME N510. The ductwork and supports from the SPS process through the HEPA-filtered exhaust train to the point where the duct penetrates the building will be designed to meet safety class seismic criteria. The ductwork and supports on the roof are not required to meet safety class seismic criteria. The ductwork that is routed outside the building will be thermally insulated.

The new 10-in. diameter inlet duct that leads to the HEPA filter plenum and the new 10-in. diameter duct that penetrate the roof above the HEPA filter plenum will be equipped with fire dampers, if needed as determined by the FHA during definitive design. The existing ductwork for HEPA filter box F-10 in room 639 will also be equipped with a fire damper. In addition, the new 10-in. diameter ducts that penetrate the roof will be provided with an approved security device to preclude unauthorized entrance. All existing supply ductwork located above the SPS will be retrofitted with seismically qualified supports.

The HEPA filter exhaust train and other related equipment, i.e., valves, fan, etc., will be constructed and installed to minimize subsystems for removal or maintenance. The design and fabrication of the system will allow access for visual inspection, assembly, or disassembly to facilitate maintainability.

Functional testing of the exhaust system will be conducted, including tests to ensure that all alarms and interlock systems perform their specific functions. A test plan will be submitted for approval prior to testing. At a minimum, the acceptance test will comply with ASME N509, Table 9-1.

SPS Process Exhaust System Operation

When fans EF-1 or EF-2 are in operation, the air is directed from the SPS HEPA filter exhaust train and routed to the inlet plenum to EF-1 and EF-2. Isolation valve V1 is open; isolation valve V2 is closed (see sketch ES-W460-H5). The differential pressure indicator transmitter (DPIT) senses the pressure in the main exhaust duct from the SPS. Differential pressure controller (DPC) XXX receives its signal from DPIT XXX and controls modulating valve V3 to maintain -3-in. wg at the interface with the SPS manifold.

When fans EF-1 and EF-2 are not in operation, isolation valve V1 is closed, isolation valve V2 is open, and the supplemental exhaust fan for the SPS is energized. Vane inlet damper on the supplemental exhaust fan controls the design setpoint pressures similarly as described above. All controls and actuators are electric. Both the actuators and the supplemental exhaust fan are connected to the emergency power supply.

The existing 2736-ZB Building supply and exhaust ventilation systems will be modified to accommodate the new configuration of the office space rearrangement. All supply and exhaust ductwork that penetrates any fire barriers must be equipped with fire dampers.

HEPA filter housings F-12 and F-13 will be relocated to accommodate the new control room for the SPS. A new recirculation air-conditioning unit will be installed in room 636 to supplement the existing cooling capacity and to maintain the room space at 72° F. The air-cooled condensing unit for the room 636 recirculating unit will be located on the roof of the building.

Cooling coil CC-3 and heating coil HC-3 will supply tempered air to the new SPS control room. New duct connections will be made to the existing ductwork in corridor 625 and will be distributed within the new control room.

Differential pressure indicating gauges will be mounted in corridor 625 and will monitor the pressure in rooms 638 and 641/642. The existing pressure controllers and transmitters that control the pressure in room 636 will be relocated to rooms 641/642 and modulate existing control damper DM-4 which will continue to maintain zone 2 pressure of -0.25-in. wg relative to atmosphere.

All equipment ductwork will conform to American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards; supply ductwork will conform to both ASHRAE and Sheet Metal and Air Conditioning Contractors National (SMACNA) standards.

Pressure zones impacted by the facility modifications will conform to the existing facility standards for maintaining pressures.

Existing exhaust fan EF-3 and the kitchen exhaust fan will be interlock with EF-1 and EF-2 and will be prevented from operating in the event that both EF-1 and EF-2 are off-line.

Existing exhaust stack 296-Z-5 will be equipped with isokinetic probes to obtain a representative sample from the exhaust airflow.

The facility ductwork will be rebalanced after modifications to the HVAC systems have been made in accordance with SMACNA and ASHRAE standards and the Associated Air Balance Council (AABC). The rebalancing will be performed with new and clean supply inlet filters, prefilters, and HEPA filters.

The laser generator will be water cooled, using a remote chiller and an air-cooled condensing unit mounted on the roof of the building to remove the heat produced by the laser generator. The laser generator will be installed in room 641B. Disposal of condensate from the laser generator will be reviewed during the definitive design. The chiller for the laser will have the capability to furnish a fast response to the temperature variations caused by the laser

generator. The chiller and air-cooled condenser will be designed for outdoor installation.

The furnaces in the SPS require cooling air with a temperature of approximately 25 °F. The air will be cooled using a remote chiller and an air-cooled condenser mounted on the roof of the building.

Instrumentation (see sketch ES-W460-H5)

The SPS exhaust ventilation system will have all electronic/electrical positioners and actuators. All new transmitters will be electronic. Existing exhaust fans EF-1 and EF-2 and the new SPS exhaust fan will be interlocked through the Micon® distributed control system (DCS) so that if both EF-1 and EF-2 fans have stopped, the SPS exhaust fan will start and the SPS exhaust ventilation system will be isolated from EF-1 and EF-2 fans. All new control loops will have standalone local control with Micon® DCS override capability similar to the existing control loops.

The fire alarm signal for the SPS will be sent to the Micon® DCS.

The Micon® DCS will monitor all new air lock door positions and control the warning lights. Local alarms will be added to all airlocks.

The kitchen and restroom fan switches will be hard-wired with building exhaust fans EF-1 and EF-2.

The differential pressure control for the 2736-ZB Building zone 2B will be relocated from room 636 to room 641/642.

The SPS exhaust fan inlet damper will have an electric positioner and an electric operator.

Local differential pressure indicators will be added to measure differential pressure between room 636 and corridor 625 and room 638 and corridor 625.

Three new calorimeters will be installed in the NDA laboratory area.

The IAEA video monitoring cabinet will be relocated from room 642 into room 635. The balance of the IAEA equipment will be temporarily relocated to room 638. The IAEA equipment will eventually be located in room 636 once the repackaging glovebox is removed.

Electrical

The existing 400-A, 3-phase, 480 V panelboard DSW-NP-1 is inadequate for the additional load of the SPS and related additions to the 2736-ZB Building, the panelboard will have to be upgraded to a 600 A panelboard with the following branch circuits:

- Four 20 A, 3-pole
- Four 80 A, 3-pole
- Two 90 A, 3-pole
- Two 100 A, 3-pole
- Two 125 A, 3-pole
- One 125 A, 3-pole (for SPS panelboard)
- One 125 A, 3-pole (for SPS laser generator)

The feeder ampacity and supplying circuit breaker for DSW-NF-1 will be upgraded to 600 A ampacity.

Three, size 1 motor starters will be installed in motor control center (MCC) EP-1 in room 602 for the 3/4-hp fan for SPS supplemental

exhaust for the 2-hp condenser compressor for room 636 and for a 2-kW heater for the backflow preventer enclosure.

Power will be provided for three new calorimeters in the NDA laboratory area. Each calorimeter will require a dedicated 20 A 120 V circuit.

2. 2736-Z Building

Civil/Structural

Secondary structural work will be included in the modifications to the plutonium storage vaults in the 2736-Z Building. This work will consist of support and anchorage of the plutonium storage devices and will not involve the primary building structure.

Architectural (see sketch ES-W460-A2)

The existing 2736-Z Building is classified as a Storage Occupancy according to NFPA 101. The 3,840-ft^2 building is Type I (443) construction in accordance with NFPA 220 (1992). The existing floor, exterior and interior bearing walls, and the roof of the existing building (vaults) are of reinforced concrete.

Planned modifications for the 2736-Z Building will match the existing noncombustible, fire-resistant type of building construction. New material surface finishes will also match existing finishes. Building egress routes will not change. Current PFP site restrictions exclude accessibility accommodations for physically disabled persons due to emergency response requirements.

Vault modifications are in the vault configuration comparison study (see Appendix M).

Fire Protection

The ionization smoke detectors installed in the 2736-Z Building vault areas and corridor will be removed and replaced with an air sampling type smoke detection system to enhance the safeguards and security of the storage vaults. The new smoke detection system will be located in the 2736-Z Building corridor or another suitable location. The system will interface with the new FCP planned for the 2736-ZB Building in accordance with NFPA 72.

Doors in the emergency egress path will be evaluated by the FHA during definitive design. If necessary, doors used for emergency egress will be modified or replaced to comply with NFPA 101.

New manual pull stations will be installed as required at new and existing exterior doors. Exit signs and emergency lighting will be provided as required by NFPA 101.

All new penetrations in existing walls will be sealed to a 2-hr fire rating.

Heating, Ventilating, and Air Conditioning

The existing ventilation system consists of two supply fans and two exhaust fans, capable of supplying 12,000 cfm. Each fan is rated at 6,000 cfm. The proposed design will be for one supply and exhaust fan to be in operation. If the decay heat in the vault rises above a predetermined set point, the other supply and exhaust fan will be energized.

A heat transfer analysis will be performed as part of the vault configuration comparison study. The 2736-Z Building ventilation system will be modified to support the results of the study.

Portions of the supply and exhaust ductwork will be removed to accommodate the new seismically-designed ductwork design. The required portions of ductwork to be removed will be determined during the ACD phase.

The supply air will be based upon 6000 cfm of air at a design temperature of approximately 56 °F to dissipate the decay heat from the stored plutonium canister. The exhaust ductwork must ensure that the airflow is drawn across the canisters in a uniform manner. A tolerance for (plus or minus cfm) airflow uniformity will be determined during definitive design. Test ports or other devices will be installed at the exhaust location that represents each specific canister area to demonstrate that the required airflow is achieved.

Security barriers will be designed at appropriate supply and exhaust locations to prevent unauthorized entry. The design of the security barriers will incorporate sound engineering principles to minimize the pressure drop across the barrier but still adhere to Site security requirements.

All modifications to the ventilation system will conform to ASME N509, ASHRAE, and SMACNA standards.

Electrical

The lightning protection system for the 2736-ZB Building will be extended to the 2736-Z Building. The system will comply with NFPA 780.

A "KILL" switch to stop the 2736-Z Building exhaust system will be installed in the vault corridor. This will allow the vault doors to be opened when the supply fans shut down.

3. Office Structure

Civil/Structural

The new office structure will be installed as shown on sketch ES-W460-C1. No permanent structures such as floor slabs or foundations will be required for this office structure.

Water for the new office structure is readily available. A 6-in. fire waterline and a 4-in. potable waterline runs along the west side of the 2736-ZB Building. An 8-in. fire watermain line runs north-south along the west side of the new office structure location. A backflow preventer and a water meter will be installed on the water supply line to the office structure.

A new package lift station or pumps in a standard manhole will be installed just north of the new office structure. This station will also intercept the current sanitary sewage flow from the 2736-ZB Building. The sewage will be pumped north along the west side of the 234-5Z Building, a distance of about 350 ft, to an existing sanitary sewer manhole located near the northwest corner of the 234-5Z Building.

Architectural (see sketch ES-W460-A6)

The existing 2736-ZB Building has limited space. Project W-460 will provide additional space for the operations and support staff in an adjacent office structure. The office structure will be classified New Business Occupancy per NFPA 101 and will be of Type V (000) construction in accordance with NFPA 220.

The 4,200 ft^2 office structure consisting of a five, 14- by 60-ft long preengineered and prefabricated relocatable structure will be anchored to buried concrete anchors for wind and seismic restraint.

The structure will have single ply roofing; wood framing; steel siding and doors; insulated roof, walls, and floor; aluminum windows; hardwood veneer interior doors; painted interior gypboard wall finishes; suspended acoustic ceilings in the office areas; gypboard ceilings in the rest/changerooms; carpeted office, conference room, and corridor areas; sheet vinyl floors in the lunchroom and rest/changerooms, painted wood exterior stairs; and steel pipe railing.

The office structure will include a 2-hr, fire-rated repository for fire-rated file cabinets, a 15-person conference room, six 100-ft^2 partitioned offices, fifteen 80-ft^2 office cubicles, three secretarial cubicles, a copy room, a lunchroom, rest/changerooms, and a fire riser and backflow preventer room.

The functional areas of the structure will provide secure and efficient operations, meet programmatic requirements, and satisfy applicable building and fire codes. Compliance will include, but is not limited to, the requirements of DOE Order 6430.1A, NFPA 101 and 220.

Fire Protection

An automatic fire sprinkler system will be provided inside the new office structure in accordance with NFPA 13 for an Ordinary Hazard Group 2 Occupancy.

A post indicator valve, located a minimum of 40 ft from the new office structure, will be provided in the line between the sanitary water loop and the new sprinkler system riser in accordance with NFPA 24.

A new fire alarm control panel, and radio fire alarm signal box, with all required initiating and notification devices will be installed in accordance with NFPA 13, 72, and 101.

The location and construction of the new office structure will comply with the requirements of NFPA 80A and DOE/EV-0043.

A waiver from DOE/EV-0043 and NFPA 24 will be required to allow placement of the new office structure over a segment of the sanitary water loop piping.

Heating, Ventilating, and Air Conditioning

The office structure will be maintained at a summer inside design temperature of 78 °F with an outside temperature of 96 °F dry bulb and 67 °F wet bulb. The winter inside design temperature will be maintained at 72 °F with an outside design temperature of 5 °F for personal comfort. For protection of fire systems against freezing, the system will be capable of maintaining an inside temperature of 40 °F with an outside temperature of -23 °F. Heat pumps will be used for both summer cooling and winter heating. Electrical resistance heaters will supply supplemental heating if the temperature drops below a predetermined set point.

Approximately 14 tons of air conditioning will be required for summer cooling and 32 kW of electric resistance heating for winter conditions. Insulated sheetmetal ductwork will be routed through the ceiling space of the office structure with flexible ductwork leading from the sheetmetal plenum to the conditioned office space.

All equipment and components will conform to ASHRAE standards; supply ductwork will conform to both ASHRAE and SMACNA standards. The restrooms will be exhausted using a roof-mounted

exhaust fan. Outside makeup for personnel comfort will conform to ASHRAE standards for indoor air quality.

The ventilation system will be provided with permanently installed manual dampers in the main trunks of the ductwork and in all branch ductwork to facilitate balancing individual office spaces. Access to these devices will also be provided.

Automatic control setback and shutdown devices with manual override feature will be provided. Use of separate or dual setting thermostats, switches, time clocks, or connections for on/off control will be considered for control of air-conditioning to raise the cooling set point during summer unoccupied periods and to control the heating set point during winter unoccupied periods.

All air-handling units (heat pumps) will recirculate air and will also be designed to automatically use outside air quantities up to 100% of the fan system capacity for cooling the space, with the exceptions noted in ASHRAE Standard 90. Economizer cycle control will not be used for the heat pumps where introduction of the additional outside air would actually increase energy consumption.

Electrical (see sketch ES-W460-E3)

A 50-kVA, 480-240/120 V, single-phase outdoor pad-mounted transformer will be installed locally to supply the prewired panelboards in the new office structure.

The new transformer will comply with the recommendations of Factory Mutual Engineering Corporation (FMEC) Loss Prevention Data Sheet 5-4.

4. 2731-ZA Building (see sketch ES-W460-A5)

Civil/Structural

No structural modifications to the 2731-ZA Building are anticipated beyond mounting pads for the dry air equipment and installation of an interior partition and doors.

Architectural

The 2731-ZA Building is a preengineered metal building on a concrete pad located to the southwest of the 2736-ZB Building. The building is currently used for storage of dry chemicals and miscellaneous items for PFP. The 2731-ZA Building will be divided into two rooms by installing a floor-to-roof partition wall in the center of the building. One of the rooms, approximately 15 by 24 ft, will contain a new dry air system for the SPS.

The partition wall will have a roll-up door to provide access to the air compressors. The compressor room will be insulated.

The 2731-ZA Building will be an Industrial Occupancy in accordance with NFPA 101 and a Type II (000) noncombustible construction per NFPA 220 (1992).

Fire Protection

The installation of the air compressor system will not require the installation of an automatic sprinkler system in the 2731-ZA Building. The two existing fire detectors in this building will not be relocated. A manual pull station will be installed inside the building at the exterior door in the north wall.

Heating, Ventilating, and Air Conditioning

The building will be heated during the winter and exhausted in the summer months when inside air is raised above outside ambient air. The exhaust fan will be located on the roof and will be energized when the inside temperature reaches approximately 96 °F or when it can be started manually. Air is introduced into the 2731-ZA Building via a louver mounted on the exterior wall. The incoming air is filtered through a 45% ASHRAE-rated filter. The exhaust fan is rated at approximately 1600 cfm at 1-in. static pressure.

The 2731-ZA Building is heated in the winter using a ceiling or wall-suspended electric unit heater rated at approximately 10 kW. The unit heater is thermostatically controlled and will be energized when the inside temperature approaches 50 °F.

Electrical (see sketch ES-W460-E3)

A new single vertical section of 3-phase, 480 V MCC will supply two 40-hp compressor motors, heating, air dryers, and a 5 kVA 480-120/240 V transformer with a 100 A panelboard. The panelboard will supply control power to vendor-furnished controls and power for lighting and receptacles in the 2731-ZA Building.

Instrumentation (see sketch ES-W460-P1)

The new air compressors and air dryers will be purchased with required controls from the vendor. Micon® interfaces will be added to monitor the vendor-supplied alarm and status points. The Micon® will also have inputs from the following separately-installed field instruments.

1. Control of the air compressor discharge valves.

2. Differential pressure transmitters across each filter train.

3. Pressure transmitter at air dryer discharge.

4. Pressure transmitter downstream from pressure reducing valve.

5. Dew point transmitter for air quality going to the SPS.

C. UTILITIES (600)

A new utility service to a new 225 kVA pad-mounted transformer that has a 3-phase, 480 V secondary will be installed. This transformer will supply the new office structure transformer and the 2731-ZA Building new dry MCC from a local distribution panelboard. The new 225 kVA transformer will comply with the recommendations contained in FM Data Sheet 5-4.

D. SPECIAL EQUIPMENT AND PROCESS SYSTEMS (700)

1. Stabilization and Packaging System

The SPS prototype has been identified at the request of RFETS for their installation. An equitable adjustment for the cost of the first nine modifications was agreed to by the DOE and the cost was applied to the four SPSs. The Hanford portion of the cost is included in the CDR estimate. RFETS also requested a design modification for a ventilation header and electrical connection that provides a minimum number of utility interface points. The PFP will request this same modification and the cost for this is included in the CDR estimate.

The SPS prototype will be modified to meet PFP requirements. These modifications will include changing the receipt hood to a glovebox by removing the hood sash and installing an entry airlock or sphincter seal-in port. The conveyor connection used on the prototype will be changed into a glovebox for the PFP SPS by

installing an entry airlock. The metal brushing equipment in the prototype will be removed and replaced with a size reduction station. Experience at PFP has shown that heating oxide causes the oxide to agglomerate into large chunks that must be broken up. The nitrogen atmosphere for the prototype will be replaced with a dry air atmosphere and an automatic fire suppression system will be added. The PFP will utilize SPS to repackage some of their existing containers without processing the oxide inside the containers. This will require some minor modifications to the SPS conveyors and fixtures.

Changes to the ventilation controls on the prototype cannot be determined at this time due to incomplete information on the prototype controls.

Fire Protection

The new SPS glovebox enclosures will be a procured system designed in accordance with the requirements of DOE Order 6430.1A and the draft DOE Glovebox Fire Protection Standard.

Processing or repackaging of plutonium metal in the SPS gloveboxes will be prohibited due to the pyrophoric nature of this material and the planned dry-air environment.

Each new enclosure will be procured with both automatic and manual fire suppression systems as required by the draft DOE Glovebox Fire Protection Standard for a non-inerted environment. Complete fire suppression systems will be procured with piping, nozzles, actuation devices, appurtenances and trim installed, and ready means of mechanical and electrical connection to building fire protection services.

All necessary fire detectors will be installed in each glovebox. Detection systems will be provided with ready means of connection to building fire protection services and fire alarm systems.

Fire protection system interfaces with building systems and services will be made outside of each enclosure at an accessible location. Junction boxes will be procured with, and attached to, each SPS enclosure as necessary to facilitate the interface between SPS enclosure detectors and other electrical components with the new FCP planned for the 2736-ZB Building.

Electrical

The electrical loads for the SPS are grouped by process into two areas. Both areas together require a single 125 A, 3-phase, 480-V power source for most of the equipment, plus 120 V UPS power for dump valves for each area. A separate 125 A, 3-phase, 480-V power source is also required for the laser generator.

The first area, the stabilization process, requires a 3-phase, 4-wire, 480 V, 100 A circuit breaker panelboard (see sketch ES-W460-E3).

The second area, the packaging process, will have a 50 A subfeed from the stabilization process panelboard for motor controllers and 208Y/120 V transformers.

Both areas will be supplied from a group of four electrical cubicles. The 100 A panelboard will be located along the east wall of room 602. The PLC/instrument cabinet will be located in room 641D near the control room. The motor controller group will be located at the north end of room 602 on an existing pad.

The 480-208Y/120 V transformers and the 208Y/120 V panelboards, for both the stabilization and packaging processes will also be located in room 602.

The SPS will be supplied with two PLCs. The laser generator will be located north of the control room in room 641B.

The UPS will be located in room 641D. The UPS will supply the PLCs and dump valves.

The following additional items will be supplied with the SPS as government-furnished equipment:

- Three 480-208Y/120 transformers (one 0.75 kVA, one 5.2 kVA, one 9 kVA).
- One 24 V dc power supply.
- Ten hood lighting fixtures and circuits.
- One UPS of undetermined size.
- Two PLCs with software.

The initial design of the SPS is described below for informational purposes only.

- The SPS will consist of two major modules: stabilization and packaging. The stabilization module will consist of a receipt glovebox, conveyor glovebox, a material preparation area, transport area, furnace area, and a test area with a

loss-on-ignition furnace. The packaging module will consist of a can dispense and fill area, can weigh and cap insertion area, intermediate can handling area, and outer can weld monitoring area.

- The design of the receipt glovebox provides a protected work area for initial receipt of incoming containers. Container identifiers are recorded and the outer container is opened manually. The inner container is removed and transferred through the entry airlock to the material preparation glovebox (outer container goes to low level waste). In the material preparation glovebox, the inner container is assayed, opened, decontaminated, compacted, and loaded out to metal waste. At the powder dispensing station, the inner container of plutonium oxide is transferred to a batch furnace tray using a screened funnel, screw conveyor, bin vibrator, and tray funnel cover. A size reduction station will be included to break apart oxide that agglomerates during heating in the furnaces.

- The transport area glovebox contains a conveyor to transport convenience cans of plutonium metal and furnace trays between the material preparation area, the furnace area, the loss-on-ignition (LOI) test area, and the tipping/dispense/fill area. The furnace area glovebox contains the furnace glovebox and two stabilization furnaces for thermal stabilization of plutonium oxide. The test area glovebox contains the LOI sampling station, the sample desiccator, and the LOI furnace to verify that plutonium oxide processed through the stabilization furnaces has achieved acceptable moisture reduction test value. In the dispense and fill area, batches of plutonium oxides in furnace trays are dispensed into convenience cans, and filled convenience cans of oxide

are moved to the can weigh and cap insertion area. The dispense and fill area contains the tipping glovebox, the dispense/fill glovebox, the seismic displacement absorber, the furnace tray elevator/transpose unit, the furnace tray tipper, the convenience can transfer unit, and the convenience can handler.

- In the can weigh and cap insertion area, a convenience can is loaded into an intermediate can and a can lid blank (cap or bung) is placed in the top. The can weigh and cap insertion area includes the can weigh and cap insertion glovebox, a gaslock, a convenience can turntable, the weigh scale and bar code reader, the convenience can pusher, the intermediate cap magazine, and the material transfer port. In the intermediate can handling area, the bung is welded to the intermediate can and the waste is cut off. The intermediate can handling area includes the fume cabinet, the intermediate can rotating sphincter seal, the intermediate can storage magazine, the laser welding/cutting tool with one waveguide, the laser generator, and the intermediate can handling unit.

- In the outer can weld and monitoring area, the intermediate can assembly is checked for surface contamination and leaks in the can seal. As each can passes the test, it is loaded into an outer can. A can lid blank (cap or bung) is inserted in the top and the outer can is welded. The whole unit is then leak tested. The outer can weld and monitoring area includes the can turntable/trolley, the outer can handling unit, the intermediate can leak detection unit, the helium fill/lid fitment unit, the laser welder with a second separate waveguide, the outer can contamination check unit, and the outer can leak detection unit. The lag storage trolley is a shielded transfer

cart is used to transfer storage containers out of the SPS operation area to the NDA laboratory or secure storage vault.

2. Standard Equipment

2736-ZB Building

Three calorimeters will be provided in the NDA laboratory area: two will be new and one will be an excess calorimeter from LANL.

Four 28-in. by 6-ft stainless steel tables will be provided for the gamma ray isotopic counting system in the NDA.

The security checkpoint (Mardex®) station will be relocated to the entrance of the 2736-ZB Building. New metal detectors and X-ray equipment for the station will be provided by PFP for project W-460.

Two 8-by 10-ft by 6-ft 8-in. high, open-office, modular workstations with 24-in. deep counters and corner personal computer layouts will be installed in room 620. The furniture system will be capable of supporting hang-on modular components that can be connected to create individual or group workstation areas. Each workstation will contain task lighting and a power/communication raceway/pole system. The workstations will comply with NFPA 101 Class A flame spread requirements, NFPA 225, and Business and Institutional Furniture Manufacturer's Association (BIFMA) standards.

Existing office furniture and office equipment in the 2736-ZB Building will be used for the remainder of offices in this building.

2736-Z Building

A vault canister handling unit will remove the DOE-STD-3013 canister from the BNFL lag storage trolley and place the canister in the vault for storage. The canister handling unit will provide shielding to reduce operator exposure to ALARA. The design of the canister handling unit will depend upon the vault storage concept chosen.

Office Structure

The office structure will contain 16 office cubicles and 3 secretarial cubicles similar to the 2 modular workstations in the 2736-ZB Building.

Each of the six hard-walled offices will be furnished with a 30- by 60-in. desk, a 24- by 36-in. side table, an ergonomic office chair, a side chair, a 36-in. wide by 42-in. high-shelving unit, and a 4- by 3-ft whiteboard.

The conference room will have a 4- by 12-ft conference table; 16 chairs; an 8-ft manually-operated projection screen; two 8-ft whiteboards; and a rolling cart for a projector, television, and VCR.

The lunchroom will be furnished with four dining tables and 24 chairs; one refrigerator; two microwave ovens; two 8-ft bulletin boards; and two trash cans with lids.

Each restroom/changeroom will have 18, double-tiered, 12- by 18- by 36-in. high steel lockers and a 6-ft wooden bench.

2731-ZA Building

The 2731-ZA Building will contain:

- Two 150-scfm air compressors
- Two desiccant air dryers
- Six air filters
- One air receiver tank
- 10 kW, 480 V, 3-phase space heater

E. DEMOLITION (810)

1. 2736-ZB Building

The following spaces contain items that will be demolished and removed:

- Room 602: Two air compressors, two air receiver tanks, air dryer system, air filters, instrument air system, one 10-hp motor.
- Room 604: Vault safety and inventory system (VSIS) computers.
- Room 608: East wall, door and frame in north wall.
- Room 613: Water heater, janitor's sink and accessories, plumbing above floor slab, west and north walls.
- Room 621: Door and frame in west wall. East wall.
- Room 622: Freestanding wall.

- Corridor 625: VSIS cable and cable rack.

- Room 626: Door and frame. North wall.

- Room 627: Door and frame, plumbing fixtures and piping above floor slab, north wall, (piping will be capped above ceiling and below floor slab).

- Room 628: South wall, plumbing fixtures and piping above floor slab, (piping will be capped above ceiling and below floor slab).

- Room 629: North, east, and west walls, including two doors. Metal detector.

- Room 630: North wall, decontamination shower and plumbing above floor slab, (piping will be capped above ceiling and below floor slab).

- Room 632: Door and frame; new door rough opening in north wall.

- Room 635: Door and frame; new door rough opening in east wall.

- Room 636: The repackaging glovebox is radioactively contaminated and requires decontamination processing prior to removal. HVAC zone II differential pressure sensor and fire zone 7 heat detector.

- Room 639/640: Abandoned emergency shower; doors and frames; west, north, and east walls, (a new pair of Class B

doors and frame will be installed for access and the north and east walls will be replaced by a 2-hr Underwriters Laboratories [UL] fire-rated wall).

- Room 641: The dividing metal stud and gypboard partition between room 641 and 642, VSIS electronic cabinets (Motorola® units) and enclosure. The connecting door between rooms 641 and 638 and adjacent section of wall will be removed temporarily to facilitate access and delivery of a new HEPA filter through room 641 and 642 to its final location in room 639/640. The exterior concrete stoop, steps, and pipe railing at door 477.

- Room 642: A new concrete opening in the east exterior wall to receive door frame anchors, a Class 5 vault door and frame.

- Exterior North Wall: Existing gas bottle storage station.

- Roof: Isokinetic sampling system, access ladder.

2. 2736-Z Building

The following items will be demolished and removed:

- Vault 1: HVAC exhaust duct on west wall, VSIS sensors and cable, cubicles, smoke detectors, CAMS.

- Vault 2: HVAC exhaust duct on west wall, metal storage racks, fire sprinkler lines, smoke detectors, CAMS.

- Vault 4: HVAC exhaust duct on east wall, VSIS sensors and cable, cubicles, smoke detectors, CAMS.

3. 2731-ZA Building

The metal storage racks and the interior partition wall will be demolished.

4. 234-ZB Building

All material and structures in the laydown area to the north of the building will be removed. The wood structure across the street, to the west of the building, will be removed.

5. Drainfield

The existing sanitary drainfield located about 40 ft west of the 2721-Z Building no longer functions and will be demolished. The area will be recompacted using suitable backfill to accommodate the new office building.

F. OTHER PROJECT COSTS (900)

Other project costs for project W-460 consist of the following activities. The statement of work for these activities is shown in Appendix C.

1. Conceptual Phase

The performance contractor will fund and direct the following activities supporting the conceptual phase:

- Functional Design Criteria
- Conceptual Design Report
- Preliminary Safety Evaluation
- Quality Assurance Program Plan
- Project Management Plan

- Project Validation
- Advanced Conceptual Design

2. Definitive Design Phase

The performance contractor will fund and direct the following activities supporting definitive design:

- Cognizant Facility personnel will be available to provide design input and review services for all phases of the design.
- A fire hazards analysis will be generated for the new stabilization and packaging process in the 2736-ZB Building.
- A security plan will be provided to detail how secure areas will be maintained during construction.
- Support the development of the appropriate level of safety documentation.
- Generate and coordinate the approval of regulatory permits to support the start of construction.

3. Procurement Phase

The performance contractor will fund and direct the following activities supporting the OAK procurement of the SPS:

- A cognizant Facility person will be designated as the "contracting officer's technical representative" to support the OAK procurement office.
- Appropriate Facility personnel will be made available to provide input to the vendor and review the equipment design.

4. **Construction Phase**

The performance contractor will fund and direct the following activities supporting construction:

- Provide Operations personnel as needed to support the construction contractor.
  - Relocate Facility equipment and materials as needed to allow access for construction.
  - Support lock and tag of equipment.
  - Configure the Facility systems as needed to allow tie-ins and testing.
  - Provide solid waste disposal services where necessary.
  - Decontaminate the room 636 glovebox prior to demolition.
  - Support tours for contract bids.
- Provide Facility planning resources as necessary for the preparation of work control packages for potentially hazardous tasks such as the demolition of the room 636 glovebox and for overall integration with other Facility activities.
- Arrange for support from Safeguards and Security (SAS) personnel for the SAS-related modifications being performed.
- Schedule maintenance resources for performance tests of installed or relocated HEPA filters.

- Schedule the Hanford fire department to support fire system modifications and tie-ins.

- Schedule and escort the IAEA to witness the relocation of the IAEA monitoring cabinet and installation of IAEA barriers that require their witness.

- Provide radiological control technicians to support the room 636 glovebox demolition, other interior demolition, or exterior excavations as needed.

- Provide escorts for vendor technical representatives to support the installation portion of the OAK procurement.

5. Testing and Startup

- Provide personnel to witness and support the acceptance testing of the SPS by the construction contractor.

- Prepare maintenance and operating procedures to accommodate the new system and associated infrastructure modifications.

- Provide training on the new system to operational and engineering personnel.

- Perform an operational readiness review to support startup of the new system.

G. DESIGN COMPLIANCE

The design and construction of project W-460 will comply with the codes and regulations listed in the FDC and the following additional design criteria.

Air Conditioning and Refrigeration Institute (ARI)

ARI 410	Forced Circulation Air Cooling and Air-Heating Coils
ARI 430	Central Station Air Handling Units

Air Movement and Control Association, Inc. (AMCA)

AMCA 99-86	Standards Handbook
AMCA 201-90	Fan Application Manual - Fans and Systems
AMCA 210-85	Certified Ratings Program Air Performance
AMCA 500-89	Test Methods for Louvers, Dampers, and Shutters

American National Standards Institute (ANSI)

ANSI\AFBMA 9-1978	Load Rating and Fatigue Life for Ball Bearings
ANSI\AFBMA 11-1978	Load Rating and Fatigue Life for Roller Bearings
ANSI N13.1-1969	Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities
ANSI N42.18-1974	Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents
C80.1-1990	Rigid Steel Conduit-Zinc Coated
C82.1c-1990	Fluorescent Lamp Ballasts

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

Standard 62	Ventilation for Acceptable Indoor Air Quality
Standard 90	Energy Conservation in New Building Design
Applications Handbook	
Equipment Handbook	
Fundamentals Handbook	
Refrigeration Handbook	
Systems Handbook	

American Society of Mechanical Engineers (ASME)

ASME B16	Fittings, Flanges and Valves
ASME B31.1	Power Piping

American Welding Society (AWS)

AWS D1.1 (1986)	Structural Welding Code - Steel
AWS D1.3 (1981)	Structural Welding Code - Sheet Steel

Associated Air Balance Council

ERDA 76-21 (ORNL-NSIC-65.1), Nuclear Air Cleaning Handbook

Factory Mutual Engineering Corporation (FMEC)

Loss Prevention Data Sheet 5-4	Transformers

Federal Specifications (FS)

W-C-375B/GEN NOT 1	Circuit Breakers, Molded Case; Branch Circuit and Service
W-C-1094A	Conduit And Conduit Fittings Plastic, Rigid

W-F-406D	Fittings For Cable, Power, Electrical And Conduit, Metal, Flexible
W-P-115C	Panel, Power Distribution
WW-C-566C	Conduit, Metal, Flexible

Institute of Electrical and Electronics Engineers (IEEE)

IEEE 112 (1984)	Test Procedure for Polyphase Induction Motors and Generators

National Electrical Manufacturers Association (NEMA)

FB 1-1988	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
MG-1-1978	Motors and Generators
ICS 2-1988	Industrial Control Devices, Controllers and Assemblies
ICS 6-1988	Enclosures for Industrial Controls and Systems
KS 1-1990	Enclosed Switches
PB 1-1990	Panelboards
RN 1-1989	Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
ST 20-1988	Dry-Type Transformers for General Applications

National Fire Protection Association (NFPA)

13 (1996)	Installation of Sprinkler Systems
24 (1995)	Installation of Private Fire Service Mains and Their Appurtenances
80A (1996)	Exterior Fire Exposures

90A (1996)	Installation of Air Conditioning and Ventilating Systems
110 (1996)	Emergency and Standby Power Systems
220 (1995)	Types of Building Construction
255 (1996)	Method of Test of Surface Burning Characteristics of Building Materials
780 (1995)	Lightning Protection Systems

Sheet Metal and Air Conditioning Contractors National

HVAC Duct Construction Standards--Metal and Flexible

HVAC Duct Design Manual

Round Industrial Duct Construction Standards

Underwriters Laboratories (UL)

Electrical Appliance and Utilization Equipment Directory	1991
Electrical Construction Materials Directory	1991
797-1983 w/Rev through 5/89	Electrical Metallic Tubing
1242-1983 w/Rev through 11/89	Intermediate Metal Conduit

U.S. Department of Energy (DOE)

Orders

470.1	Safeguards and Security Program

Standards

DOE-EV-0043	Standard on Fire Protection of Portable Structures (August 1979)
DRAFT	Glovebox Fire Protection Standard (March 1993)

DRAFT	Filter Plenum Fire Protection Criteria (February 1992)
DOE-STD-3013-96 (Draft)	Criteria for Safe Storage of Plutonium Metals and Oxides

Washington Administrative Code (WAC)

246-290-490	Public Water Supplies, Cross-Connection Control

Computer software used for design analysis will be verified and validated in accordance with NQA-1, 1989, Supplement 11S-2.

V. METHODS OF PERFORMANCE

A. ARCHITECT-ENGINEER CONSTRUCTION MANAGER WORK (WBS 1.1 AND WBS 1.2)

The architect-engineer construction manager will provide definitive design, engineering during construction, and acceptance inspection services for the project. All design media will be sealed by professional engineers registered in the State of Washington.

B. PROCUREMENT STRATEGY (WBS 2.1 AND WBS 2.2)

The major procurement action associated with project W-460 is the procurement of the SPS via a national procurement action by OAK. This procurement will encompass the design, fabrication, installation, and testing of the SPS. The performance contractor will purchase the isokinetic stack sampler and three calorimeters for the NDA laboratory.

C. CONSTRUCTION WORK BY ONSITE CONTRACTORS (WBS 3.1)

The architect-engineer construction manager will manage onsite construction forces to support the relocation of IAEA monitoring equipment, demolition of the final phase of the VSIS safeguards and

security system, and the modification of room 636 to function as an IAEA work area, including the demolition of the glovebox in this room.

D. **CONSTRUCTION WORK BY OFFSITE CONTRACTORS (WBS 3.2)**

The architect-engineer construction manager will manage fixed-price construction contracts which will:

- Install the 2736-ZB Building HVAC, electrical, architectural, and security infrastructure modifications to support the new SPS.
- Install a new modular office structure near the 2736-ZB Building to support expanded operations.
- Modify the 2731-ZA Building to house a dry air supply system for the SPS.
- Modify three vault rooms in the 2736-Z Building to accommodate the new container configuration for the SPS.

E. **PROJECT INTEGRATION (WBS 4.0)**

The performance contractor is directly responsible to the Project Hanford Management Contractor (PHMC) for performing all activities associated with the Facility Stabilization Project which includes project W-460. The performance contractor will negotiate performance measures with the PHMC and manage and integrate scope, cost, and schedule through the life of the project.

The architect-engineer construction manager will provide project management resources to the performance contractor to support project execution from the conceptual phase through acceptance testing and project close out.

F. OTHER PROJECT COSTS (WBS 5.0)

The performance contractor will direct the resources necessary to perform the expense-funded activities (other project costs) needed to implement project W-460. These actions primarily include:

- Support the conceptual phase of the project which includes the generation of an Functional Design Criteria (FDC), CDR, and ACD.
- Provide design input and reviews from cognizant plant personnel for definitive design and procurement.
- Provide support from cognizant plant personnel to generate and coordinate project permitting actions.
- Provide construction support from Facility personnel not dedicated to the project such as plant engineering, PFP planning, operations, radiological control technicians, maintenance, safety, quality, environmental, Hanford patrol, and the Hanford fire department.
- Provide Facility support for system testing and startup including the generation of procedures, personnel training, operational testing, and readiness assessment.
- Provide the inventories necessary to support initial startup and testing.

VI. REQUIREMENTS AND ASSESSMENTS

A. SAFEGUARDS AND SECURITY

The processing of SNM requires physical protection as defined in DOE Orders 470.1, 5632.1C, and 5633.3B. Current safeguards and security provisions at the PFP comply with these protection program requirements.

Project W-460 will not require any major safeguards and security physical upgrades. Only minor plant design changes are required to support installing the PFP SPS and modifying the nuclear material storage vaults to accommodate the SPS-sealed packages.

The design elements necessary to maintain adequate plant operating security and to provide secure nuclear material storage are listed below. The overall design concept is based on long-term material storage with only annual vault entries.

- The storage cubicles and VSIS equipment inside room 3 of the 2736-Z Building will be abandoned in place. The metal storage racks in room 2 and the VSIS equipment in rooms 1 and 4 will be removed. If in-floor storage is used, the material storage cubicles in rooms 3 and 4 will be removed.

- Barriers will be installed inside the air ducts at the wall boundary between rooms 1 and 3 and at the wall between rooms 3 and 4. Inspection access hatches (with provisions for tamper-indicating seals) in the duct work will be installed to permit visual verification of barrier integrity.

- McGard® security bolts will be provided at each storage location to secure canister storage.

- A means to allow fiber optic seals to be installed across rows of material storage locations will be provided. Vault penetrations will allow the seals to be read from the vault corridor.

- A special yoke for the canister lifting tool will be installed. Use of this tool will ensure adequate control of physical access to the canisters, if in-floor storage is used.

- The existing interior equipment in vaults 1, 2, and 4 in the 2736-Z Building (i.e., fire protection sensors and continuous air monitors) will be removed; the security vibration and door sensors will remain in place.

- The existing Motorola® data acquisition computers in room 641 and the PRIME host computer in room 604 (and associated cabling) will remain in place. The computers and cables will be removed after all the vaults are modified.

- The Mardex® automated access portal will be relocated from room 629 to room 610 in the 2736-ZB Building.

- All existing security equipment (sensors, cameras, etc.) in the 2736-ZB Building; outside of vaults 1, 2, 3, and 4; and in the ceiling in the 2736-Z Building will be left in place.

- Balanced magnetic switches will be added for the new exterior material access area (MAA) boundary vault doors in room 641.

- If cubicle storage is used, barriers to restrict physical access to the top and bottom of each material storage cubicle will be provided. Also, new storage cubicles to room 2 and new concrete doors to the existing cubicle structures in room 3 and room 4 will be added.

Adequate physical security protection measures must be provided during the life cycle of project W-460.

B. HEALTH AND SAFETY

Radiation Protection

Radiation shielding for operators of the SPS will be provided on the equipment by BNFL. Shielding for transporting the plutonium between the SPS and the vault will be provided by the lag storage trolley. The SPS control room will be shielded to reduce operator exposure to as low as reasonably achievable (ALARA).

Operator exposure in the NDA laboratory will be reduced by relocating the technicians desks from the laboratory area to office rooms on corridor 633.

Shielding requirements for the vaults will be determined during ACD.

The conceptual design is based on the premise that the existing criticality alarm systems in the 2736-Z and 2736-ZB Buildings will provide adequate coverage for the new process and vault configuration. Evaluation of the coverage will continue during definitive design.

Industrial Safety

Design and construction will ensure compliance with applicable industrial health and safety standards (Code of Federal Regulations [CFR] 29 CFR 1910 and 1926), Fluor Daniel Hanford Company Industrial Hygiene Manuals, WHC-CM-4-40 and WHC-CM-1-11, and the most recent consensus standards applicable to occupational safety and health (e.g., American Conference of Governmental Industrial Hygienists [ACGIH] threshold limit values for chemical substances and physical agents and biological exposure indices).

Risk Prevention During Construction

During construction, contractors will be required to take all reasonable precautions in their work to protect the health and safety of their employees, subcontractors, the operating contractor, and DOE personnel.

Construction work to modify a vault room will not occur until all stored radioactive material has been removed from the room. Processing of plutonium will then proceed until the next vault room has been completely emptied. At that time, processing will cease and construction crews will be remobilized to convert the next vault room to the new configuration.

A 24-hr advance notice of any excavation work disrupting roadways or other services will be required to ensure that emergency personnel receive adequate notification.

DOE health and safety standards and regulations will be followed to minimize risks during construction. Removing, packing, and disposing of any contaminated soil, radioactive or dangerous waste, and materials found during excavation will comply with appropriate safety standards and procedures. At all times, the construction contractor will ensure that the construction area is accessible to emergency vehicles or personnel and that emergency evacuation routes are not obstructed.

C. DECONTAMINATION AND DECOMMISSIONING

Decontamination measures are not required for modifications to the 2736-Z, 2736-ZA, and 2736-ZB Buildings. Demolition and removal of the repackaging glovebox in room 636 will require decontamination of the glovebox and the ductwork.

The SPS and related support services shall be designed to limit dispersion of radioactive materials, facilitate decontamination and decommissioning, and reuse. All SPS internal surfaces will be finished to facilitate

decontamination. SPS components will be designed for easy disassembly using common tools, to the extent practical. Internal SPS components will be small enough to be handled easily using sealouts, and compact enough to fit into a disposal package such as a 208-liter (55-gal) drum.

D. PROVISIONS FOR FALLOUT SHELTERS

There will be no provisions for fallout shelters.

E. MAINTENANCE AND OPERATION REQUIREMENTS

Project W-460 will be designed to provide access for maintenance and operations. The project W-460 Human Factors Plan will ensure that operator control panels are ergonomically designed and that operators have adequate space to perform their jobs (see Appendix K).

Access to equipment for maintenance will be provided during definitive design to ensure that maintenance can be performed in a safe and efficient manner.

The packaging section of the SPS will require metric tools for maintenance.

F. AUTOMATED DATA PROCESSING EQUIPMENT

The SPS control system consists of three subsystems: the plutonium stabilization control system (PSCS); the plutonium packaging control system (PPCS); and the data management system (DMS). The function of the PSCS and the PPCS is process control. The function of the DMS is data collection and export of management information. The processing controls and DMS are based on PC computer systems using standard off-the-shelf components and application software. Communication links between the control systems and the DMS use standard Ethernet protocols.

The processing control systems produce data during the stabilization and packaging operations that may be captured by the DMS, then stored

or exported to another system. The DMS is capable of interfacing with existing PFP systems and will be the access point for process data. Data obtained during the processing operations can be used to satisfy DOE-STD-3013 reporting requirements, security requirements, and material accountability requirements.

G. QUALITY ASSURANCE/SAFETY CLASSIFICATION

1. Quality Assurance Activities

Project activities for all contractors involved in design, procurement, construction, and acceptance will be governed, as applicable, by the requirements of 10 CFR 830.120, "Quality Assurance." Minimum project quality attributes are included in the project FDC and the project specific Quality Assurance Program Plan (QAPP). The QAPP will indicate the project critical characteristics, corresponding safety classification assignments, and programmatic criteria, as applicable. Additional requirements may be added by appropriate controlling documents. The specific technical and quality programmatic requirements and the requirements for material certifications, qualification/certification of personnel, inspections, examinations/ testing, and applicable quality assurance records will be established during definitive design and included in design documents.

Project W-460 will be designed as a nonreactor nuclear facility in accordance with DOE Order 6430.1A including applicable 1300, 1323, 1325, 99.0, and 99.1 sections. The PFP vault storage facility is a Hazards Class II facility.

2. Safety Classification

Independent design verification, in accordance with company procedures, will be required if Safety Class structures are modified. Safety Class materials will be procured from qualified suppliers or as

dedicated "commercial-grade items" through commercially available sources unless specific exception is noted during definitive design.

Safety classifications are identified for those systems, components, and structures important to safety or environmental protection so that appropriate efforts will be placed on design, procurement, construction, testing, operation, maintenance, and modifications.

Safety classification criteria and methodology are defined in Safety Analysis Manual, WHC-CM-4-46. Safety Classifications are determined through analysis and consequences of failure based on information contained in the project FDC and safety analysis documents. The resulting safety classifications form the basis for the Hanford design and quality assurance requirements applied to the project. Safety Class is the highest level applied to any element of the proposed facility.

Safety classification of systems, components, and/or structures are shown in Table 1.

H. ENVIRONMENTAL COMPLIANCE

The National Environmental Policy Act (NEPA) requires that all activities performed by a federal agency or performed on federal lands be reviewed for environmental impacts. A NEPA review will be required for project W-460 construction activities only. (It is anticipated that the level of NEPA review required for construction activities will be a categorical exclusion [CX].) Stabilization impacts were analyzed in the "Plutonium Finishing Plant Stabilization Final Environmental Impact Statement" (ref 5). The Record of Decision was approved June 25, 1996. The documentation is performed on one of three levels depending upon the size and impact of the activity. The three levels are: categorical exclusion, environmental assessment, or environmental impact statement.

TABLE 1

SAFETY CLASSIFICATION OF STRUCTURES, SYSTEMS, AND COMPONENTS		
Structure/System/Component	**Consequence of Failure**	**Safety Class Designation**
2736-ZB Building structure	Building failure would cause radiological release from SPS or ruptured canisters	Safety Class
2736-Z Building structure	Building failure would cause radiological release from ruptured canisters	Safety Class
2736-Z Building vault storage configuration	Damage to canisters, loss of ventilation, criticality from non-safe geometry	Safety Class
SPS glovebox structure and floor anchors	Release of radioactive material, non-safe geometry	Safety Class
Process exhaust system HEPA filters, and HEPA filter housing in room 639/640 and ductwork through the roof of 2736-ZB Building	Release of radioactive material into the environment	Safety Class
2736-ZB Building final HEPA filter, HEPA filter housing, and ductwork up to the HEPA filter housing	Release of radioactive material into the environment	Safety Class
2736-Z Building exhaust system HEPA filter, HEPA filter housing and ductwork up to HEPA filter housing	Release of radioactive material into the environment	Safety Class
Construction door in 2736-ZB Building	Same as building walls	Safety Class
Cutting tools and electrical equipment inside the SPS material preparation area	Sparks could cause ignition sources for fire/explosion	Safety Class
Vault ventilation supply backdraft damper or supply filters	Radioactive material release through supply path	Safety Class

TABLE 1

SAFETY CLASSIFICATION OF STRUCTURES, SYSTEMS, AND COMPONENTS		
Structure/System/Component	**Consequence of Failure**	**Safety Class Designation**
Facility CAMs (in storage vault and in rooms 641 and 642)	No notification of airborne radioactivity	Safety Significant
Furnace cooling jacket, if water cooling is used	Unsafe geometry of plutonium solution causing criticality	Safety Significant
Moisture detection in SPS gloveboxes	Moisture in canisters could allow pressure buildup in canisters while in storage, allowing for burst canister, radiological release	Safety Significant
Dryer on SPS supply air	Moisture in canisters could allow pressure buildup in canisters while in storage, allowing for burst canister, radiological release.	Safety Significant
SPS glovebox pressure indications and alarms	Positive pressure within glovebox leading to radioactive material dispersal	Safety Significant
SPS glovebox ventilation kicker fan and controls	Release of radioactive material into the building	Safety Significant
SPS glovebox sphincter seals, entry isolation doors and controls	Release of radioactive material into the building	Safety Significant
SPS dump valves and interlocks to glovebox pressure transducers	Release of radioactive material into the building	Safety Significant
Regulators and pressure relief valves (PRVs) on compressed dry air supply and compressed utility gas supplies to SPS	Overpressurization events causing failure of glovebox confinement and release of radioactive material into the building.	Safety Significant
Restraints for compressed SPS fire suppression gas bottles	Missile threat if valve breaks	Safety Significant
Criticality alarms	Undetected criticality	Safety Significant

Liquid waste generated during operation of the process will be containerized to allow for sampling and proper designation prior to disposal. Disposal of the material will be in accordance with applicable regulations. The condensate from the coils on the HVAC system will tie into the drainline for existing condensate effluent located in room 602 of the 2736-ZB Building. Condensate effluent must meet drinking water standards.

All gaseous effluents will be reviewed by the cognizant engineer prior to operation of the process. The design of the stack monitoring system will be done during definitive design. The location of monitoring and effluent release points will be reviewed with the cognizant engineer prior to construction.

Solid waste to be generated during construction or operation needs to be brought to the attention of the solid waste cognizant engineer prior to beginning the project to allow time for proper documentation preparation and approval.

I. PERMITS

The addition of a new stack or modification of the existing stack requires approval by the Washington State Department of Health and the U.S. Environmental Protection Agency (EPA) prior to construction. The stack will be a National Emission Standards for Hazardous Air Pollutants (NESHAP) compliant major stack. The stack will meet all applicable requirements for a major stack. The airflow from the stack will have a narrow range of variability.

A summary of potential permitting requirements applicable to project W-460 is shown in Table 2.

TABLE 2

SUMMARY OF POTENTIAL PERMITS/APPROVALS REQUIREMENTS				
Environment-Media	**Permit, Approval, or Requirement**	**Regulation**	**Regulatory Agency**	**Restriction**
NEPA	NEPA Documentation	10 CFR 1021	DOE	Title II Design; procurement
Radioactive Air Emissions	NESHAPs	40 CFR 61, Subpart H	EPA	Construction
Radioactive Air Emissions	Radiation Protection - Air Emissions	WAC 246-247-060	DOH*	Construction; operation
Domestic Waste Water Disposal	Septic Systems <14,500 gpd; Design Approval	WAC 246-272	DOH	Construction
All Media	Cultural Resources Review	36 CFR 800	DOE	Any surface disturbance or modification of building eligible for listing on the Historical Register
All Media	Excavation Permit	36 CFR 800	DOE	Any excavation
All Media	Ecological Compliance Review	10 CFR 1021, 50 CFR 402.6, DOE Order 5484.1	USFWS	Construction; habitat modification
All Media	Radiation Protection Standards	DOE Order 5400.5	DOE	Construction

*Washington State Department of Health (DOH)
**U.S. Fish and Wildlife Service (USFWS)

VII. IDENTIFICATION AND ANALYSIS OF UNCERTAINTIES

An ACD is planned to further define the scope of project W-460.

The CDR effort proceeded in parallel with the design of the prototype SPS at RFETS. The intention was to incorporate the design of the SPS into the CDR as it was developed by BNFL. However, the design of the RFETS SPS has been delayed and many of the details that are required to establish the interfaces of the SPS in the 2736-ZB Building are not known at this time. In addition, the type of contract that BNFL has with DOE to furnish a base prototype SPS for RFETS and then to customize that design for each of the other sites provides uncertainty of the final configuration of the PFP SPS.

One change that PFP intends to make to the prototype is to add automatic controls. The cost for this change cannot be determined at this time because information regarding the prototype controls is not available. It is anticipated that the prototype SPS will be operating and details of the basic design will be available for review before the start of ACD. A 15% contingency has been added to the cost of the SPS to account for the uncertainty of the final design.

A Vault Configuration Comparison Study will identify a preferred method for storing the DOE-STD-3013 canister in the 2736-Z vault (see appendix M). The study will not be completed until after the CDR has been issued for comments because other studies that form a part of the analysis have not been completed. The ACD will review the preferred alternative from the Vault Configuration Comparison Study and determine the impacts to the 2736-Z and 2736-ZA Buildings. The cost for the most expensive storage concept is included in the CDR estimate.

A. 2736-ZB BUILDING

At the direction of the design authority, the process exhaust from the SPS was connected to the 2736-ZB Building HVAC system at the exhaust fan inlet plenum. The 2736-ZB Building HVAC system has a history of

unreliability and a number of changes have been proposed in the architectural layout and HVAC control system of the 2736-ZB Building to improve the operation of the HVAC system. However, by connecting the SPS exhaust duct to the building exhaust, the SPS glovebox pressure control will be affected by any upsets and/or changes in the operation of the building exhaust. A separate exhaust ventilation system for the SPS process should be considered during the ACD due to the uncertainty of control functions of the present building HVAC system and static pressure availability at the exhaust fan inlet plenum.

The operation airflow rates from the SPS are uncertain. A flow diagram showing airflow rates was transmitted to BNFL for confirmation. However, the ventilation airflow rates supplied by BNFL for the process are not finalized and are being revised. The SPS exhaust ventilation system was sized for maintenance airflow which is greater than normal operational airflow. This should provide an adequate contingency for any increase in the design airflow.

It is anticipated that existing cooling coil CC-4 will be adequate for cooling rooms 641/642. As data for the SPS heat-generating equipment becomes available, a revised heat transfer analysis may be required to determine the exact heat rejection rate to rooms 641/642. If additional cooling is required, cooling coil CC-4 can be replaced and a separate condensing unit dedicated to cooling coil CC-4 can be supplied. The estimate does not have any costs for additional cooling because the risk was perceived to be low.

The types of HEPA filters and other components for the ventilation system that are being supplied by BNFL are not known. The HEPA filter and HEPA filter housing must meet ASME N509 and N510 requirements and be compatible with PFP operational necessities. The contingency for the SPS will cover replacing the HEPA filters and other components.

The FHA will determine the need for additional fire dampers in the 2736-ZB Building. No contingency has been added for additional fire dampers.

The FHA will address the combustible loading and the fire-resistance rating of each SPS enclosure. The total combustible loading in each glovebox enclosure will be less than the fire-resistance rating of the enclosure. Administrative controls will be required to control the combustible loading in each glovebox.

The harmonic dampening for the power supply to the laser generator may be required. The manufacturer of the laser generator states that the unit is now available with incoming line filters built in as standard equipment. This will have to be reviewed during definitive design. No contingency has been added for a harmonic damper.

Panelboard DSW-NP-1 may not need to be upgraded from 400 to 600 A. After project C-189 removes the MCC EP-1 load from panelboard DSW-NP-1, there may be sufficient power available for the project W-460 loads.

After project C-189 separates MCC EP-1 from panelboard DSW-NP-1, definitive design will have to review if MCC EP-1 can accommodate a 3/4-hp SPS exhaust fan, a 2-hp condenser compressor for room 636, and a 2-kW heater for the backflow preventer enclosure.

Interface points between the Micon® DCS and the SPS will be determined during definitive design. The estimate contains an allowance for interfaces between the SPS and the Micon® DCS.

External system needs for data from the stabilization and packaging operation need to be defined. Methods of data transfer from the DMS also

need to be defined. Removable media or direct network connections represent viable alternatives to accomplish data transfer. The CDR assumes that there will not be any direct network connections between the SPS and the Safeguards and Security computers.

The SPS design and this CDR do not have any provisions for inspecting the final weld on the DOE-STD-3013 canister. The requirement for inspection of seal welds on the DOE-STD-3013 canister has not been established and should be reviewed before the start of the ACD.

The modifications to rooms 641 and 642 to prepare them for the SPS will require removing the stud wall that separates the rooms. After the wall is removed, the special protective coating on the floor must be repaired. An allowance has been included in the CDR to patch the coating. If the material cannot be repaired, the entire floor will have to be resurfaced.

The ceiling in rooms 641 and 642 is a lowered sheetrock system that was painted with a special protective coating during installation to ease decontamination. The ceiling is 9 ft 6 in. high. The SPS prototype is 8 ft 11 in. at its highest point and will not require any demolition of the ceiling. However, the ventilation manifold designed for the prototype would interfere with the ceiling. The ventilation manifold for the PFP SPS must be designed to remain below the ceiling in rooms 641 and 642. The CDR assumes that the ceiling will remain in place.

The floors in rooms 641 and 642 are covered with a special protective coating. Demolition of the wall dividing these two rooms will expose a section of the floor that will have to be coated. The existing type of coating on the floor could not be identified during the CDR preparation. The CDR assumed that a current coating could be found to patch the newly exposed section of floor.

The cooling air to the furnace in the SPS must be cooled to 25 °F per BNFL. An allowance has been added to the estimate to cover the cost of a chiller system for this purpose.

B. 2736-Z BUILDING

The FHA will address the need for lightning protection. The 2736-ZB Building is protected from lightning strike and the 2736-Z Building is not. This CDR assumes that lightning protection will be required for the 2736-Z Building and surrounding structures. There is an adequate contingency in the CDR for lightning protection.

The electrical, instrumentation, and HVAC requirements for the vault modifications are unknown. There are no allowances for the cost of these items in the estimate.

C. OFFICE STRUCTURE

A new 60- by 70-ft relocatable office structure conforming to NFPA 101, NFPA 220 Type V (000), and DOE/EV-0043 has been assumed for this CDR. If any relocatable structures on the Hanford Site are available and can be modified to satisfy project requirements, the structures may be obtained at the time of project implementation to affect some savings.

The FHA will determine the required separation distance between the new office structure and the surrounding structures.

The source for the 50-kVA, single-phase, 480-240/120 V transformer that will supply the new office structure will be identified during definitive design.

D. 2731-ZA BUILDING

The FHA will address the need to retrofit the 2731-ZA Building with automatic sprinkler protection due to proximity to other structures. The

building is less than 5,000 ft^2 in area, and the addition of air compressors as planned does not cause fire loss potential to exceed $1 million, therefore, this CDR assumes that automatic sprinklers will not be required.

E. PERMITS

The CDR scope includes installing a sewage lift station to replace the septic system for the 2736-ZB Building and to provide for the new office structure. Upon funding approval and completion of construction, Project L-281, "200-West Area Regional Drainfield," has been proposed as the preferred means to manage the waste from the septic system located near the 2736-ZB Building. If project L-281 is not approved, the sewage waste would be required to be disposed of in a septic tank system. Modification to the existing system will require the blanking of the septic tank from the drainfield.

The current septic tank is not large enough to meet holding tank requirements. A new septic holding tank with a larger holding capacity would have to be installed and would require an engineering report and approval by the State. As septic holding tanks are only permitted for 2 to 5 years, a new drainfield would be required if the system would be required past that length of time. The cost for the sewage lift station in the CDR will be adequate to cover the cost of the septic tank system.

VIII. REFERENCES

1. Functional Design Criteria, "Plutonium Stabilization and Handling (PuSH)," Project W-460, Document No. FDH-SD-CP-FDC-005, Rev. 1, prepared by Fluor Daniel Hanford Company, December 1996.

2. System Design Document, "Plutonium Stabilization and Packaging System," Document No. CDRL Sequence No. A001, Rev. 1, prepared by British Nuclear Fuels Limited, Incorporated, June 1996.

3. System Specification, "Plutonium Stabilization and Packaging System," Document No. CDRL Sequence No. A002, Rev. 1, prepared by British Nuclear Fuels Limited, Incorporated, June 1996.

4. Letter, J. E. Mecca to E. C. Vogt, "Completion of Dose Estimate for PFP Stabilization Operations," prepared by Westinghouse Hanford Company, Document No. 9652258, May 17, 1996.

5. Supporting Document, "Plutonium Finishing Plant Stabilization Final Environmental Impact Statement," Document No. DOE/EIS-0244-F, prepared by U.S. Department of Energy, Richland Operations Office, May 1996.

6. Supporting Document, "Structural Evaluation of the 2736-ZB Building for Seismic Loads," Document No. WHC-SD-CP-SA-025, Rev. 0, prepared by ICF Kaiser Hanford Company, April 1994.

APPENDIX A

Work Breakdown Structure

WORK BREAKDOWN STRUCTURE

1.0 ENGINEERING

- 1.1 Definitive Design (Architect-Engineer Construction Manager)
- 1.2 Engineering and Inspection (Architect-Engineer Construction Manager)

2.0 PROCUREMENT

- 2.1 Procurement (U.S. Department of Energy, Oakland Office)
- 2.2 Procurement (Performance Contractor)

3.0 CONSTRUCTION

- 3.1 Force Account Construction (Architect-Engineer Construction Manager)
- 3.2 Fixed-Price Construction (Offsite Construction Contractor)

4.0 PROJECT INTEGRATION

5.0 OTHER PROJECT COSTS

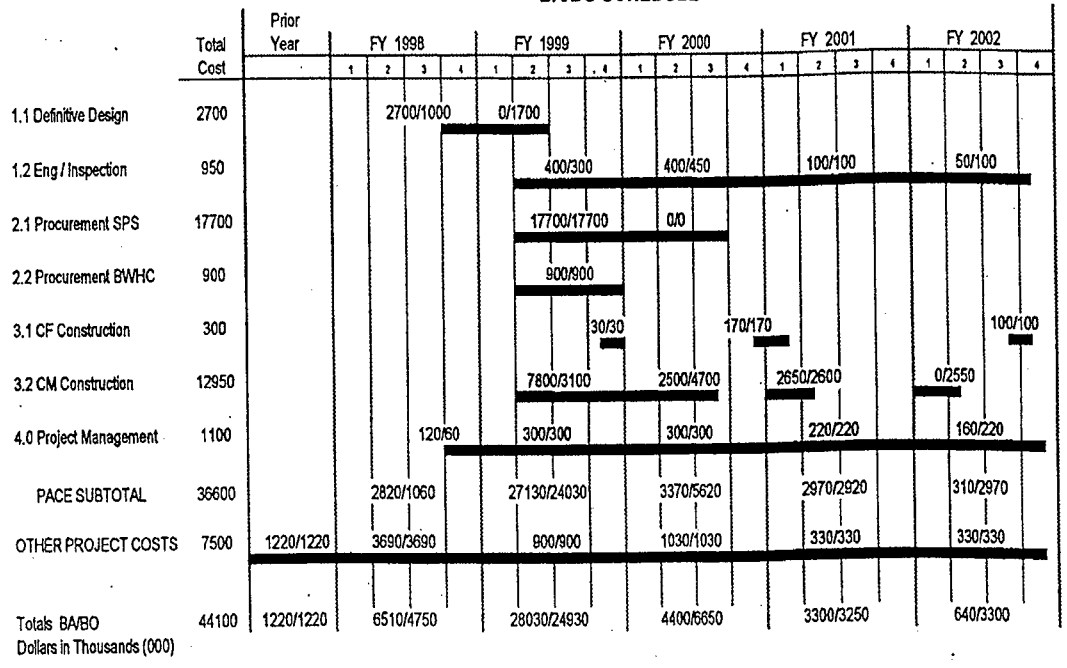
- 5.1 Conceptual Design Phase
- 5.2 Definitive Design
- 5.3 Procurement
- 5.4 Construction Support
- 5.5 Testing and Start-up
- 5.6 3013 Container Procurement

APPENDIX B

Budget Authorized/Budget Outlay Schedule

PROJECT W-460
Plutonium Stabilization and Handling (PuSH)

BA/BO SCHEDULE



APPENDIX C

Cost Estimate Summary

COST CODE	DESCRIPTION	ESCALATED TOTAL COST	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
000	ENGINEERING	3,890,000	25	970,000	4,860,000
	(ADJUSTED TO MEET DOE 5100.4)	10,000		30,000	40,000
TOTAL DESIGN & MANAGEMENT		3,900,000	0	1,000,000	4,900,000
501	BUILDINGS	5,740,000	34	1,940,000	7,680,000
600	UTILITIES	340,000	26	90,000	430,000
700	SPECIAL EQUIP/PROCESS SYSTEMS	18,440,000	18	3,340,000	21,780,000
810	DEMOLITION	1,350,000	36	480,000	1,830,000
	(ADJUSTED TO MEET DOE 5100.4)	-70,000		50,000	-20,000
TOTAL CONSTRUCTION COST		25,800,000		5,900,000	31,700,000
910	OTHER PROJECT COSTS FY 96	230,000	0	0	230,000
920	OTHER PROJECT COSTS FY 97	900,000	10	90,000	990,000
930	OTHER PROJECT COSTS FY 98	3,610,000	2	80,000	3,690,000
940	OTHER PROJECT COSTS FY 99	820,000	10	80,000	900,000
950	OTHER PROJECT COSTS FY 2000	940,000	10	90,000	1,030,000
960	OTHER PROJECT COSTS FY 2001	300,000	10	30,000	330,000
970	OTHER PROJECT COSTS FY 2002	260,000	10	30,000	290,000
	(ADJUSTED TO MEET DOE 5100.4)	40,000		0	40,000
TOTAL OTHER PROJECT COSTS		7,100,000		400,000	7,500,000
TOTAL PROJECT COSTS (TPC)		36,800,000	20	7,300,000	44,100,000

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TYPE OF ESTIMATE CONCEPTUAL FEBRUARY 5, 1997

ARCHITECT ENGINEER H. Chadwick Charles O'Neill

PHMC CONTRACTOR Wesley-Wess

REMARKS:

(ROUNDED/ADJUSTED TO THE NEAREST " 10,000 / 100,000 " - PERCENTAGES NOT RECALCULATED TO REFLECT ROUNDING)

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
110201	DEF DES PLANNG/ MOBIL. (CAT 2)	297669	0	297669	4.84	14406	312075	25	78021	390096
110202	DEF DES DRAWINGS (CAT 1)	360851	0	360851	4.84	17464	378315	25	94579	472896
110203	DEF DES CALCULATIONS (CAT 1)	102637	0	102637	4.84	4968	107605	25	26902	134507
110204	DEF DES SPECIFICATIONS (CAT 1)	88158	0	88158	4.84	4265	92423	25	23107	115530
110205	DEF DES CHECKING (CAT 1)	59533	0	59533	4.84	2882	62415	25	15604	78017
110206	DEF DES INTER DISCP REVW (CAT 1)	46520	0	46520	4.84	2252	48772	25	12193	60965
110207	ENGR. SUPPORT DISCP 21 - 31 (CAT2)	439295	0	439295	4.84	21262	460557	25	115139	575696
110208	ENGR. SUPPORT DISCP 32 -65 (CAT 2)	56030	0	56030	4.84	2711	58741	25	14686	73428
110210	VAULT DEFINITIVE DESIGN CAT 1	234818	0	234818	4.84	11365	246183	25	61546	307729
110211	VAULT DEFINITIVE DESIGN CAT 2	436091	0	436091.	4.84	21107	457198	25	114299	571497
SUBTOTAL 11	DEFINITIVE DESIGN (AE/CM)	2121602	0	2121602	4.84	102682	2224284	25	556076	2780361
121000	ENGINEERING/INSPECTION-ONSITE E/C	700000	0	700000	10.17	71190	771190	25	192798	963988
SUBTOTAL 12	ENGINEERING/INSP. (AE/CM)	700000	0	700000	10.17	71190	771190	25	192798	963988
SUBTOTAL 1	ENGINEERING	2821602	0	2821602	6.16	173872	2995474	25	748874	3744349
211000	BNFL SPS & FIRE SUPPRESSION SYSTEM	14365000	0	14365000	7.25	1041463	15406463	15	2310970	17717432
SUBTOTAL 21	PROC. (US DOE OAKLAND)	14365000	0	14365000	7.25	1041463	15406463	15	2310970	17717432
220000	CALORIMETERS AND ISO PROBE SYS	662000	0	662000	7.25	47995	709995	35	248498	958493
SUBTOTAL 220	CALORIMETERS & ISO PROBE SY.	662000	0	662000	7.25	47995	709995	35	248498	958493
SUBTOTAL 22	PROC. (PERFORMANCE CONTR.	662000	0	662000	7.25	47995	709995	35	248498	958493
SUBTOTAL 2	PROCUREMENT	15027000	0	15027000	7.25	1089458	16116458	16	2559468	18675925
311016	RELOC THE IAEA MONITOR CAB TO RM635	17888	0	17888	7.02	1256	19144	35	6792	25936
SUBTOTAL 311	RELOC THE IAEA MONITOR CAB	17888	0	17888	7.02	1256	19144	35	6792	25936
312000	DEMO OF RM 636 REPKG GLOVEBOX	97734	0	97734	10.43	10194	107928	40	43171	151098

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
312001	ESCORTS FOR CPAF WORK	11405	0	11405	10.43	1190	12595	30	3778	16373
SUBTOTAL 312	DEMO OF RM 636 REPKG GLOVEB	109139	0	109139	10.43	11384	120523	39	46949	167471
313016	REMOVE THE VSIS SYSTEM AND CABLING	45366	0	45366	15.63	7091	52457	35	18360	70817
SUBTOTAL 313	REMOVE THE VSIS SYSTEM AND	45366	0	45366	15.63	7091	52457	35	18360	70817
SUBTOTAL 31	FA CONST. (AE/CM)	172393	0	172393	11.45	19731	192124	38	72101	264224
321116	ELECTRICAL UTILITIES BLDG 2736-ZB	175343	30860	206203	7.73	15939	222143	35	77751	299893
321200	HVAC & MECH. MODS BLDG 2736ZB	492709	86717	579426	7.73	44790	624215	30	185257	809474
321301	ARCHITECTURAL MODS	230880	95635	326515	7.73	25238	351755	30	105525	457280
321302	NEW EAST ENTRY AIRLOCK (ZB BLDG)	35134	6183	41317	7.73	3194	44511	30	13353	57864
321400	HELIUM BOTTLE PIPING	18227	3208	21435	7.73	1657	23092	25	5773	28865
321401	BACKFLOW PREVENTORS & WATER METER	20500	3608	24108	7.73	1864	25972	25	6493	32464
321416	SPS UTIL ELECTRICAL BLDG 2736-ZB	166979	29389	196368	7.73	15179	211546	35	74041	285588
321501	ESCORTS FOR FIXED PRICE WK	455521	80172	535693	7.73	41409	577102	30	173131	750232
321516	SAFEGUARD & SECURITY MODS ELECTRIC	26325	4633	30958	7.73	2393	33351	35	11673	45024
SUBTOTAL 321	BUILDING 2736-ZB MODS	1621618	340405	1962023	7.73	151663	2113687	31	652997	2766684
322101	VAULT #1	1396262	245742	1642004	10.17	166992	1808995	37	669328	2478325
322116	VAULT 1 MODS BLDG 2736-Z	46672	8214	54886	10.17	5582	60468	35	21164	81632
SUBTOTAL 3221	VAULT #1 MODS	1442934	253956	1696890	10.17	172574	1869463	37	690492	2559957
322201	VAULT #2	1120654	197235	1317889	10.17	134030	1451917	35	508171	1960091
322216	VAULT 2 MODS BLDG 2736-Z	18494	3255	21749	10.17	2212	23961	35	8386	32347
SUBTOTAL 3222	VAULT #2 MODS	1139148	200490	1339638	10.17	136242	1475878	35	516557	1992438
322301	VAULT #4	1396262	245742	1642004	10.17	166992	1808995	35	633148	2442145
322316	VAULT 4 MODS BLDG 2736-Z	58465	10290	68755	10.17	6993	75747	35	26511	102259
SUBTOTAL 3223	VAULT #4 MODS	1454727	256032	1710759	10.17	173985	1884742	35	659659	2544404

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
322400	VAULT 2 (HVAC - IN THE FLOOR VER.)	28556	5025	33581	10.17	3415	36996	35	12949	49945
322402	VAULT 4 (HVAC - IN THE FLOOR VER.)	28587	5031	33618	10.17	3419	37036	35	12963	50000
322403	VAULT 1 (HVAC - IN THE FLOOR VER.)	54730	9632	64362	10.17	6546	70907	35	24818	95726
SUBTOTAL 3224	VAULT HVAC MODS	111873	19688	131561	10.17	13380	144939	35	50730	195671
322516	SAFEGUARD & SECURITY MODS ELECTRIC	24050	4233	28283	10.17	2876	31159	35	10906	42065
322600	Pu CANNISTER HANDLING MACHINES	300000	52800	352800	10.17	35880	388680	50	194340	583020
SUBTOTAL 322	BUILDING 2736-Z MODS - VAUL	4472732	787199	5259931	10.17	534937	5794861	37	2122684	7917555
323101	SITE PREP.	16100	2834	18934	8.69	1645	20579	25	5145	25724
323201	SANITARY WATERLINE	8530	1501	10031	8.04	806	10838	25	2710	13548
323202	SANITARY SEWER SYSTEM	54091	9520	63611	8.69	5528	69139	25	17285	86424
323203	REMOVE EXISTING DRAIN FIELD	3203	564	3767	8.68	327	4094	25	1024	5118
323216	UTILITIES ELECTRICAL NEW OFFICE	221857	39047	260904	8.69	22673	283576	28	79057	362633
323301	MODULAR OFFICE - ARCHITECURAL	590479	103924	694403	8.69	60343	754746	25	188687	943435
SUBTOTAL 323	NEW OFFICE STRUCTURE	894260	157390	1051650	8.68	91322	1142972	26	293908	1436882
324300	CMPSR BLDG. AIR HANDLING EQ & PIPE	194318	34200	228518	6.58	15036	243554	25	60889	304443
324316	UTILITIES ELECTRICAL BLDG 2731-ZA	88510	15578	104088	6.58	6849	110936	35	38828	149765
324401	2731-ZA BLDG. MODS	28225	4968	33193	6.58	2184	35376	24	8519	43896
SUBTOTAL 324	AIR COMPRESSOR WORK	311053	54746	365799	6.58	24069	389866	28	108236	498104
SUBTOTAL 32	CONST.-FP (OFFSITE CONST. C	7299663	1339740	8639403	9.28	801991	9441386	34	3177825	12619225
330000	BURIAL CHARGE	109817	0	109817	9.17	10070	119887	35	41961	161848
SUBTOTAL 330	BURIAL CHARGE	109817	0	109817	9.17	10070	119887	35	41961	161848
SUBTOTAL 33	CONSTRUCTION-O/C	109817	0	109817	9.17	10070	119887	35	41961	161848
SUBTOTAL 3	CONSTRUCTION	7581873	1339740	8921613	9.32	831792	9753397	34	3291887	13045297

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
400000	PROJECT MANAGEMENT (FDNW)	816335	0	816335	9.90	80817	897152	25	224288	1121440
SUBTOTAL 40	PROJECT INTEGRATION	816335	0	816335	9.90	80817	897152	25	224288	1121440
511000	FDC	50000	0	50000	0.00	0	50000	0	0	50000
512001	CDR PLANNING & CDR FY96	180000	0	180000	0.00	0	180000	0	0	180000
512002	CDR FY97	790000	0	790000	1.16	9164	799164	10	79916	879080
512003	ENVIRONMENTAL PERMIT CHECK-	8973	0	8973	1.16	104	9077	10	908	9985
512004	PRELIMINARY SAFETY EVALUA-	80000	0	80000	1.16	928	80928	10	8093	89021
512005	PROJ MGMT PLAN & REQUEST FOR	10400	0	10400	1.16	121	10521	10	1052	11573
512006	QUALITY ASSUR. PROG. PLAN	5200	0	5200	1.15	60	5260	10	526	5786
513001	ACD PLANNING/ MOBILIZATION	95195	0	95195	3.55	3380	98575	10	9858	108431
513002	ACD REVIEW BNFL DESIGN	54385	0	54385	3.55	1932	56317	10	5632	61948
513003	ACD VAULT CONCEPT	78268	0	78268	3.55	2778	81046	10	8106	89151
513004	ACD ENGR. SUPPORT	109146	0	109146	3.55	3876	113022	10	11301	124324
513005	ACD FDNW PROJ. MGMT.	33800	0	33800	3.55	1200	35000	10	3500	38500
513006	ACD BWHC PLANT INPUT/REVIEW	49350	0	49350	3.55	1752	51102	10	5110	56212
SUBTOTAL 5130	ADVANCED CONCEPTUAL DESIGN	420144	0	420144	3.55	14918	435062	10	43507	478566
SUBTOTAL 51	CONCEPTUAL DESIGN PHASE	1544717	0	1544717	1.64	25295	1570012	9	134002	1704011
521001	PFP DEF DESIGN INPUT	131451	0	131451	3.76	4943	136394	10	13639	150033
521002	PFP PROGRAM SUPPORT FOR	76268	0	76268	3.76	2868	79136	10	7914	87049
521003	BNFL SUPPORT TO DEF DESIGN	150000	0	150000	3.76	5640	155640	10	15564	171204
521004	PFP FIRE HAZARDS ANALYSIS	17946	0	17946	6.36	1141	19087	10	1909	20996
521005	SECURITY PLAN FOR CONSTR.	44864	0	44864	6.36	2853	47717	10	4772	52489
522000	ENVIRONMENTAL PERMITTING	250000	0	250000	6.36	15900	265900	10	26590	292490
523000	PFP DEF DESIGN REVIEWS	91971	0	91971	6.36	5849	97820	10	9782	107602
SUBTOTAL 52	DEFINITIVE DESIGN OPCS	762500	0	762500	5.14	39194	801694	10	80170	881863
531001	PFP PROCUREMENT REVIEWS	161510	0	161510	7.06	11396	172906	10	17291	190197
531002	PFP PROCUREMENT TRAVEL	30000	0	30000	7.30	2189	32189	10	3219	35408
531003	PFP PROCUREMENT COTR SUPPORT	61912	0	61912	7.27	4500	66412	10	6641	73052
SUBTOTAL 53	PROCUREMENT	253422	0	253422	7.14	18085	271507	10	27151	298657

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
541000	PFP OPPS SUPPORT TO CONSTR.	230094	0	230094	11.49	26444	256538	10	25653	282193
542000	PFP PLANT ENGR SUPPORT TO	492832	0	492832	10.68	52617	545449	10	54545	599993
543000	PFP GENERAL PLANT SUPPORT	209384	0	209384	10.69	22377	231761	10	23177	254937
544000	PATROL SUPPORT FOR VAULT MOD	103941	0	103941	10.86	11289	115230	10	11523	126753
SUBTOTAL 54	CONSTR. SUPPORT	1036251	0	1036251	10.88	112727	1148978	10	114898	1263876
551000	ATP SUPPORT	37798	0	37798	9.17	3466	41264	10	4126	45390
552000	PROCEDURE MODIFICATION	71782	0	71782	9.17	6582	78364	10	7836	86201
553000	TRAINING	50250	0	50250	9.17	4608	54858	10	5486	60344
554000	OTP	162810	0	162810	9.17	14930	177740	10	17774	195514
555000	READINESS REVIEW	104925	0	104925	9.17	9622	114547	10	11455	126001
SUBTOTAL 55	TESTING & STARTUP	427565	0	427565	9.17	39208	466773	10	46677	513450
560000	3013 CONTAINER PROCUREMENT	2700000	0	2700000	3.76	101520	2801520	0	0	2801520
SUBTOTAL 56	3013 CONTAINER PROCUREMENT	2700000	0	2700000	3.76	101520	2801520	0	0	2801520
SUBTOTAL 5	OTHER PROJECT COST	6724455	0	6724455	5.00	336029	7060484	6	402898	7463377
PROJECT TOTAL		32,971,265	1,339,740	34,311,005	7.32	2,511,968	36,822,965	20	7,227,415	44,050,388

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1. DOCUMENTS AND DRAWINGS

DOCUMENTS:CONCEPTUAL DESIGN REPORT JAN 1997 (SHEETS DATED 01/13/97)

DRAWINGS:ES-W460-C4,A1,C1,C2,C3,A2,A3,A4,A5,A6,S2-1+-2,S3-1+-2,H1,H2-1THRU-4,H5-1THRU-4,E3,P1,P2 ALL REV 0 UNAPPROVED

2. MATERIAL PRICES

UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL.

3. LABOR RATES

A.) ICF-KH HOURLY RATES HAVE BEEN ADOPTED AS INTERIM FLUOR DANIEL NORTHWEST LABOR RATES UNTIL SUCH TIME NEW SITE RATES ARE ESTABLISHED. SEE HANFORD SOFT REPORTING, FDS BUDGET GUIDELINE HANDBOOK, SECTION 2, KAISER RATES (REPORT BGHB0205).
B.) WHC HOURLY RATES HAVE BEEN ADOPTED AS INTERIM FLUOR DANIEL HANFORD SUBCONTRACTOR LABOR RATES UNTIL SUCH TIME NEW SITE RATES ARE ESTABLISHED. SEE SOFT RESPORTING, FDST 321R REPORT - ORGANIZATION RATES PLUS ADDERS.
C.) BASE CRAFT RATES INCLUDE FRINGE BENEFITS, LABOR INSURANCE, TAXES AND TRAVEL WHERE APPLICABLE, PER HANFORD SITE STABILIZATION AGREEMENT, APPENDIX A (EFFECTIVE 09-06-96).

4. GENERAL REQUIREMENTS/TECHNICAL SERVICES/OVERHEADS

A.) ONSITE CONSTRUCTION FORCES GENERAL REQUIREMENTS AND TECHNICAL SERVICES COSTS ARE INCLUDED AS A COMPOSITE PERCENTAGE APPLIED TO ONSITE CONSTRUCTION FORCES LABOR, WHICH IS REFLECTED IN THE "OH&P/B&I" COLUMN OF THE ESTIMATE DETAIL, FOR THIS PROJECT IS 52%.

B.) ONSITE CONTRACT ADMINISTRATION AND CONSTRUCTION MANAGEMENT COSTS ASSOCIATED WITH THE OVERALL MANAGEMENT OF THE FIXED PRICE CONTRACTS, ARE INCLUDED AS A COMPOSITE PERCENTAGE AND LUMP SUM ALLOWANCE (FOR BID PACKAGE PREP). THE TOTAL COMPOSITE PERCENTAGE AND LUMP SUM ALLOWANCE ARE APPLIED AGAINST THE TOTAL FIXED PRICE CONTRACT AMOUNT WHICH IS REFLECTED ON THE SUMMARY REPORT DOE_R07, INCLUDED WITH THIS ESTIMATE. THE CONSTRUTION MANAGEMENT ESTIMATING PERCENTAGES ARE AS SHOWN ON HANFORD SOFT REPORTING, FDS BUDGET GUIDELINE HANDBOOK, SECTION 2, KAISER RATES (REPORT BGHB0205).

C.) ONSITE PROJECT MANAGEMENT COSTS, ASSOCIATED WITH THE OVERALL MANAGEMENT OF THE FIXED PRICE CONTRACTS, ARE INCLUDED AS A MANLOADED ESTIMATE DETAIL ENTRIES.

C.) FIXED PRICE CONTRACTOR OVERHEAD, PROFIT, BOND AND INSURANCE COSTS HAVE BEEN APPLIED AT THE FOLLOWING PERCENTAGES AND ARE REFLECTED IN THE "OH&P/B&I" COLUMN OF THE ESTIMATE DETAIL:
LABOR - 26.5% MATERIAL - 26.5% EQUIPMENT USAGE - 26.5% SUBCONTRACTS -10%

5. ESCALATION

ESCALATION PERCENTAGES WERE CALCULATED FROM THE AUGUST 1996 UPDATE OF THE ECONOMIC ESCALATION PRICE CHANGE INDICES FOR DOE CONSTRUCTION PROJECTS AS PUBLISHED BY THE "OFFICE OF INFRASTRUCTURE AQUISITION" FM-50.

6. ROUNDING

THE PROJECT COST SUMMARY REPORT (DOE_R01) IS SUMMARIZED AND ADJUSTED/ROUNDED AS FOLLOWS:

THE ESCALATED TOTAL COST COLUMN, CONTINGENCY TOTAL COLUMN AND TOTAL DOLLARS COLUMN DOE COST CODE SUB-TOTALS ARE SUMMARIZED BY DESIGN AND MANAGEMENT, CONSTRUCTION, AND OTHER PROJECT COST. THE COLUMN SUBTOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $1,000/$10,000.
THE PROJECT TOTAL SUMMARY LINE TOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $10,000/$100,000.

6. ROUNDING

THE PROJECT COST SUMMARY REPORT (DOE_R01) IS SUMMARIZED AND ADJUSTED/ROUNDED AS FOLLOWS:
THE ESCALATED TOTAL COST COLUMN, CONTINGENCY TOTAL COLUMN AND TOTAL DOLLARS COLUMN DOE COST CODE SUB-TOTALS ARE SUMMARIZED BY DESIGN AND MANAGEMENT, CONSTRUCTION, AND OTHER PROJECT COST. THE COLUMN SUBTOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $1,000/$10,000.
THE PROJECT TOTAL SUMMARY LINE TOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $10,000/$100,000.

7. REMARKS

A.) FIXED PRICE WORK IS FIGURED AS REQUIRING NO SWP.
B.) FOR THE COMPRESSOR WORK M-9 PIPE AND 150# BALL VALVES ARE USED INSTEAD OF THE SPECIFIED TUBING AT THE LEAD ENGINEER'S DIRECTION.
C.) ABOVE GROUND SUPPORTS ARE USED FOR THE COMPRESSED AIR PIPING TO THE MAIN BUILDING.
D.) COST FOR Pu HANDLING MACHINES HAS BEEN PROVIDED BY FDNW P.E..
E.) THE SPS (STABILIZATION & PACKAGING SYSTEM) IS PROVIDED BY BNFL AND COSTS FOR IT ARE INCLUDED.
F.) THE CAT 1 DEFINITIVE DESIGN IS IN WBS 110202- 110206, 110210. CAT 2 DESIGN IS IN WBS 110201, 110207, 110208, & 110211.
G.) DESIGN IS BY FDNW. DEMOLITION OF GLOVEBOX BY FDNW. THE BALANCE OF THE CONSTRUCTION IS BY FIXED PRICE CONTRACTOR.
H.) ALL SPECIAL NUCLEAR MATERIAL WILL BE REMOVED FROM THE VAULTS BEFORE CONSTRUCTION WORK BEGINS.
I.) THERE IS NO RADIOLOGIOCAL CONTAMINATION IN THE VAULTS.
J.) PFP SECURITY PROCEDURES WILL ACCOMODATE CONSTRUCTION IN THE VAULTS AND 2736ZB.
K.) THE VAULT WORK USES THE IN FLOOR CONCEPT.
L.) THE MODULAR OFFICE FACILITY WILL BE DESIGN CONSTRUCT CONTRACT.
m.) GENERALLY DUCT WORK IS FIGURED AS RECTANGULAR GALV SHEETMETAL. VAULT EXHAUST DUCT IS SCH 5S 304 SST.
N.) ESCORTS ARE REQUIRED FOR NON CLEARED PERSONNEL.
O.) FDNW IS PROVIDING TOTAL PROJECT MANAGEMENT FOR BABCOCK & WILCOX HANFORD COMPANY.
P.) BWHC PROVIDED COST FOR 3013 CONTAINERS (WBS 560000) INCLUDING CONTINGENCY. NO FURTHER CONTINGENCY WAS ADDED.

ASSUMPTIONS ELECTRICAL INSTRUMENTATION

A.) CF TO RELOCATE IAEA MONITOR ASSUMEDTO BE AS SIMPLY REMOVING BATTERIES,PULL BACK CABLES,RELOCATE CABINETS, RECONNECT CABLE INSTALL BATTERIES.
B.) CF TO REMOVE VSIS SECURITY SENSOR CABLE, & MONITOR. ASSUMED WILL BE DONE AFTER FIXED PRICE CUTS IT LOOSE IN CELL.
C.) FP REVISE BLDG 2736-ZB COST CODE 501 REPLACE DSW-NP-1 SWITCH WITH NEW PNL, RELOCATE MARDEX SECURITY PORTAL AND EXTEND CONTROLS SAME WITH CCTV. INSTALL NEW FIRE ALARM PANEL AND MPS.
COST CODE 7060 AND 7065 ADDS POWER AND CONTROL FOR NEW FAN.
D.) FP WILL INSTALL NEW EQUIPMENT FOR THE SPS. MCC SPS, PANELBOARD, TRANSFORMERS, AND CONNECT LASER GENERATOR,CALORIMETER. NEW CND/WIRE FOR THE NEW EQUIPMENT. NEW AIR LOCK ROOMS ELECTRICAL INTERLOCKS.
E.) FP WILL INSTALL NEW SMOKE DETECTOR IN CELLS
F.) FP WILL INSTALL POWER FOR NEW OFFICES FROM NEW SOURCE.
G.) FP WILL INSTALL NEW EQUIPMENT. NEW MCC,CND/WIRE, FOR NEW AIR COMPRESSOR EQUIPMENT.
H.) THE 2736-ZB BUILDING IS A OPERATING FACILITY IT IS ASSUMED THE BUILDING OCCUPANTS WILL BE AS HELPFUL AS POSSIBLE TO ASSIST THE CONTRACTOR TO COMPLETE THE WORK IN A TIMELY FASHION BY NOT CHANGING THE CONTRACTORS WORK PLAN OR INTERRUPTING HIS WORK.

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
000	ENGINEERING									
110201	DEF DES PLANNG/ MOBIL. (CAT 2)	297669	0	297669	4.84	14406	312075	25	78021	390096
110202	DEF DES DRAWINGS (CAT 1)	360851	0	360851	4.84	17464	378315	25	94579	472896
110203	DEF DES CALCULATIONS (CAT 1)	102637	0	102637	4.84	4968	107605	25	26902	134507
110204	DEF DES SPECIFICATIONS (CAT 1)	88158	0	88158	4.84	4265	92423	25	23107	115530
110205	DEF DES CHECKING (CAT 1)	59533	0	59533	4.84	2882	62415	25	15604	78017
110206	DEF DES INTER DISCP REVW (CAT 1)	46520	0	46520	4.84	2252	48772	25	12193	60965
110207	ENGR. SUPPORT DISCP 21 - 31 (CAT2)	439295	0	439295.	4.84	21262	460557	25	115139	575696
110208	ENGR. SUPPORT DISCP 32 -65 (CAT 2)	56030	0	56030	4.84	2711	58741	25	14686	73428
110210	VAULT DEFINITIVE DESIGN CAT 1	234818	0	234818	4.84	11365	246183	25	61546	307729
110211	VAULT DEFINITIVE DESIGN CAT 2	436091	0	436091	4.84	21107	457198	25	114299	571497
121000	ENGINEERING/INSPECTION-ONSITE E/C	700000	0	700000	10.17	71190	771190	25	192798	963988
400000	PROJECT MANAGEMENT (FDNW)	816335	0	816335	9.90	80817	897152	25	224288	1121440
TOTAL 000	ENGINEERING	3637937	0	3637937	7.00	254689	3892626	25	973162	4865789
460	IMPROVEMENTS TO LAND									
323201	SANITARY WATERLINE	2625	462	3087	6.58	203	3290	25	823	4113
TOTAL 460	IMPROVEMENTS TO LAND	2625	462	3087	6.58	203	3290	25	823	4113
501	BUILDINGS									
321116	ELECTRICAL UTILITIES BLDG 2736-ZB	109961	19353	129314	7.73	9996	139310	35	48759	188069
321200	HVAC & MECH. MODS BLDG 2736ZB	9301	1637	10938	7.73	846	11783	30	3535	15319
321301	ARCHITECTURAL MODS	180418	86754	267172	7.73	20651	287824	30	86346	374170
321302	NEW EAST ENTRY AIRLOCK (ZB BLDG)	35134	6183	41317	7.73	3194	44511	30	13353	57864
321516	SAFEGUARD & SECURITY MODS ELECTRIC	26325	4633	30958	7.73	2393	33351	35	11673	45024
322101	VAULT #1	1085967	191130	1277097	10.17	129881	1406977	37	520581	1927560
322116	VAULT 1 MODS BLDG 2736-Z	18494	3255	21749	10.17	2212	23961	35	8386	32347
322201	VAULT #2	1085967	191130	1277097	10.17	129881	1406977	35	492442	1899421
322216	VAULT 2 MODS BLDG 2736-Z	18494	3255	21749	10.17	2212	23961	35	8386	32347
322301	VAULT #4	1085967	191130	1277097	10.17	129881	1406977	35	492442	1899421
322316	VAULT 4 MODS BLDG 2736-Z	18494	3255	21749	10.17	2212	23961	35	8386	32347
322516	SAFEGUARD & SECURITY MODS ELECTRIC	24050	4233	28283	10.17	2876	31159	35	10906	42065
323101	SITE PREP.	16100	2834	18934	8.69	1645	20579	25	5145	25724

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
323216	UTILITIES ELECTRICAL NEW OFFICE	38143	6713	44856	8.69	3898	48754	35	17064	65818
323301	MODULAR OFFICE - ARCHITECURAL	590479	103924	694403	8.69	60343	754746	25	188687	943435
324316	UTILITIES ELECTRICAL BLDG 2731-ZA	31034	5462	36496	6.58	2401	38897	35	13614	52512
324401	2731-ZA BLDG. MODS	26032	4582	30614	6.58	2014	32627	24	7832	40460
TOTAL 501	BUILDINGS	4400360	829463	5229823	9.69	506536	5736355	34	1937537	7673903
600	UTILITIES									
321401	BACKFLOW PREVENTORS & WATER METER	20500	3608	24108	7.73	1864	25972	25	6493	32464
323201	SANITARY WATERLINE	5905	1039	6944	8.68	603	7548	25	1887	9435
323202	SANITARY SEWER SYSTEM	54091	9520	63611	8.69	5528	69139	25	17285	86424
323203	REMOVE EXISTING DRAIN FIELD	3203	564	3767	8.68	327	4094	25	1024	5118
323216	UTILITIES ELECTRICAL NEW OFFICE	183714	32334	216048	8.69	18775	234822	26	61993	296815
TOTAL 600	UTILITIES	267413	47065	314478	8.62	27097	341575	26	88682	430256
700	SPECIAL EQUIP/PROCESS SYSTEMS									
211000	BNFL SPS & FIRE SUPPRESSION SYSTEM	14365000	0	14365000	7.25	1041463	15406463	15	2310970	17717432
220000	CALORIMETERS AND ISO PROBE SYS	662000	0	662000	7.25	47995	709995	35	248498	958493
311016	RELOC THE IAEA MONITOR CAB TO RM635	17888	0	17888	7.02	1256	19144	35	6792	25936
321116	ELECTRICAL UTILITIES BLDG 2736-ZB	42628	7502	50130	7.73	3875	54006	35	18902	72907
321200	HVAC & MECH. MODS BLDG 2736ZB	475147	83626	558773	7.73	43193	601966	30	178582	780549
321400	HELIUM BOTTLE PIPING	18227	3208	21435	7.73	1657	23092	25	5773	28865
321416	SPS UTIL ELECTRICAL BLDG 2736-ZB	166979	29389	196368	7.73	15179	211546	35	74041	285588
321501	ESCORTS FOR FIXED PRICE WK	455521	80172	535693	7.73	41409	577102	30	173131	750232
322400	VAULT 2 (HVAC - IN THE FLOOR VER.)	24251	4268	28519	10.17	2900	31419	35	10997	42416
322402	VAULT 4 (HVAC - IN THE FLOOR VER.)	24251	4268	28519	10.17	2900	31419	35	10997	42416
322403	VAULT 1 (HVAC - IN THE FLOOR VER.)	50394	8869	59263	10.17	6027	65290	35	22852	88142
322600	Pu CANNISTER HANDLING MACHINES	300000	52800	352800	10.17	35880	388680	50	194340	583020
324300	CMPSR BLDG. AIR HANDLING EQ & PIPE	194318	34200	228518	6.58	15036	243554	25	60889	304443
324316	UTILITIES ELECTRICAL BLDG 2731-ZA	57476	10116	67592	6.58	4448	72039	35	25214	97253
TOTAL 700	SPECIAL EQUIP/PROCESS SYSTEM	16854080	318418	17172498	7.36	1263218	18435715	18	3341978	21777692
810	DEMOLITION									

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
312000	DEMO OF RM 636 REPKG GLOVEBOX	97734	0	97734	10.43	10194	107928	40	43171	151098
312001	ESCORTS FOR CPAF WORK	11405	0	11405	10.43	1190	12595	30	3778	16373
313016	REMOVE THE VSIS SYSTEM AND CABLING	45366	0	45366	15.63	7091	52457	35	18360	70817
321116	ELECTRICAL UTILITIES BLDG 2736-ZB	22754	4005	26759	7.73	2068	28827	35	10090	38917
321200	HVAC & MECH. MODS BLDG 2736ZB	8261	1454	9715	7.73	751	10466	30	3140	13606
321301	ARCHITECTURAL MODS	50462	8881	59343	7.73	4587	63931	30	19179	83110
322101	VAULT #1	310295	54612	364907	10.17	37111	402018	37	148747	550765
322116	VAULT 1 MODS BLDG 2736-Z	28178	4959	33137	10.17	3370	36507	35	12778	49285
322201	VAULT #2	34687	6105	40792	10.17	4149	44940	35	15729	60670
322301	VAULT #4	310295	54612	364907	10.17	37111	402018	35	140706	542724
322316	VAULT 4 MODS BLDG 2736-Z	39971	7035	47006	10.17	4781	51786	35	18125	69912
322400	VAULT 2 (HVAC - IN THE FLOOR VER.)	4305	757	5062	10.17	515	5577	35	1952	7529
322402	VAULT 4 (HVAC - IN THE FLOOR VER.)	4336	763	5099	10.18	519	5617	35	1966	7584
322403	VAULT 1 (HVAC - IN THE FLOOR VER.)	4336	763	5099	10.18	519	5617	35	1966	7584
324401	2731-ZA BLDG. MODS	2193	386	2579	6.59	170	2749	25	687	3436
330000	BURIAL CHARGE	109817	0	109817	9.17	10070	119887	35	41961	161848
TOTAL 810	DEMOLITION	1084395	144332	1228727	10.11	124196	1352920	36	482335	1835258
910	OTHER PROJECT COSTS FY 96									
511000	FDC	50000	0	50000	0.00	0	50000	0	0	50000
512001	CDR PLANNING & CDR FY96	180000	0	180000	0.00	0	180000	0	0	180000
TOTAL 910	OTHER PROJECT COSTS FY 96	230000	0	230000	0.00	0	230000	0	0	230000
920	OTHER PROJECT COSTS FY 97									
512002	CDR FY97	790000	0	790000	1.16	9164	799164	10	79916	879080
512003	ENVIRONMENTAL PERMIT CHECK-	8973	0	8973	1.16	104	9077	10	908	9985
512004	PRELIMINARY SAFETY EVALUA-	80000	0	80000	1.16	928	80928	10	8093	89021
512005	PROJ MGMT PLAN & REQUEST FOR	10400	0	10400	1.16	121	10521	10	1052	11573
512006	QUALITY ASSUR. PROG. PLAN	5200	0	5200	1.15	60	5260	10	526	5786
TOTAL 920	OTHER PROJECT COSTS FY 97	894573	0	894573	1.16	10377	904950	10	90495	995445
930	OTHER PROJECT COSTS FY 98									

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
513001 ACD	PLANNING/ MOBILIZATION	95195	0	95195	3.55	3380	98575	10	9858	108431
513002 ACD	REVIEW BNFL DESIGN	54385	0	54385	3.55	1932	56317	10	5632	61948
513003 ACD	VAULT CONCEPT	78268	0	78268	3.55	2778	81046	10	8106	89151
513004 ACD	ENGR. SUPPORT	109146	0	109146	3.55	3876	113022	10	11301	124324
513005 ACD	FDNW PROJ. MGMT.	33800	0	33800	3.55	1200	35000	10	3500	38500
513006 ACD	BWHC PLANT INPUT/REVIEW	49350	0	49350	3.55	1752	51102	10	5110	56212
521001 PFP	DEF DESIGN INPUT	131451	0	131451	3.76	4943	136394	10	13639	150033
521002 PFP	PROGRAM SUPPORT FOR	76268	0	76268	3.76	2868	79136	10	7914	87049
521003 BNFL	SUPPORT TO DEF DESIGN	150000	0	150000	3.76	5640	155640	10	15564	171204
560000	3013 CONTAINER PROCUREMENT	2700000	0	2700000	3.76	101520	2801520	0	0	2801520
TOTAL 930	OTHER PROJECT COSTS FY 98	3477863	0	3477863	3.73	129889	3607752	2	80624	3688372
940	OTHER PROJECT COSTS FY 99									
521004	PFP FIRE HAZARDS ANALYSIS	17946	0	17946	6.36	1141	19087	10	1909	20996
521005	SECURITY PLAN FOR CONSTR.	44864	0	44864	6.36	2853	47717	10	4772	52489
522000	ENVIRONMENTAL PERMITTING	250000	0	250000	6.36	15900	265900	10	26590	292490
523000	PFP DEF DESIGN REVIEWS	91971	0	91971	6.36	5849	97820	10	9782	107602
531001	PFP PROCUREMENT REVIEWS	121510	0	121510	6.36	7728	129238	10	12924	142162
531002	PFP PROCUREMENT TRAVEL	20000	0	20000	6.36	1272	21272	10	2127	23399
531003	PFP PROCUREMENT COTR SUPPORT	41912	0	41912	6.36	2666	44578	10	4458	49035
541000	PFP OPPS SUPPORT TO CONSTR.	44664	0	44664	6.36	2841	47505	10	4750	52255
542000	PFP PLANT ENGR SUPPORT TO	81204	0	81204	6.36	5165	86369	10	8637	95005
543000	PFP GENERAL PLANT SUPPORT	54250	0	54250	6.36	3450	57700	10	5770	63470
TOTAL 940	OTHER PROJECT COSTS FY 99	768321	0	768321	6.36	48865	817186	10	81719	898903
950	OTHER PROJECT COSTS FY 2000									
531001	PFP PROCUREMENT REVIEWS	40000	0	40000	9.17	3668	43668	10	4367	48035
531002	PFP PROCUREMENT TRAVEL	10000	0	10000	9.17	917	10917	10	1092	12009
531003	PFP PROCUREMENT COTR SUPPORT	20000	0	20000	9.17	1834	21834	10	2183	24017
541000	PFP OPPS SUPPORT TO CONSTR.	47377	0	47377	9.17	4344	51721	10	5172	56894
542000	PFP PLANT ENGR SUPPORT TO	208618	0	208618	9.17	19130	227748	10	22775	250523
543000	PFP GENERAL PLANT SUPPORT	59941	0	59941	9.17	5497	65438	10	6544	71981
544000	PATROL SUPPORT FOR VAULT MOD	47614	0	47614	9.17	4366	51980	10	5198	57178
551000	ATP SUPPORT	37798	0	37798	9.17	3466	41264	10	4126	45390
552000	PROCEDURE MODIFICATION	71782	0	71782	9.17	6582	78364	10	7836	86201

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
553000	TRAINING	50250	0	50250	9.17	4608	54858	10	5486	60344
554000	OTP	162810	0	162810	9.17	14930	177740	10	17774	195514
555000	READINESS REVIEW	104925	0	104925	9.17	9622	114547	10	11455	126001
TOTAL 950	OTHER PROJECT COSTS FY 2000	861115	0	861115	9.17	78964	940079	10	94008	1034087
960	OTHER PROJECT COSTS FY 2001									
541000	PFP OPPS SUPPORT TO CONSTR.	69408	0	69408	12.29	8530	77938	10	7794	85732
542000	PFP PLANT ENGR SUPPORT TO	102066	0	102066	12.29	12544	114610	10	11461	126071
543000	PFP GENERAL PLANT SUPPORT	43348	0	43348	12.29	5327	48675	10	4868	53543
544000	PATROL SUPPORT FOR VAULT MOD	56327	0	56327	12.29	6923	63250	10	6325	69575
TOTAL 960	OTHER PROJECT COSTS FY 2001	271149	0	271149	12.29	33324	304473	10	30448	334921
970	OTHER PROJECT COSTS FY 2002									
541000	PFP OPPS SUPPORT TO CONSTR.	68645	0	68645	15.63	10729	79374	10	7937	87312
542000	PFP PLANT ENGR SUPPORT TO	100944	0	100944	15.63	15778	116722	10	11672	128394
543000	PFP GENERAL PLANT SUPPORT	51845	0	51845	15.63	8103	59948	10	5995	65943
TOTAL 970	OTHER PROJECT COSTS FY 2002	221434	0	221434	15.63	34610	256044	10	25604	281649
PROJECT TOTAL		32,971,265	1,339,740	34,311,005	7.32	2,511,968	36,822,965	20	7,227,415	44,050,388

CSI	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
ENGINEERING										
00	TECHNICAL SERVICES	700000	0	700000	10.17	71190	771190	25	192798	963988
21	CIVIL	811998	0	811998	4.84	39300	851298	25	212826	1064123
23	ARCHITECTUAL	121039	0	121039	4.84	5858	126897	25	31725	158622
26	FIRE PROT/SAFETY	66353	0	66353	4.84	3212	69565	25	17391	86956
27	PIPING/VESSEL	122049	0	122049	4.84	5907	127956	25	31989	159947
28	HVAC	145058	0	145058	4.84	7021	152079	25	38020	190099
29	INSTRUMENT	96621	0	96621	4.84	4676	101297	25	25324	126621
31	ELECTRICAL	129710	0	129710	4.84	6277	135987	25	33998	169985
32	SPECIF	17670	0	17670	4.84	855	18525	25	4631	23157
33	SPCLTY ENGRG	369692	0	369692	4.84	17893	387585	25	96896	484481
35	DESIGN ADMIN	145939	0	145939	4.84	7063	153002	25	38251	191253
38	VALUE ENGINEERING	11309	0	11309	4.84	547	11856	25	2964	14820
40	PROJECT MANAGER	816335	0	816335	9.90	80817	897152	25	224288	1121440
42	QUALITY ENGINEERING	64349	0	64349	4.84	3114	67463	25	16867	84329
46	ESTIMATES	9920	0	9920	4.84	480	10400	25	2600	13000
49	SUB/PROC	4241	0	4241	4.83	205	4446	25	1112	5558
51	INDUSTRIAL HEALTH	5654	0	5654	4.85	274	5928	25	1482	7410
	TOTAL ENGINEERING	3,637,937	0	3,637,937	7.00	254,689	3,892,626	25	973,162	4,865,789
CONSTRUCTION										
01	GENERAL REQUIRMENTS	608468	105083	713551	8.30	59247	772798	31	240020	1012818
02	SITEWORK	795406	139991	935397	9.81	91758	1027156	34	352997	1380153
03	CONCRETE	308816	54351	363167	9.80	35599	398766	34	137308	536076
05	METALS	2896544	509793	3406337	10.15	345813	3752147	36	1336639	5088788
07	MOISTURE AND THERMAL	14660	2581	17241	7.54	1300	18539	28	5264	23804
08	DOORS,WINDOWS AND G	54259	9550	63809	7.62	4862	68671	30	20277	88948
09	FINISHES	85307	70014	155321	7.68	11921	167242	30	49435	216677
12	FURNISHINGS	182300	32084	214384	8.61	18454	232839	25	59194	292034
13	SPECIAL CONSTRUCTION	15032500	123640	15156140	7.36	1115938	16272078	16	2628297	18900376
15	MECHANICAL	1727361	144813	1872174	7.80	146106	2018277	32	643399	2661679
16	ELECTRICAL	903252	147840	1051092	8.59	90252	1141342	33	378525	1519869
21	CIVIL	33591	0	33591	3.55	1193	34784	10	3479	38262
23	ARCHITECTUAL	27650	0	27650	3.55	981	28631	10	2862	31495
25	NUCLEAR EQUIP	2700000	0	2700000	3.76	101520	2801520	0	0	2801520
26	FIRE PROT/SAFETY	32221	0	32221	3.55	1145	33366	10	3337	36701

CSI	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
27	PIPING/VESSEL	34003	0	34003	3.55	1207	35210	10	3521	38731
28	HVAC	69387	0	69387	3.55	2464	71851	10	7185	79036
29	INSTRUMENT	17810	0	17810	3.55	632	18442	10	1845	20287
31	ELECTRICAL	27857	0	27857	3.55	989	28846	10	2884	31730
35	DESIGN ADMIN	52673	0	52673	3.55	1870	54543	10	5455	59997
42	QUALITY ENGINEERING	14706	0	14706	3.56	523	15229	10	1523	16751
65	RECORDS MGMT/TURNOVER	27096	0	27096	3.55	962	28058	10	2806	30864
90	PROJECT MANAGEMENT	3687461	0	3687461	6.04	222543	3910004	9	368001	4278003
TOTAL CONSTRUCTION		29,333,328	1,339,740	30,673,068	7.36	2,257,279	32,930,339	19	6,254,253	39,184,599
PROJECT TOTAL		32,971,265	1,339,740	34,311,005	7.32	2,511,968	36,822,965	20	7,227,415	44,050,388

REFERENCE: ESTIMATE BASIS SHEET — PAGE 7 & 8 OF 40
COST CODE ACCOUNT SUMMARY — PAGE 9 - 13 OF 40

THE U.S. DEPARTMENT OF ENERGY - RICHLAND ORDER 5700.3 "COST ESTIMATING, ANALYSIS AND STANDARDIZATION" DATED 3-27-85, PROVIDES GUIDELINES FOR ESTIMATE CONTINGENCIES. THE GUIDELINE FOR A CONCEPTUAL ESTIMATE SHOULD HAVE AN OVERALL RANGE OF 15% TO 25% .

CONTINGENCY IS EVALUATED AT THE THIRD COST CODE LEVEL AND SUMMARIZED AT THE PRIMARY AND SECONDARY COST CODE LEVEL OF THE DETAILED COST ESTIMATE.

000	ENGINEERING		
110	DESIGN	25%	CONTINGENCY WAS ADDED CONSISTENT WITH THE AMOUNT OF DESIGN DONE AT THIS TIME, UNKNOWN CONDITIONS IN AN EXISTING BUILDING, AND THE DOE GUIDELINES FOR CONTINGENCY APPLICATION.
121	INSPECTION	25%	CONTINGENCY WAS ADDED SINCE A SIGNIFICANT PORTION OF THE CONSTRUCTION WILL BE SAFETY CLASS AND MORE INSPECTIONS AND NCRS COULD BE REQUIRED.
400	PROJECT MANAGEMENT FDNW	25%	CONTINGENCY WAS ADDED TO ACCOUNT FOR THE EXTRA INTERFACE REQUIRED FOR THIS TYPE OF EXISTING OPERATING FACILITY.

AVERAGE ENGINEERING CONTINGENCY 25%

CONSTRUCTION

460	IMPROVEMENTS TO LAND		
323	NEW OFFICE STRUCTURE	26%	CONTINGENCY WAS APPLIED SINCE THE OFFICE STRUCTURE IS A DESIGN BUILD CONTRACT AND CAN VARY GREATLY AS THE SUBMITTED DESIGNS VARY.
501	BUILDINGS		
321	BUILDING 2736-ZB MODS	32%	CONTINGENCY WAS APPLIED SINCE THE WORK IS IN EXISTING BUILDINGS AND BEHIND PFP WHERE UNKNOWN CONDITIONS (SUCH AS SECURITY DELAYS AND RWP CONDITIONS) CAUSE COSTS TO RISE.
322	BUILDING 2736-Z MODS - VAULTS	35%	CONTINGENCY HAS BEEN APPLIED TO ALL CONSTRUCTION DUE TO THE UNIQUE TYPE OF WORK, UNKNOWNS AND UNCERTAINTIES CONCERNING THE METHOD OF PERFORMANCE, AND AVALABILITY OF ACCESS DUE TO SECURITY.
323	NEW OFFICE STRUCTURE	26%	CONTINGENCY WAS APPLIED SINCE THE OFFICE STRUCTURE IS A DESIGN BUILD CONTRACT AND CAN VARY GREATLY AS THE SUBMITTED DESIGNS VARY.

324	AIR COMPRESSOR WORK	30%	CONTINGENCY WAS APPLIED AS AIR COMPRESSOR WORK IS NOW IN AN EXISTING BUILDING LIKELY TO CHANGE FROM ASSUMED DESIGN AS THIS WORK WAS SHOWN IN A NEW BUILDING BUILDING AND DESIGN TO FIT THE EXISTING BUILDING HAD NOT BEEN RELEASED.
600	UTILITIES		
321	BUILDING 2736-ZB MODS	25%	CONTINGENCY WAS APPLIED SINCE THE WORK IS IN EXISTING BUILDINGS AND BEHIND PFP WHERE UNKOWN CONDITIONS (SUCH AS SECURITY DELAYS AND RWP CONDITIONS) CAUSE COSTS TO RISE.
323	NEW OFFICE STRUCTURE	26%	CONTINGENCY WAS APPLIED SINCE THE OFFICE STRUCTURE IS A DESIGN BUILD CONTRACT AND VARY GREATLY AS THE SUBMITTED DESIGNS VARY.
700	SPECIAL EQUIP/PROCESS SYSTEMS		
211	BNFL SPS	15%	CONTINGENCY WAS APPLIED TO THE SPS COST ESTIMATE SUPPLIED TO ESTIMATING BY BWHC ACCOUNT FOR CONTRACT MODIFICATIONS.
220	CALORIMETERS AND ISO PROB SYS	35%	CONTINGENCY WAS APPLIED TO ESTIMATES PROVIDED BY BWHC WITHOUT DETAILED BACKUP. THE CALORIMETERS ARE A SPECIALIZED DESIGN AND FINAL DESIGN REQUIREMENTS COULD INCREASE COST.
311	RELOC THE IAEA MONITOR CAB TO RM635	35%	AN AVERAGE 35% CONTINGENCY WAS APPLIED SINCE THE WORK IS IN EXISTING BUILDINGS & BEHIND PFP WHERE UNKOWN CONDITIONS (SUCH AS SECURITY DELAYS AND RWP CONDITIONS) CAUSE COSTS TO RISE.
321	BUILDING 2736-ZB MODS		
322	BUILDING 2736-Z MODS - VAULTS		
324	AIR COMPRESSOR WORK	27%	CONTINGENCY WAS APPLIED SINCE AIR COMPRESSOR WORK IS NOW IN AN EXISTING BUILDING WHICH COULD CHANGE THE ASSUMED DESIGN CHANGING THE QUANTITIES OF MATERIAL REQUIRE
810	DEMOLITION		
312	DEMO OF RM 636 REPKG GLOVEBOX	35%	AN AVERAGE OF 35% CONTINGENCY WAS ADDED AS DEMOLITION CANNOT BE ESTIMATED EXACTLY. SWP AND BURIAL COSTS CAN VARY WIDELY. THE DEMO PROCEDURES ARE NOT WELL SPELLED OUT YET. THE FACILITY IS IN USE AND SCHEDULE INTERFERENCES ARE LIKELY.
313	REMOVE THE VSIS SYSTEM AND CABLING		
321	BUILDING 2736-ZB MODS		
322	BUILDING 2736-Z MODS - VAULTS		
324	AIR COMPRESSOR WORK		
330	BURIAL FEE CHARGES		
900	OTHER PROJECT COSTS		
5XX	OTHER PROJECT COSTS	10%	CONTINGENCY APPLIED PER PROJECT MANAGER'S DIRECTION; EXCEPT FOR FDC & CDR PRIOR TO 1997 (0%).

AVERAGE CONSTRUCTION CONTINGENCY 33%
AVERAGE PROJECT CONTINGENCY 20%

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	CONTRACT %	ADMINISTRATION TOTAL	BID PACK PREP.	OTHER INDIRECTS	TOTAL INDIRECTS
110201	DEF DES PLANNG/ MOBIL. (CAT 2)	297669	0.00	0	0	0	0
110202	DEF DES DRAWINGS (CAT 1)	360851	0.00	0	0	0	0
110203	DEF DES CALCULATIONS (CAT 1)	102637	0.00	0	0	0	0
110204	DEF DES SPECIFICATIONS (CAT 1)	88158	0.00	0	0	0	0
110205	DEF DES CHECKING (CAT 1)	59533	0.00	0	0	0	0
110206	DEF DES INTER DISCP REVW (CAT 1)	46520	0.00	0	0	0	0
110207	ENGR. SUPPORT DISCP 21 - 31 (CAT2)	439295	0.00	0	0	0	0
110208	ENGR. SUPPORT DISCP 32 -65 (CAT 2)	56030	0.00	0	0	0	0
110210	VAULT DEFINITIVE DESIGN CAT 1	234818	0.00	0	0	0	0
110211	VAULT DEFINITIVE DESIGN CAT 2	436091	0.00	0	0	0	0
121000	ENGINEERING/INSPECTION-ONSITE E/C	700000	0.00	0	0	0	0
211000	BNFL SPS & FIRE SUPPRESSION SYSTEM	14365000	0.00	0	0	0	0
220000	CALORIMETERS AND ISO PROBE SYS	662000	0.00	0	0	0	0
311016	RELOC THE IAEA MONITOR CAB TO RM635	17888	0.00	0	0	0	0
312000	DEMO OF RM 636 REPKG GLOVEBOX	97734	0.00	0	0	0	0
312001	ESCORTS FOR CPAF WORK	11405	0.00	0	0	0	0
313016	REMOVE THE VSIS SYSTEM AND CABLING	45366	0.00	0	0	0	0
321116	ELECTRICAL UTILITIES BLDG 2736-ZB	175343	17.60	30860	0	0	30860
321200	HVAC & MECH. MODS BLDG 2736ZB	492709	17.60	86717	0	0	86717
321301	ARCHITECTURAL MODS	230880	17.60	40635	25000	30000	95635
321302	NEW EAST ENTRY AIRLOCK (ZB BLDG)	35134	17.60	6183	0	0	6183
321400	HELIUM BOTTLE PIPING	18227	17.60	3208	0	0	3208
321401	BACKFLOW PREVENTORS & WATER METER	20500	17.60	3608	0	0	3608
321416	SPS UTIL ELECTRICAL BLDG 2736-ZB	166979	17.60	29389	0	0	29389
321501	ESCORTS FOR FIXED PRICE WK	455521	17.60	80172	0	0	80172
321516	SAFEGUARD & SECURITY MODS ELECTRIC	26325	17.60	4633	0	0	4633
322101	VAULT #1	1396262	17.60	245742	0	0	245742
322116	VAULT 1 MODS BLDG 2736-Z	46672	17.60	8214	0	0	8214
322201	VAULT #2	1120654	17.60	197235	0	0	197235
322216	VAULT 2 MODS BLDG 2736-Z	18494	17.60	3255	0	0	3255
322301	VAULT #4	1396262	17.60	245742	0	0	245742
322316	VAULT 4 MODS BLDG 2736-Z	58465	17.60	10290	0	0	10290
322400	VAULT 2 (HVAC - IN THE FLOOR VER.)	28556	17.60	5025	0	0	5025
322402	VAULT 4 (HVAC - IN THE FLOOR VER.)	28587	17.60	5031	0	0	5031
322403	VAULT 1 (HVAC - IN THE FLOOR VER.)	54730	17.60	9632	0	0	9632
322516	SAFEGUARD & SECURITY MODS ELECTRIC	24050	17.60	4233	0	0	4233
322600	Pu CANNISTER HANDLING MACHINES	300000	17.60	52800	0	0	52800
323101	SITE PREP.	16100	17.60	2834	0	0	2834
323201	SANITARY WATERLINE	8530	17.60	1501	0	0	1501
323202	SANITARY SEWER SYSTEM	54091	17.60	9520	0	0	9520
323203	REMOVE EXISTING DRAIN FIELD	3203	17.61	564	0	0	564

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	CONTRACT %	ADMINISTRATION TOTAL	BID PACK PREP.	OTHER INDIRECTS	TOTAL INDIRECTS
323216	UTILITIES ELECTRICAL NEW OFFICE	221857	17.60	39047	0	0	39047
323301	MODULAR OFFICE - ARCHITECURAL	590479	17.60	103924	0	0	103924
324300	CMPSR BLDG. AIR HANDLING EQ & PIPE	194318	17.60	34200	0	0	34200
324316	UTILITIES ELECTRICAL BLDG 2731-ZA	88510	17.60	15578	0	0	15578
324401	2731-ZA BLDG. MODS	28225	17.60	4968	0	0	4968
330000	BURIAL CHARGE	109817	0.00	0	0	0	0
400000	PROJECT MANAGEMENT (FDNW)	816335	0.00	0	0	0	0
511000	FDC	50000	0.00	0	0	0	0
512001	CDR PLANNING & CDR FY96	180000	0.00	0	0	0	0
512002	CDR FY97	790000	0.00	0	0	0	0
512003	ENVIRONMENTAL PERMIT CHECK-	8973	0.00	0	0	0	0
512004	PRELIMINARY SAFETY EVALUA-	80000	0.00	0	0	0	0
512005	PROJ MGMT PLAN & REQUEST FOR	10400	0.00	0	0	0	0
512006	QUALITY ASSUR. PROG. PLAN	5200	0.00	0	0	0	0
513001	ACD PLANNING/ MOBILIZATION	95195	0.00	0	0	0	0
513002	ACD REVIEW BNFL DESIGN	54385	0.00	0	0	0	0
513003	ACD VAULT CONCEPT	78268	0.00	0	0	0	0
513004	ACD ENGR. SUPPORT	109146	0.00	0	0	0	0
513005	ACD FDNW PROJ. MGMT.	33800	0.00	0	0	0	0
513006	ACD BWHC PLANT INPUT/REVIEW	49350	0.00	0	0	0	0
521001	PFP DEF DESIGN INPUT	131451	0.00	0	0	0	0
521002	PFP PROGRAM SUPPORT FOR	76268	0.00	0	0	0	0
521003	BNFL SUPPORT TO DEF DESIGN	150000	0.00	0	0	0	0
521004	PFP FIRE HAZARDS ANALYSIS	17946	0.00	0	0	0	0
521005	SECURITY PLAN FOR CONSTR.	44864	0.00	0	0	0	0
522000	ENVIRONMENTAL PERMITTING	250000	0.00	0	0	0	0
523000	PFP DEF DESIGN REVIEWS	91971	0.00	0	0	0	0
531001	PFP PROCUREMENT REVIEWS	161510	0.00	0	0	0	0
531002	PFP PROCUREMENT TRAVEL	30000	0.00	0	0	0	0
531003	PFP PROCUREMENT COTR SUPPORT	61912	0.00	0	0	0	0
541000	PFP OPPS SUPPORT TO CONSTR.	230094	0.00	0	0	0	0
542000	PFP PLANT ENGR SUPPORT TO	492832	0.00	0	0	0	0
543000	PFP GENERAL PLANT SUPPORT	209384	0.00	0	0	0	0
544000	PATROL SUPPORT FOR VAULT MOD	103941	0.00	0	0	0	0
551000	ATP SUPPORT	37798	0.00	0	0	0	0
552000	PROCEDURE MODIFICATION	71782	0.00	0	0	0	0
553000	TRAINING	50250	0.00	0	0	0	0
554000	OTP	162810	0.00	0	0	0	0
555000	READINESS REVIEW	104925	0.00	0	0	0	0
560000	3013 CONTAINER PROCUREMENT	2700000	0.00	0	0	0	0
PROJECT TOTAL		32,971,265		1,284,740	25,000	30,000	1,339,740

Engineering Statement of Work

Definitive Design
Project W-460
Plutonium Stabilization and Handling

Customer : Babcock & Wilcox Hanford Company W.O. No. : E55631
Prepared by: Charles O'Neill Date: January 15, 1996

PROJECT SCOPE

Project W-460, "Plutonium Stabilization and Handling," (PuSH) encompasses several related actions to ensure the safe storage of the plutonium remaining at Hanford's Plutonium Finishing Plant (PFP) for up to fifty years. The major sections of the project are:

- Site Preparation
  A site selection study chose Rooms 641 and 642 in Building 2736-ZB to house the SPS. The rooms will be combined into one, with a small control room located in an adjacent area of the building. Structural preparations such as temporary large equipment access will be made. Various facility work areas will be relocated, with some non structural modifications, to allow all needed tasks to be carried out.

  Capacities of facility ventilation systems will be verified and enhanced if necessary. Configuration of the systems will be modified if necessary to provide appropriate separation of facility and process enclosure ventilation. The capacity of utilities and support systems required for operation of the SPS and of the modified vaults will be verified; for existing utilities such as electrical power, reconfiguration or enhancement may be required. Utilities not currently available or of insufficient capacity at 2736-ZB such as nitrogen gas, bottled laser gases or dry air will be supplied by this project.

- SPS Procurement, Installation and Testing
  Via the common procurement agent (DOE-OAK), the design of the prototype SPS unit (to be tested at Rocky Flats during 1997) will be modified to suit Hanford's needs, constructed, installed and tested. It is anticipated that the vendor will install the SPS equipment. The system design may utilize surplus equipment currently at the Hanford Site if feasible, e.g. a glovebox for size reduction of impure oxide forms.

  Within the SPS, items to be procured will include approximately thirteen gloveboxes and fume hoods with associated ventilation and service connections, stabilization and laboratory furnaces (a total of three are anticipated), a laser welding machine with

multiple waveguides, a variety of automated material movement equipment and a system control unit. An initial order of packaging components will be procured for equipment testing and qualification.

Technical requirements for this phase of the Project are detailed in Appendix B and governed by the PuSAP contract. The Hanford portion of the contract is managed by a Contracting Officer's Representative (COR) appointed by the Project Management Division of RL.

- Vault Modification

  Secure vault storage fixtures in Building 2736-Z will be modified to accommodate the 3013 packages sealed in the SPS. A minimum of two vault rooms must have fixtures modified to hold the existing inventory, as the portion of the PFP inventory under agreement with the IAEA must be maintained physically separate from the rest of the inventory. The storage configuration will be determined based on requirements of domestic and international security. Security equipment and data management configuration (seals, item identification equipment, database connections, etc) will be also modified as needed. The 2736-Z facility ventilation systems will be enhanced if necessary.

  Significant operational sequencing will be required to allow construction access while minimizing radiological dose to construction and operational workers and maintaining required physical security. Consolidation of the inventory now in vault storage to allow an empty room prior to construction of new vault storage fixtures will require advance planning and creativity. Any temporary storage modifications will be designed, installed and removed by this project.

- Control and Laboratory Equipment Additions

  Surveillance equipment and international safeguards equipment currently in Room 642 will be relocated within Building 2736-ZB to make space for the SPS unit.

  Laboratory equipment for non-destructive assay (NDA) of 3013 packages will be purchased and installed in the 2736-ZB NDA laboratory, Room 637. One to three (based on planned SPS throughput rates) calorimetry units will be purchased to accommodate the new package configuration, along with a pre-equilibration bath if deemed necessary. The gamma scan unit will be updated, and a second unit will be purchased if required to handle SPS throughput rates. Based on discussions with the PuSAP task team, space for a radiography unit capable of determining weld signatures and contents baselining will be set aside as a good practice item. Site preparation for these items will be undertaken in sequence to minimize disruptions to NDA laboratory operations.

REFERENCES

Functional Design Criteria, "Plutonium Stabilization and Handling," Project W-460, FDH-SD-CP-FDC-005, Rev 1 December 10, 1996.

System Specification for the Plutonium Stabilization and Packaging System (PuSAP), Contract No. DE-ACO3-96SF20948, May 1996.

System Design Document for the Plutonium Stabilization and Packaging System, Contract No. DE-ACO3-96SF20948, May 1996.

Conceptual Design Report, "Plutonium Stabilization and Handling," Project Q-460, FDH-SD-CDR-001, Rev.0, January 15, 1997.

DEFINITIVE DESIGN SCOPE

During definitive design Fluor Daniel Northwest will produce and provide the following products and services.

CALCULATIONS

- Finalize all calculations of the heat rejection to room 640/641 and determine final cooling requirement to the area.
- Finalize the volumetric airflow from the SPS process.
- SPS exhaust fan static pressure
- 2736-ZA exhaust fan static pressure
- 2736-ZA cooling coil capacity
- Room 641/642 HVAC seismic duct supports
- Room 641/642 fire water piping seismic supports
- Dry air piping supports
- Dry air flow and pressure
- Shielding calculations for the canister handling machines and room 641/642
- Criticality calculations for the vault
- Hydraulic (for sewer)
- Hydraulic (for fire water)
- Structural (2736-ZB wall modification)
- Structural (New Airlock footings & Above Grade Structure)
- Structural (Misc anchors and 2736-Z vault mods)
- Structural (Misc. Hangers and anchors)
- Structural (2736-ZB stack mods)

DRAWINGS

- Civil
  Drawing list and vicinity map
  Mobile Office Location and Setup
  Sanitary Drainfield Demolition and backfill
  Sewage Pump Station Plan and Details
  2736-ZB External Roof Access Stairs Details
  2736-ZB Stack Modification Details
  Pressure Sewer Plan/Profile
  Sanitary water and Fire Water Piping
  Misc. Details 1
  Misc. Details 2
  Vault Door installation East Wall 2736-ZB
  New Air Lock and Entrance 2736-ZB (Est. 2 Dwgs)
  Cubical Mods in 2736-Z (Est. 3 Dwgs)

- Architectural
  2736-ZB demolition
  2736-ZB floor plan
  Enlarged floor plan room 641/642
  Room 641/642 details
  2736-ZB interior and exterior elevations
  2736-ZB entrance airlock plan and details
  NDA airlock details

  2731-ZA
  2731-ZA floor plan and section
  Exterior elevations and details
  Demolition plan

  Office structure
  Office structure floor plan
  Reflected ceiling plan
  Exterior elevations
  Sections and details

- HVAC
  Air flow and control diagram.
  2736-ZB HVAC pressure zone plan
  2736-ZB SPS exhaust plan view
  2736-ZB exhaust roof plan
  2736-ZB HVAC plan and section

2736-ZB miscellaneous details
2736-ZB miscellaneous sections

2736-Z
Air flow and control diagram
Room 1 duct modifications, plan and section
Room 2 duct modifications, plan and section
Room 4 duct modifications, plan and section

2731-ZA
HVAC plan and section

- Mechanical
  Dry air flow diagram
  2731-ZA equipment layout plan and elevation
  Dry air piping layout, plan and elevation
  2736-ZB equipment demolition
  Helium piping layout, plan and elevation

- Electrical/Instrumentation
  2736-Z, 2736-ZA and 2736-ZB buildings:
  New instruments location plan.
  Instrumentation specification sheets.
  Update essential P&Ids.
  Update essential Micon loop sheets.
  Instrument installation details.
  Helium distribution plan.
  Vault instrumentation demolition plan.
  2736-Z power plan.
  2736-ZA power plan.
  2736-ZB power plan Sh 1.
  2736-ZB power plan Sh 2.
  Update essential one-line diagrams
  Motor control diagrams Sh 1.
  Motor control diagrams Sh 2.
  Update essential Micon elementary diagrams.

  New office structure:
  Power plan.
  Update essential one-line diagram.
  Transformer and panelboard installation details.

Dry air compressor building:
New instrument location plan.
Instrumentation specification sheets.
Update essential P&Ids.
Update essential Micon loop sheets.
Instrument installation details.
Power Plan
Update essential one-line diagram.
Motor control diagrams.
Update essential Micon elementary diagrams.

- Fire Protection
  FCP Wiring Diagram 2736-ZB
  Duct Detector Installation Details 2736-ZB
  Sprinkler Installation Details 2736-ZB
  As-Built Sprinkler Plan 2736-ZB
  Fire Detector Installation Details 2736-Z
  Underground Fire Main Restraint Details
  Backflow Preventer/Hot Box Details Yard
  Backflow Preventer Details Office Structure
  PIV/Yard Main Details Office Structure

MISCELLANEOUS

- Prepare construction specifications establishing the functional requirement of the selected equipment and components for both the 2736-Z and 2736-ZB facility.
- Prepare procurement specification for the office structure.
- Perform field walk downs which will consist of gathering dimensional and photographic data and determine any impact from reviewing the ACDR design package. The compiled information will be used for the finalization of the design.
- Evaluate and incorporate all relevant comments received from both the internal and customers review.
- ACDR reviews will be provided at the 60% and 90% points in the development of the report. B&W Hanford will provide consolidated comments on Review Comment Record (RCR) forms. Disposition of all comments will be documented on the RCRs.

- Provide Fire Protection input to the specification for sprinkler upgrades, fire alarm upgrades, and other fire protection systems.

- Update the FSAR for PFP to reflect the W-460 project.

- Prepare Acceptance Test Procedures for:
  Dry air system
  Helium system
  SPS exhaust system
  Electrical systems

- Provide Fire Hazards Analysis (FHA) for SPS Upgrade and New Office Structure.

DESIGN SUPPORT SERVICES

- Final project cost estimate
- Final project schedule
- Prepare master submittal list
- Document control for issuing documents
- Technical Documents for preparation of specification and procedures

ENGINEERING AND INSPECTION DURING CONSTRUCTION

During construction engineering will provide the following services.

- Acceptance inspection of construction activity as required by the inspection plan.
- Witnessing of all ATPs.
- Review and approval of submittals
- Preparation, review, and approval of engineering changes required during construction.
- Review, disposition, and approval of nonconformance reports.
- Safety, environmental, and quality assurance support of engineering activities.
- As-builting of project drawings at completion of construction.

ASSUMPTIONS

- A new prefabricated, site assembled, office structure will be procured by specification.
- All design work will be done in accordance with the safety class determinations as stated in the FDC and safety analysis documents. See table 1 of the CDR for a component listing of safety class designation.

DESIGN CRITERIA

The Definitive Design shall comply with the criteria specified in the CDR.3.

Engineering Statement of Work

Advanced Conceptual Design
Project W-460
Plutonium Stabilization and Handling

Customer : Babcock & Wilcox Hanford Company W.O. No. : E55631
Prepared by: Charles O'Neill Date: January 15, 1996

PROJECT SCOPE

Project W-460, "Plutonium Stabilization and Handling," (PuSH) encompasses several related actions to ensure the safe storage of the plutonium remaining at Hanford's Plutonium Finishing Plant (PFP) for up to fifty years. The major sections of the project are:

- Site Preparation
  A site selection study chose Rooms 641 and 642 in Building 2736-ZB to house the SPS. The rooms will be combined into one, with a small control room located in an adjacent area of the building. Structural preparations such as temporary large equipment access will be made. Various facility work areas will be relocated, with some non structural modifications, to allow all needed tasks to be carried out.

  Capacities of facility ventilation systems will be verified and enhanced if necessary. Configuration of the systems will be modified if necessary to provide appropriate separation of facility and process enclosure ventilation. The capacity of utilities and support systems required for operation of the SPS and of the modified vaults will be verified; for existing utilities such as electrical power, reconfiguration or enhancement may be required. Utilities not currently available or of insufficient capacity at 2736-ZB such as nitrogen gas, bottled laser gases or dry air will be supplied by this project.

- SPS Procurement, Installation and Testing
  Via the common procurement agent (DOE-OAK), the design of the prototype SPS unit (to be tested at Rocky Flats during 1997) will be modified to suit Hanford's needs, constructed, installed and tested. It is anticipated that the vendor will install the SPS equipment. The system design may utilize surplus equipment currently at the Hanford Site if feasible, e.g. a glovebox for size reduction of impure oxide forms.

  Within the SPS, items to be procured will include approximately thirteen gloveboxes and fume hoods with associated ventilation and service connections, stabilization and laboratory furnaces (a total of three are anticipated), a laser welding machine with

multiple waveguides, a variety of automated material movement equipment and a system control unit. An initial order of packaging components will be procured for equipment testing and qualification.

Technical requirements for this phase of the Project are detailed in Appendix B and governed by the PuSAP contract. The Hanford portion of the contract is managed by a Contracting Officer's Representative (COR) appointed by the Project Management Division of RL.

- Vault Modification

  Secure vault storage fixtures in Building 2736-Z will be modified to accommodate the 3013 packages sealed in the SPS. A minimum of two vault rooms must have fixtures modified to hold the existing inventory, as the portion of the PFP inventory under agreement with the IAEA must be maintained physically separate from the rest of the inventory. The storage configuration will be determined based on requirements of domestic and international security. Security equipment and data management configuration (seals, item identification equipment, database connections, etc) will be also modified as needed. The 2736-Z facility ventilation systems will be enhanced if necessary.

  Significant operational sequencing will be required to allow construction access while minimizing radiological dose to construction and operational workers and maintaining required physical security. Consolidation of the inventory now in vault storage to allow an empty room prior to construction of new vault storage fixtures will require advance planning and creativity. Any temporary storage modifications will be designed, installed and removed by this project.

- Control and Laboratory Equipment Additions

  Surveillance equipment and international safeguards equipment currently in Room 642 will be relocated within Building 2736-ZB to make space for the SPS unit.

  Laboratory equipment for non-destructive assay (NDA) of 3013 packages will be purchased and installed in the 2736-ZB NDA laboratory, Room 637. One to three (based on planned SPS throughput rates) calorimetry units will be purchased to accommodate the new package configuration, along with a pre-equilibration bath if deemed necessary. The gamma scan unit will be updated, and a second unit will be purchased if required to handle SPS throughput rates. Based on discussions with the PuSAP task team, space for a radiography unit capable of determining weld signatures and contents baselining will be set aside as a good practice item. Site preparation for these items will be undertaken in sequence to minimize disruptions to NDA laboratory operations.

REFERENCES

Functional Design Criteria, "Plutonium Stabilization and Handling," Project W-460, FDH-SD-CP-FDC-005, Rev 1 December 10, 1996.

System Specification for the Plutonium Stabilization and Packaging System (PuSAP), Contract No. DE-AC03-96SF20948, May 1996.

System Design Document for the Plutonium Stabilization and Packaging System, Contract No. DE-AC03-96SF20948, May 1996.

Conceptual Design Report, "Plutonium Stabilization and Handling," Project Q-460, FDH-SD-CDR-001, Rev.0, January 15, 1997.

ADVANCED CONCEPTUAL DESIGN SCOPE

The advanced conceptual design will focus on reviewing two areas that were addressed in the conceptual design.

REVIEW IMPACT OF FINAL SPS DESIGN ON THE CDR

The final design drawings and specifications for the prototype SPS at Rocky Flats will be available for review. This information will be reviewed to determine the impact to the CDR.

REVIEW IMPACT TO THE 2736-Z AND 2736-ZA BUILDINGS OF THE PREFERRED STORAGE CONCEPT

The preferred storage concept for the vault was not determined before completion of the CDR. The ACDR will further develop the preferred concept to refine the cost estimate and identify design criteria. The ACDR will also review how the concept that is chosen affects the existing HVAC and electrical systems in the 2736-Z and 2736-ZA buildings.

MISCELLANEOUS

Develop the concept for the 3013 canister handling machines for the NDA lab and the vault.

Participate in the Fire Hazard Analysis for the 2736 Complex.

Review impact of Safety Classification of the SPS and systems on the CDR.

Revised Outline Specification.

CALCULATIONS

- Provide preliminary calculations supporting the structural modifications required to provide an entry point for the SPS.
- Provide preliminary HVAC calculations to determine additional heating and cooling requirements of the 2736 ZB Building.

SKETCHES

- Civil/Structural sketches of the vault modifications based on the preferred storage concept.
- Revised architectural layout sketches of the 2736 ZB Building and the office trailer.
- Revised engineering sketches showing the location of the HVAC equipment, components, ductwork, and the ductwork connections with the SPS.
- Revised electrical one-line diagrams:

  The existing 480 volt normal power supply one line diagram modified to supply the PuSAP equipment.

  The existing 480 volt standby power supply one line diagram modified to supply the PuSAP equipment.
- Revised flow diagram for instrument air and bottled inert gas distribution for the SPS equipment.

MISCELLANEOUS

- Revise the outline specifications as required.
- Constructibility review during the 60% design review.
- Total project cost estimate at the completion of the advanced conceptual design.
- A final project schedule at the completion of the advanced conceptual design.

- Project Management and Design Administration will provide daily management of project activities including planning, scheduling, estimating, and technical direction.

- As-build existing drawings at start of advanced conceptual design

ASSUMPTIONS

- Planning for the ACDR is based upon the scope as defined by the project FDC and CDR.

- The HVAC design will be a Safety Significant system.

- BWHC will screen design review comments and submit them on RCR forms.

- BWHC will provide escorts for job walks. Job walks will be coordinated to minimize the impact on PFP operations.

- Detailed design for the Rocky Flats SPS will be provided at the beginning of the advanced conceptual design.

- An FHA for the existing building has been done by others and has been submitted for approval. Preliminary FHA for this project is limited to the new office structure and the affect of the new SPS system on the previously prepared FHA. Preliminary FHA will be finalized during definitive design.

DESIGN CRITERIA

The ACDR shall comply with the criteria specified in the CDR.

STATEMENT OF WORK
PROJECT W-460 - PROJECT MANAGEMENT
PREPARED BY: G. A. Johnston
DATE: January 10, 1997

PROJECT SCOPE

Project W-460, Plutonium Stabilization and Handling (PuSH) encompasses several related actions to assure the safe storage of plutonium remaining at Hanford's Plutonium Finishing Plant (PFP). The scope of this project is to procure and install a Stabilization and Packaging System (SPS) via a DOE national procurement. Facility infrastructure will be modified to support the SPS and the new storage container configuration. Building 2736-ZB will be modified to house the SPS and accommodate the new process. Building 2736-Z will have the necessary vaults modified to handle the new standardized storage containers.

STATEMENT OF WORK (SOW) SCOPE

This SOW identifies the Project Management (PM) services to be provided by the Architect-Engineer Construction Manager (AECM) to support Project W-460 for those activities that will be covered by capital funding and be reflected in the Total Estimated Construction Costs (TECC). Separate documents have addressed the expense funded Project Management tasks which will be reflected in Other Project Costs (OPC). The activities addressed by this SOW will commence with project authorization and cover the definitive design, procurement, construction, testing, and project close out phases of the project.

The immediate customer contracting for these services will be the Facility Stabilization Project Performance Contractor. The Performance Contractor will direct all activities implementing project tasks and negotiate budget, schedule, scope, and performance measures with the Project Hanford Management Contractor (PHMC). The PHMC will in turn provide high level management and integration with the overall site and a contractual interface with the Department of Energy Field Office, Richland (RL).

The AECM PM will be directly responsible to the Performance Contractor for the quality, safety, scope, schedule, and cost objectives of the project. The AECM PM will be responsible for the hands on management of the day-to-day project activities and provide a focal point for project ownership and accountability.

DELIVERABLES

The general AECM Project Management deliverables applicable through all project phases will be identified first followed by tasks applicable to a specific project phase.

1. General

A. Establish project record files and provide appropriate client distribution of all project associated correspondence, reports, design drawings, nonconformance reports, plans and schedules, cost estimates, Quality Assurance (QA) programs and related audits, Engineering Change Notice (ECN), subcontracts, work orders, supplements, minutes of meetings, test procedures, and photographs, etc.
B. Provide timely client notification of meetings, acceptance tests, and final inspections (with agenda when applicable).
C. Provide immediate client notification of accidents, incidents, significant problems, work stoppages, etc.
D. Generate a monthly project report detailing the status of cost and schedule and identifying any outstanding issues with the associated impacts and planned resolutions.
D. Provide information to support the RL Management Review Meetings (MRM) and represent the Performance Contractor at these meetings.
E. Support project revalidation as needed.
F. Generate Letters of Instruction (LOI) for client signature to provide authorization and funding for specific project tasks.

2. Design Phase

A. Schedule and chair a Definitive Design kick-off meeting.
B. Schedule and attend value engineering sessions as needed to support or define a design direction.
C. Establish and chair a weekly internal AECM Design Discipline Lead meeting to track progress and assure communications.
D. Provide a focal point for the Discipline Leads to interface with the Facility to obtain design inputs.
E. Establish bi-weekly design progress meetings with the client and issue meeting minutes.
F. Manage design costs and schedule compliance.
G. Assure compliance with the technical criteria established by the client. Provide ongoing documentation of the technical basis for the design as it evolves based upon client and vendor inputs.
H. Generate change control documentation and obtain approvals as needed for changes to cost, schedule, and scope baselines that exceed threshold levels.
I. Establish the appropriate level and type of design reviews required. Schedule and chair client reviews for 30%, 60%, and 90% design packages. Provide comment resolutions and assure that the resolutions have client concurrence.
J. Manage internal AECM and Subcontractor resources to support other aspects of the design phase such as fair cost estimates, constructibility reviews, contracts, specifications, definitive design project estimate, reproduction, and text documents.

K. Coordinate with client Environmental Permitting organizations to assure that the permitting actions are supporting project objectives.
L. Assure that cost effectiveness is stressed in the project design and construction, and that life cycle cost analysis, as appropriate, is a basis for design selections and decisions.
M. Provide a focal point for interface between the SPS vendor and the ongoing design for the infrastructure upgrades to support this system.
N. Track SPS vendor progress to assure compliance with project objectives.

3. Construction

A. Schedule, chair, and document construction kick-off meetings.
B. Schedule, chair, and document weekly construction progress meetings with the client and construction contractor.
C. Manage construction costs and schedule.
D. Generate change control documentation and obtain approvals as needed for changes to cost, schedule, and scope baselines that exceed threshold levels.
E. Manage the internal AECM resources providing engineering during construction and Title III Inspection services.
F. Provide a direct interface with Facility Operations to assure integration between the Construction Contractor and the Facility and provide a focal point to both to resolve issues.
G. Coordinate obtaining construction permits from the Facility for the contractor.
H. Review and coordinate the approval of Construction Contractor submittals from the client and AECM Engineering.
I. Coordinate the SPS Vendor fabrication and installation with the Construction Contractor and the Facility.

4. Testing and Close Out

A. Schedule, participate in, and obtain client approval of acceptance testing, punchlist walkdowns, and acceptance of completed systems for operation.
B. Support client project startup readiness reviews as needed.
C. Assure accurate completion of as-built drawings.
D. Prepare the project close out documents and obtain the required approvals.
E. Arrange for disposition and/or storage of project records.

STATEMENT OF WORK
PROJECT W-460
OTHER PROJECT COSTS
Prepared by: G. A. Johnston
Date: January 27, 1997

PROJECT SCOPE

Project W-460, Plutonium Stabilization and Handling (PuSH) encompasses several related actions to assure the safe storage of plutonium remaining at Hanford's Plutonium Finishing Plant (PFP). The scope of this project is to procure and install a Stabilization and Packaging System (SPS) via a DOE national procurement. Facility infrastructure will be modified to support the SPS and the new storage container configuration. Building 2736-ZB will be modified to house the SPS and accommodate the new process. Building 2736-Z will have the necessary vaults modified to handle the new standardized storage containers.

STATEMENT OF WORK (SOW) SCOPE

This SOW identifies expense funded activities performed by, or under the direction of, the Facility Stabilization Project Performance Contractor. These are activities directly associated with the implementation of the project that are not capital costs included in the Total Estimated Construction Cost (TECC). These type of activities are identified as Other Project Costs (OPC).

Refer to Table 1 at the end of this SOW for a general matrix of the overall activities associated with Project W-460 and which are considered OPC. OPC costs normally span projects from RL approval as a candidate project through turnover of the project for operational use. In the case of W-460 there are several phases of construction related to vault modifications that are contingent upon operational use of the SPS to allow access to vault rooms for construction. The OPC will not include any of the operational costs associated with these process campaigns.

DELIVERABLES

The deliverables for this section will be broken out under the general project phase. Many of the items listed deal with the client review associated with the design. These are necessary reviews to assure that the design properly interfaces with existing plant equipment and procedures (fit and function) and to assure that the user will be satisfied with the end product. The remaining items fall into two general categories which are nondedicated Facility personnel support for the project construction activities and the actions necessary to integrate the project into the existing Facility Operations.

1. Conceptual Phase

The Facility Stabilization Project Performance Contractor shall fund and direct the following activities that will be reflected as OPC:

- Preparation of a Functional Design Criteria document.
- Preparation of a Conceptual Design Report.
- Preparation of a Preliminary Safety Evaluation.
- Preparation of a Quality Assurance Program Plan.
- Preparation of a Project Management Plan.
- Project validation.
- Preparation of an Advanced Conceptual Design.

2. Definitive Design Phase

The Facility Stabilization Project Performance Contractor shall fund and direct the following activities supporting the Definitive Design that will be reflected as OPC:

- Cognizant Facility personnel will be made available to provide design input and review services for all phases of the design.
- A Fire Hazards Analysis will be generated for the new stabilization and packaging process being implemented in 2736-ZB.
- A Security Plan will be generated to detail how secure areas will be maintained during construction.
- Support the development of the appropriate level of safety documentation.
- Generate and coordinate the approval of regulatory permits to support the start of construction.

3. Procurement Phase

The Facility Stabilization Project Performance Contractor shall fund and direct the following activities supporting the DOE-OAK procurement of the SPS:

- A cognizant Facility person will be designated as the "Contracting Officer's Technical Representative" in support of the DOE-OAK procurement office.
- Appropriate Facility personnel will be made available to provide input to the vendor and review the equipment design.

4. Construction Phase

The Facility Stabilization Project Performance Contractor shall fund and direct the following activities supporting construction:

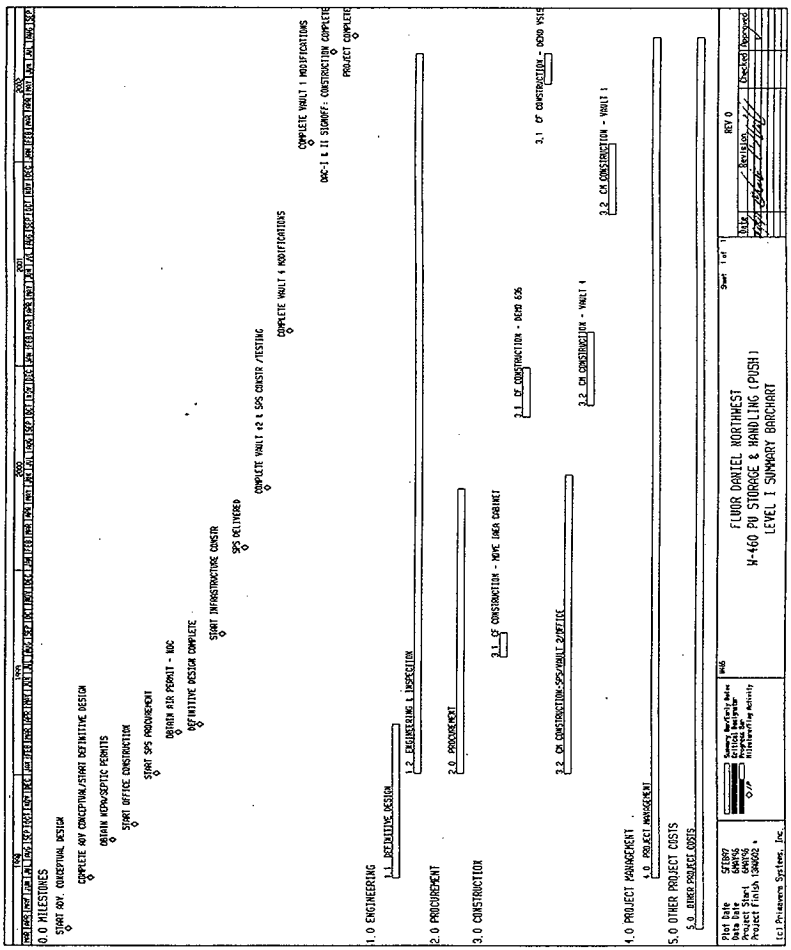
- Provide Operations personnel as needed to support the construction contractor.
  - Relocate Facility equipment and materials as needed to allow access for construction.
  - Support lock and tag of equipment.
  - Configure the Facility systems as needed to allow tie-ins and testing.
  - Provide solid waste disposal services were necessary.
  - Decontaminate the Room 636 glovebox prior to demolition.
  - Support tours for contract bids.
- Provide Facility Planning resources as necessary for the preparation of work control packages for potentially hazardous tasks such as the demolition of the Room 636 glovebox and for overall integration with other Facility activities.
- Arrange for support from Safeguards and Security (SAS) personnel for the SAS related modifications being performed.
- Schedule maintenance resources for performance tests of installed or relocated HEPA filters.
- Schedule the Hanford Fire Department to support fire system modifications and tie-ins.
- Schedule and escort the IAEA to witness the relocation of the IAEA monitoring cabinet and installation of IAEA barriers which require their witness.
- Provide Radiological Control Technicians to support the Room 636 glovebox demolition, other interior demolition, or exterior excavations as needed.
- Provide escorts for vendor technical representatives to support the installation portion of the DOE-OAK procurement.
- Schedule the Hanford Patrol to provide coverage when Vault boundaries are compromised for construction activities such as:
  - Penetration of the Room 642 East wall for a new equipment door.
  - Penetration of the Room 638 roof for HVAC duct.
  - Routine opening of Door 11 in the 2736-Z for construction access for vault room modifications.

5. Testing and Start-Up

- Provide personnel to witness and support the acceptance testing of the SPS and construction contractor.
- Prepare maintenance and operating procedures to accommodate the new system and associated infrastructure modifications.
- Provide Operational and Engineering personnel with training on the new system.
- Perform an Operational Readiness Review to support start up of the new system.
- Provide the planned quantity (2,425 containers) of "3013" containers to support the testing and processing.

APPENDIX D

Conceptual Project Schedule


1998
1999
2000
2001
2002
0.0 MILESTONES
START ADV. CONCEPTUAL DESIGN
COMPLETE ADV CONCEPTUAL/START DEFINITIVE DESIGN
OBTAIN NOW-SEPTIC PERMITS
START OFFICE CONSTRUCTION
START SPS PROCUREMENT
OBTAIN AIR PERMIT - NOC
DEFINITIVE DESIGN COMPLETE
START INFRASTRUCTURE CONSTR
SPS DELIVERED
COMPLETE VAULT #2 & SPS CONSTR /TESTING
COMPLETE VAULT 4 MODIFICATIONS
COMPLETE VAULT 1 MODIFICATIONS
DOE-I & II SIGNOFF: CONSTRUCTION COMPLETE
PROJECT COMPLETE
1.0 ENGINEERING
1.1 DEFINITIVE DESIGN
1.2 ENGINEERING & INSPECTION
2.0 PROCUREMENT
2.0 PROCUREMENT
3.0 CONSTRUCTION
3.1 CF CONSTRUCTION - MOVE DATA CABINET
3.1 CF CONSTRUCTION - ROOM 606
3.1 CF CONSTRUCTION - ROOM 956
3.2 CM CONSTRUCTION-SPS/VAULT 2/OFFICE
3.2 CM CONSTRUCTION - VAULT 4
3.2 CM CONSTRUCTION - VAULT 1
4.0 PROJECT MANAGEMENT
4.0 PROJECT MANAGEMENT
5.0 OTHER PROJECT COSTS
5.0 OTHER PROJECT COSTS
Plot Date 5FEB97
Data Date 04MAY96
Project Start 04MAY96
Project Finish 13NOV02
(c) Primavera Systems, Inc.
Summary Activity
Critical Activity
Noncritical Activity
Milestone/Key Activity
WBS
FLUOR DANIEL NORTHWEST
W-460 PU STORAGE & HANDLING (PUSH)
LEVEL I SUMMARY BARCHART
Sheet 1 of 1
REV 0
Date
Revision
Checked
Approved

APPENDIX E

Outline Specification

OUTLINE SPECIFICATION

DIVISION 2 - SITEWORK

Section 02220 Excavating, Backfilling, and Compacting

1. Excavation for underground pipe and conduit.
2. Excavation for underground fiberglass sewage holding tanks.
3. Structural backfill, compacted: WSDOT M41-10, Section 2-03.3(14)C.
4. Sand bedding for underground pipe and conduit: ASTM D 653.
5. Plastic sheet marker for buried pipe and conduit.
6. Stabilization of disturbed areas.

Section 02650 Piped Utilities

1. Buried sanitary piping: Polyvinyl chloride (PVC) plastic pipe, AWWA C900. Design, AWWA M23. Installation, AWWA M23 and NFPA 24.
2. Fittings: Ductile iron, AWWA C110; cement-mortar lined, AWWA C104. Installation, NFPA 24.
3. Valves: Provide with adjustable cast iron valve boxes.

Section 02668 Fire Water Systems

1. Restraints: Pipe restraints shall be in accordance with NFPA 24, Article 8-6 and A-8-6-2.
2. Pipe, Pipe Joints, and Fittings: Pipe, pipe joints and fittings shall be in accordance with NFPA 24 and listed in UL Fire Protection Equipment Directory or FM Approval Guide.
3. Backflow preventer: Reduced pressure type, 6 inch, FEBCO model 825YD OS&Y, or approved substitute. Equivalent assembly shall be a model included on current list of State of Washington, Department of Health, Approved Backflow Prevention Assemblies.
4. Backflow preventer enclosure: HYDROCOWL model 600T-AL or approved substitute with 2 kW electric heater.

Section 02730 Sanitary Sewerage

1. Pipe: PVC, ASTM D 3034, SDR 35 or ductile iron, AWWA C151, Class 50; cement-mortar lined, AWWA C104.

DIVISION 3 - CONCRETE

Section 03300 Cast-in-Place Concrete

1. Concrete minimum strength: 3000 psi at 28 days.

2. Reinforcing steel: ASTM A 615/A 615M, deformed, Grade 60.

3. Concrete forms: Wood, steel, or plywood.

DIVISION 6 - WOOD AND PLASTICS

Section 06100 Rough Carpentry

1. Interior wall framing for office structure: Seasoned framing lumber with 19 percent maximum moisture content.

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

Section 07200 Insulation

1. Wall insulation for office structure: Mineral fiber batts with aluminum foil vapor barrier on one side. Interior partition cavities, R-11 minimum, (R-19 in Compressor Building) exterior walls, R-19 minimum, roof insulation: R-30 minimum.

Section 07460 Metal Siding and Interior Wall Flat Liner Panels

1. Compressor Building structure: 24 gage prefinished steel liner panels.

Section 07900 Joint Sealers

1. Sealants: Nonfirestopping and firestopping system.

DIVISION 8 - DOORS AND WINDOWS

Section 08100 Metal Doors and Frames

1. Interior doors for 2736-ZB: Seamless standard metal doors, 1-3/4 inch thick, 0.0478 inch (18 gage), SDI 100 and 108.

2. Frames for all doors: Standard metal frames, 0.060-inch (16-gage) cold-rolled steel.

Section 08210 Wood Doors

1. Interior doors for office structure: 1-3/4-inch flush, 20-minute fire-rated interior doors.

2. Frames: See Section 08100.

Section 08316 Vault Doors

1. Exterior doors to rooms 641/642.
2. Exterior door at new entry airlock.

Section 08710 Door Hardware

1. Door closers: BHMA A156.4
2. Exit devices: BHMA A156.3
3. Hinges: BHMA A156.1
4. Bored and pre-assembled locks and latches: BHMA A156.2.
5. Door pulls, kick plates, thresholds, and push plates: BHMA A156.6
6. Wall or floor stops: BHMA A156.16
7. Door seals.

Section 08800 Glazing

1. Office structure: Insulated reflective glass.

DIVISION 9 - FINISHES

Section 09250 Gypsum Board

1. Metal studs: 3-1/2 inch, 0.040 inch (20 gage).
2. Standard board: 5/8 inch.
3. Fire-retardant board: 5/8 inch, Type X.
4. Water resistant board: 5/8 inch, Type MR.
5. Suspended ceiling framing (File Cabinets Storage, Rest and Change Rooms): Cold rolled channels and metal furring.
6. Hangers, ties, and clips: Galvanized, annealed, wire.

Section 09500 Acoustical Treatment

1. Corridor and office ceilings for office structure: ASTM C 653 metal tee-grid suspended system and ASTM E 1264, 2- by 4-foot fire-rated lay-in panels with noise reduction coefficient range of 0.60 to 0.70.

Section 09540 Special Wall Surfaces

1. Restrooms: UL Class A fiberglass reinforced plastic panels.

Section 09650 Resilient Flooring

1. Office structure, lunch room, restrooms: Sheet vinyl, FS L-F-475. Vinyl wall base, FS SS-W-40 except in shower areas and restrooms, where vinyl sheet will be coved 5 inches up the wall.

Section 09680 Carpet

1. Office structure: Tufted, level loop, Class A, 28 ounce, continuous nylon filament with permanent static control, adhesive attached.

Section 09805 Special Protective Coating

1. 2736-ZB floors: Aliphatic polyurethane.

2. Primers, thinners, and coating materials shall be produced and approved for use by same manufacturer as finish coating system.

Section 09900 Painting

1. Furnish materials identified in PDCA Architectural Specification Manual, Chapters 5, 6, and 7 for scheduled systems.

2. Furnish ready-mixed materials.

3. Paint new nonfactory-finished materials 2 coats over primer coat.

DIVISION 10 - SPECIALTIES

Section 10160 Metal Toilet Compartments

1. Doors, partitions, screens: 1-inch thick steel face panels.

Section 10400 Identifying Devices

1. Door signage: Non-illuminating.

Section 10500 Lockers

1. Lockers: Single, 12 by 18 by 3 feet high, stacked 2 high.

2. Benches: Hardwood seats and tubular steel pedestals.

Section 10522 Fire Extinguishers, Cabinets, and Accessories

1. Portable fire extinguishers, wall mounted.

Section 10800 Toilet and Bath Accessories

1. Paper towel dispensers.

2. Waste receptacles.

3. Toilet paper holders.

4. Mirrors.

5. Soap dispensers.

6. Sanitary napkin dispensers.

7. Sanitary napkin disposer.

8. Coat hooks.

9. Toilet seat cover holders.

DIVISION 12 - FURNISHINGS

Section 12302 Wood Casework

1. Office structure lunchroom cabinets: FS L-P-508, 0.050-inch laminated plastic face, general purpose.

DIVISION 13 - SPECIAL CONSTRUCTION

Section 13122 Metal Building Systems

1. Compressor Building.

Section 13440 Instrumentation

1. Pressure Measuring Instruments: Provide instruments consisting of individual instrument loops of compatible devices.

2. Isolation and modulating valves for SPS exhaust ventilation system shall have entirely electric/electronic actuators and positioners.

DIVISION 15 - MECHANICAL

Section 15140 Supports and Anchors

1. Provide supports of plumbing piping and HVAC ductwork meeting ICBO UBC Seismic Zone 2B.

Section 15190 Mechanical Identification

1. Identify piping and equipment.

Section 15260 Piping Insulation

1. Thickness: In accordance with standards for hot water and cold water piping.

Section 15280 Equipment Insulation

1. Thickness: In accordance with energy standards for hot water heaters and HVAC equipment.

Section 15290 Ductwork Insulation

1. Thickness: In accordance with energy standards for HVAC ductwork.

Section 15300 Fire Protection

1. Pipe and fittings: In accordance with NFPA 13, Schedule 40 steel, threaded or grooved type (rubber gasketed).

2. Flexible and rigid couplings: Bolted sleeve type for use with grooved-end pipe, with rubber rings for sealing.

3. Concrete expansion anchors: FS FF-S-325, wedge type; Hilti Fastening Systems "Kwik-Bolt II," ITW-Ramset "Trubolt Wedge Anchor," or approved substitute. Plug type anchors, set by driving anchor bodies into holes and over plugs, shall not be used.

4. Firestopping materials: Select for a 2-hour rating.

5. Fire dampers: Select for a 1½-hour rating.

6. Fire doors: Select for a 1½-hour rating.

7. Automatic Sprinklers: Nominal 15-mm (1/2-inch) diameter orifices, rated for ordinary temperature classification.

8. Protection of gloveboxes and HEPA filters will be provided if required by the FHA.

Section 15400 Plumbing

1. Fixtures: Comply with Energy Policy Act of 1992 for equipment and the low flow requirements of this report.

Section 15493 Chemical Process Piping Systems

A. Materials

1. Pipe: Pipe Code M-31, 1.5 inch, 304L stainless steel.

2. Valves: Flanged ball valves for on/off service, 316 stainless steel.

3. Supports: Stainless steel shapes, ASTM A 276, Type 304 or 304L.

B. Equipment

1. Air compressor: Sullair Model LS-40L, single stage, rotary screw, frame mounted compressor. Air cooled lubrication system with 10 micron filter and filled with Sullube 32. Air/oil separator. 40 hp motor, 480 volt. 150 scfm at 115 psi. Included options: motor starter, air-cooled aftercooler, sequence solenoid valve, and Supervisor II solid state control.

2. Air dryer: Great Lakes Air Inc. Model GEH-250. 250 scfm at 100 psig. Minus 40 °F dew point air output.

3. Coalescing air filter: Great Lakes Model GC-350A. Differential pressure gages and automatic drains.

4. Particulate air filter: Great Lakes Model GP-600A. Differential pressure gages and automatic drains.

5. Air receiver: Brunner MFG. Co. Vertical air receiver. 660 gallon capacity, pressure gage, safety relief valve, and auto drain.

Section 15500 Heating, Ventilating, and Air-Conditioning

A. Materials

1. Exhaust Rectangular Duct-work:

   a. Stainless steel sheet: ASTM A 240, Type 304 or 304L.

   Supply Rectangular Duct-work:

   b. Carbon steel: ASTM A 569.

2. Rectangular Duct-work Reinforcements:

   a. Stainless steel sheet: ASTM A 240, Type 304 or 304L.

   b. Carbon steel: ASTM A 36.

3. Supports:

   a. Carbon Steel shapes: ASTM A 36.

   b. Stainless steel shapes: ASTM A 276, Type 304 or 304L.

4. Insulation: UL listed in the Building Materials Directory, and carry the UL label.

   a. Insulation and adhesive shall have a UL fire hazard classification of 25 maximum for flame spread and 50 maximum for smoke developed.

b. Rectangular Duct Insulation: Armstrong Armaflex II sheet insulation, 2 inch thick having a thermal conductivity of 0.28 Btuh/inch/ft^2/°F at a 75 °F mean temperature.

c. Pipe Insulation: Armstrong Armaflex II, 2 inch thick having a thermal conductivity of 0.27 Btuh/inch/ft^2 at a 75 °F mean temperature.

5. Supply Air Rectangular Duct-work and Fittings.

a. Duct-work and fittings shall be constructed in accordance with SMACNA HVAC Duct Constructions Standards First Edition 1985. The duct-work shall be galvanized 20 gage.

b. Flexible duct-work shall be in accordance with SMACNA HVAC Duct Construction Standards First Edition 1985.

6. Process Exhaust Rectangular Duct-work and Fittings.

a. Rectangular duct-work and fittings shall be 12 gage welded construction, all sheet metal seams shall be seal welded.

b. Non-process exhaust duct-work and fittings (Office trailer rest room) shall be constructed in accordance with SMACNA HVAC Duct Constructions Standards First Edition 1985. The duct-work shall be galvanized 20 gage.

7. Process Round Exhaust Duct-work and Fittings.

a. Round exhaust duct-work and fittings shall be stainless pipe schedule 5S.

b. Flanges shall be 125 pound lightweight slip on flanges.

B. Equipment

1. Exhaust Fan: Twin City Fan and Blower Company centrifugal exhaust fan. The fan shall be painted carbon steel, arrangement 9 or 10. The fans shall meet the requirements of ASME N509. The fan shall be furnished with radial inlet damper and electric actuator. The fan shall be furnished with a radial type high efficiency wheel for handling clean air. The fan shall be equipped with vibration isolation mounts, a drain in the bottom of the fan scroll, an access door, and have a flange inlet and outlet, and a external vane inlet damper with electric actuator. The fans shall be equipped with AMCA labels. The fan shall be rated at 400 cfm at 10 inch wg. The motor shall be in accordance with NEMA MG 1 and have a premium efficiency classification.

2. HEPA Filter Housings: Flanders filter housing bag-in -bag-out, model E-6 bag-out containment housing gasket seal. Model number E-1x1-GG-F-(304)-R type 1. The filter housing shall be one filter high by one filter wide (1 x 1), the filter housing shall be

rated at 1000 cfm. The filter housing shall be all welded construction, welding shall meet the requirements of ASME-N-509-1989, paragraph 7.3. The filter housing shall be constructed per ASME N-509-1989 and tested per ASME-N-510-1989. Filter housings shall be constructed from 11 and 14 gage 304 Stainless steel. The filter housings shall be furnished with inlet test sections (TI) test section down stream of the first stage of HEPA filters (TC) and a test section down stream of the second stage (TO).

The filter housing shall be furnished with static pressure ports, aerosol test ports, 1-inch welded coupling (drain) to the bottom of the filter housing located in the center of the housing. (See Drawing for arrangement and number of stages.)

3. HEPA Filters: Having metal frames, 24 inch by 24 inch by 11.5 inch, be rated at no less than 1000 cfm with a clean pressure drop of 1 inch wg and meet the requirements of ASME N-509.

4. Isolation Valves: Keystone figure AR1. Resilient seated/general purpose valve. 10 inch diameter. The body shall be ductile iron, the disc shall be electroless nickel coated ductile iron, and have a phosphate treated steel stem, the resilient seat shall be EPDM, the stem bushing shall be acetal and have 316 stainless steel screws, the "o" ring and stem packing shall be buna-n. Furnish with a gear operator. The valve shall meet the requirements of ASME N-509.

5. Rectangular Manual Dampers: Ruskin model MD-35 opposed blade. Sizes vary.

6. Round Manual Dampers: Ruskin model CDR82 heavy duty control damper. Sizes vary.

7. Pressure Gages: Dwyer series 2000 Magnahelic, Model 2006, range 0 to 6 inch wg for the HEPA filters and model 2001, range 0 to 1 inch for monitoring room pressure.

8. Recirculating Unit, Room 636: Carrier model 40QYB fan High Wall fan coil unit rated at 24000 btuh furnished with a model 38-HDC-024 condensing unit. The fan coil unit shall be furnished with accessible filters, condensate pump, and thermostat with sub-base.

9. Heat Pumps for Office Trailer: Bard, Wall mounted Hi-Boy Heat Pump, model WH602-C rated at 56,500 btuh cooling, 58,000 btuh heating, 1650 cfm at 0.5-inch wg external static pressure. The Hi-Boy heat pump shall be mounted externally on the outside wall of the office trailer. Furnish with rain hood, economizer, mounting brackets, and a 12-KW supplemental electric resistance heater. Pre-filters for Heat Pumps shall be FARR 30/30 24 X 24 X 2, Class I 30 Efficient per ASHRAE 52-76 rated air flow 1000 cfm at initial resistance of 0.08 inch wg. (3 Heat Pumps required).

10. Automatic Temperature Controls for Office Trailer: Automatic control setback and shutdown thermostat with manual override feature shall be provided. Each heat pump shall be provided with its own control module.

11. Rest room Exhaust Fan for Office Trailer: Penn Ventilator Company Type Domex centrifugal roof exhauster model AQ24L, 800 cfm at 0.5 inch wg, 1/2 hp motor. Furnish with roof curb.

12. Ceiling Diffuser: Titus, sizes will vary.

13. Exhaust Grilles: Titus, sizes will vary.

14. Chiller/Condensing Unit for Laser Generator: By Rapp Machinery model RAC 18. The unit shall have capacity to cool a Lumonics MW 2000 laser. The unit shall have a rating of 238,900 btuh at a water temp of 68 degrees fahrenheit and outside condensing air temperature of 105 degrees Fahrenheit. The water flow rate to the generator shall be approximately 35 gpm. The chiller/condensing unit shall be mounted out of doors.

15. Exhaust Fan for Compressor Building: Penn Ventilator Company Type Domex centrifugal roof exhauster model DX-14B, 1600 cfm at 1-inch wg, 1/2-hp motor. Furnish with roof curb.

16. Electric Unit Heater for Compressor Building: Chromalox Horizontal Unit Heater, Model LUH-10. Rated at 10 KW, 480 volts 3 phase. Furnish with mounting bracket and self contained thermostat.

17. Outside Louver for Compressor Building: Ruskin model ELM811D, Extruded aluminum Adjustable louver drain-able blade. Louver shall be 48 by 24 inch. Furnish with bird screen.

18. Filter For Compressor Building: Farr Riga-Flo/PH filter 45 percent efficient in accordance with ASHRAE 52-76, size 24 by 24 by 12 inch rated at 1,000 with an initial pressure loss of 0.11 inch wg.

DIVISION 16 - ELECTRICAL

Section 16400 Low-Voltage Distribution

1. Motor Control Center: UL listed and labeled, meeting NEC requirements.

   a. NEMA 1 enclosure, class II, type B wiring, front mounting, standard prefabricated 13-inch deep sections containing motor starter buckets that can be removed without deenergizing the entire MCC. Busses shall be copper, braced to withstand maximum available fault current, but not less than 25,000 symmetrical amperes.

b. Each motor control section shall have its own full length enclosed vertical wireway with hinged access doors and attachment points for cable supports. MCC motor starter buckets shall have "motor circuit protector" type breakers, 120 volt individual starter control voltage transformers, indicating lights, 2 NO and 2 NC auxiliary interlock contacts, and bimetallic or melting alloy type overloads resettable without opening enclosure. Compartment breakers shall be padlockable in the Off position with the door closed.

c. MCC bussing shall be 600 amp, 480 Volt, 3-phase 4-wire, and shall be arranged as shown in the Drawing. Feeder shall enter from the top. MCC shall have separate copper ground bus. Breakers above 100 amps continuous rating, including the main breaker, shall be provided with ground fault protection. MCC shall have a 100 A ground bus and a 300 amp neutral bus.

2. Power Panelboards: UL listed and labeled, meeting NEC requirements, NEMA 1 enclosures.

   a. Busses shall be copper, braced to withstand maximum available fault current, but not less than 25,000 symmetrical amperes, rated 480 Volt, 3-phase 3-wire, suitable for use on B Phase grounded delta, and shall be arranged as shown in Appendix K sketches.

   b. Breakers above 100 amps continuous rating, including the main breakers, shall be provided with ground fault protection. Feeders shall enter from the top. Breakers, including the main breakers, shall be padlockable in the Off position. Panelboards shall have separate copper ground busses.

3. Pad Mounted Outdoor Transformers: UL listed and labeled, meeting NEC requirements, dry type, 60 Hz, of the kVA rating shown on the Drawings with a minimum of 2-1/2 percent taps above and below normal rated primary voltage. Insulation system rated for 185 °C with 40 °C winding temperature rise above ambient.

4. Non-fused Disconnect Switches: UL listed and labeled. Each unit to meet NEC requirements and be rated 480 V ac, 3-phase, 60 hertz in current rating as called out in the sketches. Auxiliary contacts where required shall be rated 120 V ac pilot duty, normally open.

5. Wire and Cable: UL listed and labeled. Power wire to be stranded copper, 600 V THWN or THHN insulation in the sizes shown on the sketches. Control wiring to be number 16 AWG stranded copper 300 V in either single pair or multiple pair shielded as shown on the sketches.

6. EMT, IMT, and rigid galvanized steel conduit: UL listed and labeled.

Section 16721 Fire Alarm and Detection Systems

1. Fire Alarm Control Panel (FCP): Provide Pyrotronics, Model SYSTEM-3, or approved substitute.

2. Battery Backup Power Supply: Rechargeable batteries of heavy-duty, sealed lead acid gelled electrolyte type, designed for fire alarm use in accordance with NFPA 72, with ventilated metal battery housing.

3. Manual Fire Alarm Stations: Double action, nonbreak glass type.

4. Detectors: Provide detectors FCP manufacturer has approved for use with FCP. Detection may be required for the HEPA filters and gloveboxes if required by the FHA.

5. Valve position supervisory switches: Tamperproof, alarm when cover is removed, SPDT, 120 V ac, rated for pilot duty and provided with suitable mounting hardware.

APPENDIX F

Energy Conservation Report and Analysis

Project W-460 has received approval to deviate from DOE Order 6430.1A, "General Design Criteria," energy conservation requirements. The project will use the Washington State Energy Code to show compliance with the intent of DOE Order 6430.1A.

APPENDIX G

Preliminary Safety Evaluation

(Provided under separate cover as
document HNF-SD-W460-PSE-001, Rev. 1)

APPENDIX H

Life-Cycle Cost Comparison Analysis

(The Life-Cycle Cost Analysis for project W-460 will be finalized during Advance Conceptual Design.)

LIFE-CYCLE COST COMPARISON ANALYSIS NITROGEN VERSUS DRY AIR

INTRODUCTION

Project W-460 will purchase a process glovebox system, the stabilization and packaging system (SPS), designed by British Nuclear Fuels Limited, Incorporated (BNFL). The SPS will be installed in the 2736-ZB Building at the Plutonium Finishing Plant (PFP). The glovebox will be used to process and repackage plutonium oxide into a new storage container.

The SPS is based on a prototype SPS being designed for the Rocky Flats Environmental Test Site (RFETS) in Colorado. The RFETS SPS will process plutonium metal and, as a result, it will operate with a nitrogen inert atmosphere inside the glovebox. The PFP SPS will only process plutonium oxide and does not require a nitrogen atmosphere.

Project W-460 proposes to change the atmosphere inside the SPS glovebox from nitrogen to dry air to lower the life-cycle cost of the project.

PURPOSE

The purpose of this analysis is to determine if it is life-cycle cost effective to use a dry air atmosphere in the SPS glovebox instead of a nitrogen atmosphere.

DISCUSSION

Four options were compared for this analysis. Options 1, 2, and 4 use nitrogen as the inert atmosphere and option 3 provides dry air to the glovebox. The four options are described below.

The analysis was done using the BLCC4 computer code using 1996 interest rates. The analysis are based on a 30-year life. The beginning year for the analysis is February 1998. The service date is October 1999. The proposed operating schedule for the analysis is 24 hour, 5 days a week for 7 months. Then, there would be a 3-month shutdown followed by 2 months of operation. Starting with the second year of operation after the service date, the operating schedule would be 1 month a year through the remaining life of the project.

The equipment and nitrogen costs used for the analysis were provided by vendors. The engineering and construction costs are estimates based on experience. Energy costs were calculated at three cents per kilowatt hour.

OPTION 1

Option 1 consists of a nitrogen generator with a liquid nitrogen system for backup. The generator system produces nitrogen using compressed air. It consists of a 300 scfm rotary screw air compressor, nitrogen membrane separator, and a surge tank. The liquid nitrogen backup system consists of a 1500-gal liquid nitrogen tank and a vaporizer.

This system will produce 200 scfm of 96% pure dry nitrogen. The liquid nitrogen provides 10 hours of normal operation for a safe shutdown or up to three days at minimal flows.

This system would be leased from the vendor at a monthly rate that includes maintenance, installation, and removal. The cost of the lease is based on the amount of nitrogen produced and would be approximately $4,216 per month. The lease has a 7-year life and must be renewed every 7 years. Shortening the life of the lease will increase the monthly rate.

The lease includes the backup liquid nitrogen system but does not include the cost of the liquid nitrogen. The cost of the liquid nitrogen is estimated at $1,300 per month.

The cost of the electricity to run this system is $1,845.

The generator and backup tank would be mounted on a concrete pad estimated at $6,500. Electrical installation costs are estimated at $11,000. Piping installation costs are estimated at $50,000.

Engineering costs for this option are estimated to be $30,000.

OPTION 2

Option 2 consists of a liquid nitrogen tank and a gas nitrogen backup system. The liquid nitrogen tank would hold 13,000 gal. The backup systems would be high pressure nitrogen tanks, 2400 psi., mounted on a skid. This system would provide 99.9% pure nitrogen to the process.

The liquid nitrogen system would provide enough nitrogen for 1 month of operation. The backup system would provide enough gas for 1 hour of operation for a safe shutdown.

The cost for this system is $206,000 and includes one 13,000 gal liquid nitrogen tank, two vaporizers, two 8,000-gal nitrogen tanks, and a control panel. The tank would be mounted on a concrete pad estimated at $4,500. Electrical installation costs are estimated at $3,500. Piping installation costs are estimated at $50,000. Installation of the tanks is estimated to cost $10,000.

The liquid nitrogen would be refilled on a monthly basis and the gas nitrogen tanks approximately every 5 years. Liquid nitrogen costs were provided by Air Liquid, the Site provider of liquid nitrogen, at $.47/100 cubic feet. Gas nitrogen costs were also provide by Air Liquid at $1,000 per refill.

This system does not require any significant amount of electricity for operation. Maintenance cost are estimated at $1,000 annually.

Engineering costs for Option 2 are estimated to be $20,000.

OPTION 3

Option 3 consists of a dry air system with redundant air compressor trains to provide backup. Each air compressor train would have an air dryer and filters for independent operation. A common receiver tank would provide for minor fluctuation in flows.

Each compressor would be sized for 150 scfm which would provide sufficient air for normal operation. The dryers would produce air with a minus 40^{O} F dew point.

The cost for this system is $44,000 and installation is estimated at $30,000. The dry air system would be located in a metal building on a concrete slab on grade. The cost for the building including slab is $28,500. Electrical installation costs are estimated at $88,000. Piping installation costs are estimated at $97,000. The estimate includes $100 per month for maintenance during operation and $500 annually thereafter.

The fire protection system costs are estimated to be $35,000.

The cost for electricity is calculated based on a single compressor operation 120 hours per week during operation.

Engineering costs for Option 3 are estimated to be $80,000. This includes $40,000 for BNFL to design the modifications to the SPS.

OPTION 4

Option 4 combines parts of Options 1 and 2. Option 4 would utilize a nitrogen generator during the initial 2 years. After 2 years, the generator lease would be canceled and the generator removed by the vendor. At that time, a 13,000-gal liquid nitrogen tank would be installed for the duration of the 30-year life.

Option 4 was analyzed using two separate cash flows, 4A and 4B. The 4A cash flow is identical to Option 1 through the year 2000 except that the monthly lease amount is higher to account for the shorter life. The 4B cash flow assumes that during the initial engineering for the nitrogen generating system some allowance is

made for the future installation of a liquid system. With this assumption, an additional $10,000 is estimated for engineering to install the liquid tank. The $161,000 cost for the liquid tank and vaporizers is incurred in the year 2000 to provide lead time for procurement.

There will be some piping modifications required, estimated at $5,000. Installation of the tank and vaporizers is estimated at $10,000.

The cost for liquid nitrogen and maintenance would be the same as for Option 2.

RESULTS

The preferred system is Option 3, dry air. It has a 30-year life-cycle cost of $442,000. The next closest option, Option 4, has a life-cycle cost of $619,000.

A number of the assumptions made in this analysis, i.e., piping cost, installation cost, maintenance cost were based on engineering judgement and experience. Some of these costs may be under-estimated due to the lack of any design data for any of the options. However, the purpose of this analysis was to rank the options to determine which was the most cost effective not to calculate the exact life-cycle cost. The large difference in cost between Option 1 and Option 4 indicates that refining the LCCA to reflect actual cost would not change the final ranking of the options.

A printout of the BLCC4 life-cycle cost analysis follows.

COMPARATIVE PRESENT-VALUE COSTS OF ALTERNATIVE PROJECTS
(Shown in ascending order of initial cost, * = lowest LCC)

PROJECT ALTERNATIVE	LCC FILENAME	INITIAL COST (PV)	LIFE CYCLE COST (PV)
Option1	OPTION1	$95,223	$871,639
Option2	OPTION2	$287,134	$777,694
Option3	OPTION3	$391,219	$441,783*

BLCC Summary for Alternative: Option4A

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$95,535	$36,431
NON-AN. RECURRING OM&R COSTS	$11,966	$4,563
ENERGY COSTS	$17,665	$6,736
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$125,166	$47,731

BLCC Summary for Alternative: Option4B

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$169,878	$10,925
ANNUALLY RECURRING OM&R COSTS	$323,589	$20,811
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$493,466	$31,736

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PART I - INITIAL ASSUMPTIONS AND COST DATA

Project Name:
Project Alternative: Option1
Run date: 01-07-1997 13:02:09
Run type: Federal Analysis--Projects Subject to OMB A-94
Comment: Nitrogen Generator with Liquid Nitrogen backup
Input data file: OPTION1.DAT, last modified: 01-07-1997/12:49:53
LCC output file: OPTION1.LCC, created: 01-07-1997/12:49:56
Base Date of Study: FEB 1998
Service Date: OCT 1999
Study period: 30.00 years (FEB 1998 through JAN 2028)
Plan/constr. period: 1.67 years (FEB 1998 through SEP 1999)
Service Period: 28.33 years (OCT 1999 through JAN 2028)
Discount rate: 4.9% Real (exclusive of general inflation)
End-of-year discounting convention

INITIAL CAPITAL ASSET COSTS (NOT DISCOUNTED)
(ADJUSTED FOR PRICE CHANGES DURING PLAN/CONST. PERIOD, IF ANY)

	YEAR (Beginning)	Cost Phasing	Yearly Cost	Total Cost
	FEB 1998	50.0%	$48,750	
	FEB 1999	50.0%	$48,750	
AT SERVICE DATE:	OCT 2000	0.0%	$0	
TOTAL INITIAL CAPITAL ASSET COSTS				$97,500

ENERGY-RELATED COSTS

Energy Type	Units	Units/ Year	Price+ ($/Unit)	Annual Cost Energy	Annual Cost Demand	Total P.V. Cost
Electricity	kWh	61,488	$0.030	$1,845	$0	$29,019

+Price and annual cost are as of base date (not adjusted for price escalation).

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PART II - LIFE-CYCLE COST ANALYSIS
Discount Rate = 4.9% Real (exclusive of general inflation)

PROJECT ALTERNATIVE: Option1 RUN DATE: 01-07-1997/13:02:09

	PRESENT VALUE (1998 DOLLARS)	ANNUAL VALUE (1998 DOLLARS)
CASH REQUIREMENTS AS OF SERVICE DATE:		
DURING CONSTRUCTION	$95,223	$6,124

AT SERVICE DATE	$0	$0
SUBTOTAL	$95,223	$6,124
OPERATING, MAINTENANCE & REPAIR COSTS:		
ANNUALLY RECURRING COSTS (NON-ENERGY)	$725,793	$46,677
NON-ANNUALLY RECURRING COSTS	$21,604	$1,389
SUBTOTAL	$747,397	$48,066
ENERGY COSTS	$29,019	$1,866
RESALE VALUE OF ORIG CAPITAL COMPONENTS	$0	$0
RESALE VALUE OF CAPITAL REPLACEMENTS	$0	$0
TOTAL LIFE-CYCLE PROJECT COST	$871,639	$56,057

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PART III - EMISSIONS SUMMARY \a

Region: US Average Source Documentation: SRP

Energy Type	Annual Emissions	Life-cycle Emissions
Electricity:		
CO2 (Kg):	59,603.9	1,688,779
SO2 (Kg):	442.8	5,414
NOx (Kg):	179.6	5,087
Total:		
CO2 (Kg):	59,603.9	1,688,779
SO2 (Kg):	442.8	5,414
NOx (Kg):	179.6	5,087

\a Based on emission factors from file USAVG.EMI

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PART I - INITIAL ASSUMPTIONS AND COST DATA

Project Name:
Project Alternative: Option2
Run date: 01-07-1997 13:02:17
Run type: Federal Analysis--Projects Subject to OMB A-94
Comment: Liquid Nitrogen with Gas Bottle backup
Input data file: OPTION2.DAT, last modified: 01-07-1997/12:47:54
LCC output file: OPTION2.LCC, created: 01-07-1997/12:47:56
Base Date of Study: FEB 1998
Service Date: OCT 1999
Study period: 30.00 years (FEB 1998 through JAN 2028)
Plan/constr. period: 1.67 years (FEB 1998 through SEP 1999)
Service Period: 28.33 years (OCT 1999 through JAN 2028)
Discount rate: 4.9% Real (exclusive of general inflation)
End-of-year discounting convention

INITIAL CAPITAL ASSET COSTS (NOT DISCOUNTED)
(ADJUSTED FOR PRICE CHANGES DURING PLAN/CONST. PERIOD, IF ANY)

	YEAR (Beginning)	Cost Phasing	Yearly Cost	Total Cost
	FEB 1998	50.0%	$147,000	
	FEB 1999	50.0%	$147,000	
AT SERVICE DATE:	OCT 2000	0.0%	$0	
TOTAL INITIAL CAPITAL ASSET COSTS				$294,000

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PART II - LIFE-CYCLE COST ANALYSIS
Discount Rate = 4.9% Real (exclusive of general inflation)

PROJECT ALTERNATIVE: Option2 RUN DATE: 01-07-1997/13:02:17

	PRESENT VALUE (1998 DOLLARS)	ANNUAL VALUE (1998 DOLLARS)
CASH REQUIREMENTS AS OF SERVICE DATE:		
DURING CONSTRUCTION	$287,134	$18,466
AT SERVICE DATE	$0	$0
SUBTOTAL	$287,134	$18,466
OPERATING, MAINTENANCE & REPAIR COSTS:		
ANNUALLY RECURRING COSTS (NON-ENERGY)	$332,881	$21,408
NON-ANNUALLY RECURRING COSTS	$157,679	$10,141
SUBTOTAL	$490,561	$31,549

RESALE VALUE OF ORIG CAPITAL COMPONENTS	$0	$0
RESALE VALUE OF CAPITAL REPLACEMENTS	$0	$0
TOTAL LIFE-CYCLE PROJECT COST	$777,694	$50,015

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PART I - INITIAL ASSUMPTIONS AND COST DATA

Project Name:
Project Alternative: Option3
Run date: 01-07-1997 13:03:03
Run type: Federal Analysis--Projects Subject to OMB A-94
Comment: Dry Air System with Liquid Nitrogen backup
Input data file: OPTION3.DAT, last modified: 01-07-1997/12:53:22
LCC output file: OPTION3.LCC, created: 01-07-1997/12:53:23
Base Date of Study: FEB 1998
Service Date: OCT 1999
Study period: 30.00 years (FEB 1998 through JAN 2028)
Plan/constr. period: 1.67 years (FEB 1998 through SEP 1999)
Service Period: 28.33 years (OCT 1999 through JAN 2028)
Discount rate: 4.9% Real (exclusive of general inflation)
End-of-year discounting convention

INITIAL CAPITAL ASSET COSTS (NOT DISCOUNTED)
(ADJUSTED FOR PRICE CHANGES DURING PLAN/CONST. PERIOD, IF ANY)

	YEAR (Beginning)	Cost Phasing	Yearly Cost	Total Cost
	FEB 1998	40.0%	$161,000	
	FEB 1999	60.0%	$241,500	
AT SERVICE DATE:	OCT 2000	0.0%	$0	
TOTAL INITIAL CAPITAL ASSET COSTS				$402,500

ENERGY-RELATED COSTS

Energy Type	Units	Units/ Year	Price+ ($/Unit)	Annual Cost Energy	Annual Cost Demand	Total P.V. Cost
Electricity	kWh	15,033	$0.030	$451	$0	$7,095

+Price and annual cost are as of base date (not adjusted for price escalation).

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PART II - LIFE-CYCLE COST ANALYSIS
Discount Rate = 4.9% Real (exclusive of general inflation)

PROJECT ALTERNATIVE: Option3 RUN DATE: 01-07-1997/13:03:03

	PRESENT VALUE (1998 DOLLARS)	ANNUAL VALUE (1998 DOLLARS)
CASH REQUIREMENTS AS OF SERVICE DATE:		
DURING CONSTRUCTION	$391,219	$25,160

AT SERVICE DATE	$0	$0
SUBTOTAL	$391,219	$25,160
OPERATING, MAINTENANCE & REPAIR COSTS:		
ANNUALLY RECURRING COSTS (NON-ENERGY)	$28,776	$1,851
NON-ANNUALLY RECURRING COSTS	$3,862	$248
SUBTOTAL	$32,638	$2,099
ENERGY COSTS	$7,095	$456
REPLACEMENTS TO CAPITAL COMPONENTS	$10,830	$697
RESALE VALUE OF ORIG CAPITAL COMPONENTS	$0	$0
RESALE VALUE OF CAPITAL REPLACEMENTS	$0	$0
TOTAL LIFE-CYCLE PROJECT COST	$441,783	$28,412

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PART III - EMISSIONS SUMMARY \a

Region: US Average   Source Documentation: SRP

Energy Type	Annual Emissions	Life-cycle Emissions
Electricity:		
CO2 (Kg):	14,572.3	412,884
SO2 (Kg):	108.3	1,324
NOx (Kg):	43.9	1,244
Total:		
CO2 (Kg):	14,572.3	412,884
SO2 (Kg):	108.3	1,324
NOx (Kg):	43.9	1,244

\a Based on emission factors from file USAVG.EMI

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PART I - INITIAL ASSUMPTIONS AND COST DATA

Project Name:
Project Alternative: Option4A
Run date: 01-07-1997 13:03:11
Run type: Federal Analysis--Projects Subject to OMB A-94
Comment: Nitogen Generator for 2 years/Liquid Ntrogen
Input data file: OPTION4A.DAT, last modified: 01-07-1997/12:57:31
LCC output file: OPTION4A.LCC, created: 01-07-1997/12:57:32
Base Date of Study: FEB 1998
Service Date: OCT 1999
Study period: 2.83 years (FEB 1998 through NOV 2000)
Plan/constr. period: 1.67 years (FEB 1998 through SEP 1999)
Service Period: 1.17 years (OCT 1999 through NOV 2000)
Discount rate: 4.2% Real (exclusive of general inflation)
End-of-year discounting convention

INITIAL CAPITAL ASSET COSTS (NOT DISCOUNTED)
(ADJUSTED FOR PRICE CHANGES DURING PLAN/CONST. PERIOD, IF ANY)

	YEAR (Beginning)	Cost Phasing	Yearly Cost	Total Cost
	FEB 1998	50.0%	$48,750	
	FEB 1999	50.0%	$48,750	
AT SERVICE DATE:	OCT 2000	0.0%	$0	
TOTAL INITIAL CAPITAL ASSET COSTS				$97,500

ENERGY-RELATED COSTS

Energy Type	Units	Units/ Year	Price+ ($/Unit)	Annual Cost Energy	Annual Cost Demand	Total P.V. Cost
Electricity	kWh	553,392	$0.030	$16,602	$0	$17,665

+Price and annual cost are as of base date (not adjusted for price escalation).

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PART II - LIFE-CYCLE COST ANALYSIS
Discount Rate = 4.2% Real (exclusive of general inflation)

PROJECT ALTERNATIVE: Option4A RUN DATE: 01-07-1997/13:03:11

	PRESENT VALUE (1998 DOLLARS)	ANNUAL VALUE (1998 DOLLARS)
CASH REQUIREMENTS AS OF SERVICE DATE:		
DURING CONSTRUCTION	$95,535	$36,431

AT SERVICE DATE	$0	$0
SUBTOTAL	$95,535	$36,431
OPERATING, MAINTENANCE & REPAIR COSTS:		
NON-ANNUALLY RECURRING COSTS	$11,966	$4,563
SUBTOTAL	$11,966	$4,563
ENERGY COSTS	$17,665	$6,736
RESALE VALUE OF ORIG CAPITAL COMPONENTS	$0	$0
RESALE VALUE OF CAPITAL REPLACEMENTS	$0	$0
TOTAL LIFE-CYCLE PROJECT COST	$125,166	$47,731

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PART III - EMISSIONS SUMMARY \a

Region: US Average   Source Documentation: SRP

Energy Type	Annual Emissions	Life-cycle Emissions
Electricity:		
CO2 (Kg):	536,434.8	625,862
SO2 (Kg):	3,985.2	2,697
NOx (Kg):	1,616.0	1,885
Total:		
CO2 (Kg):	536,434.8	625,862
SO2 (Kg):	3,985.2	2,697
NOx (Kg):	1,616.0	1,885

\a Based on emission factors from file USAVG.EMI

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*  N I S T  B L C C:  D E T A I L E D  L C C  A N A L Y S I S (ver. 4.3-96 )  *
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PART I - INITIAL ASSUMPTIONS AND COST DATA

Project Name:
Project Alternative: Option4B
Run date: 12-24-1996 09:26:16
Run type: Federal Analysis--Projects Subject to OMB A-94
Comment:
Input data file: OPTION4B.DAT, last modified: 12-10-1996/10:42:19
LCC output file: OPTION4B.LCC, created: 12-10-1996/10:42:21
Base Date of Study: FEB 1998
Service Date: 2000
Study period: 30.00 years (FEB 1998 through JAN 2028)
Plan/constr. period: 2.92 years (FEB 1998 through DEC 2000)
Service Period: 27.08 years (2000 through JAN 2028)
Discount rate: 4.9% Real (exclusive of general inflation)
End-of-year discounting convention

INITIAL CAPITAL ASSET COSTS (NOT DISCOUNTED)
(ADJUSTED FOR PRICE CHANGES DURING PLAN/CONST. PERIOD, IF ANY)

	YEAR (Beginning)	Cost Phasing	Yearly Cost	Total Cost
	FEB 1998	5.0%	$9,300	
	FEB 2000	95.0%	$176,700	
AT SERVICE DATE:	2001	0.0%	$0	
TOTAL INITIAL CAPITAL ASSET COSTS				$186,000

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PART II - LIFE-CYCLE COST ANALYSIS
Discount Rate = 4.9% Real (exclusive of general inflation)

PROJECT ALTERNATIVE: Option4B RUN DATE: 12-24-1996/09:26:16

	PRESENT VALUE (1998 DOLLARS)	ANNUAL VALUE (1998 DOLLARS)
CASH REQUIREMENTS AS OF SERVICE DATE:		
DURING CONSTRUCTION	$169,878	$10,925
AT SERVICE DATE	$0	$0
SUBTOTAL	$169,878	$10,925
OPERATING, MAINTENANCE & REPAIR COSTS:		
ANNUALLY RECURRING COSTS (NON-ENERGY)	$323,589	$20,811
SUBTOTAL	$323,589	$20,811

RESALE VALUE OF ORIG CAPITAL COMPONENTS	$0	$0
RESALE VALUE OF CAPITAL REPLACEMENTS	$0	$0
TOTAL LIFE-CYCLE PROJECT COST	$493,467	$31,736

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APPENDIX I

Physically Handicapped Assessment

ACCOMMODATIONS OF PHYSICALLY HANDICAPPED

PROJECT NO. 98L-EWW-460

PROJECT TITLE Plutonium Stabilization and Handling

LOCATION PFP (area) BUILDING 2736-ZB, 2736-Z, & Office Trlr

Prepared By G. A. Johnston Title FDNW Project Manager

Date 11/01/96

Type of Project:

- [X] New Building (or Building Addition)
- [X] Building Alteration
- [ ] Site Development (Grading, Walks, Parking Lots)
- [ ] Other

Application of Regulations:

DOE Order 6430.1A, "General Design Criteria," General Requirements 0101-4, "Handicapped Provisions."

41 CFR, Public Contracts and Property Management, Subtitle C, 101-19.6, "Accommodations for the Physically Handicapped."

- [ ] All Regulations
- [ ] Limited Application (indicate in comments section)

Exceptions:

DOE Order 6430.1A, "General Design Criteria," General Requirements 0101-4, "Handicapped Provisions."

- [X] a. Not intended for occupancy or use by the handicapped
- [ ] b. Alteration not involving existing stairs, doors, elevators, toilets, etc.
- [ ] c. Not structurally possible

General Comments:

The PFP Site currently restricts access to individuals with mobility handicaps due to emergency response requirements. In line with this, the project modifications to building 2736-ZB, 2736-Z, and the installation of a new office trailer are not intended for occupancy by the handicapped.

PFP INDUSTRIAL SAFETY — Signature

1·8·97 — Date

A-6000-806 (09/92)

APPENDIX J

Plant Forces Work Review

FDH	Fluor Daniel Hanford, Inc. P.O. Box 1000, Richland, WA 99352-1000 **PLANT FORCES WORK REVIEW**	Plant Forces Work Review No. FDH-003-97	Date 1/7/97	Page 1 of 3

REQUESTER	Title	JCS Work Pkg or Project No.	Area	Bldg. No.
	PFP PLUTONIUM STABILIZATION & HANDLING	W-460	200W	2736-ZB

Estimated Cost of Work:

*1.	Procured Material/Equipment	$ 13,520,000
*2.	Materials/Equipment Purchased for Shop Fabrication	$ 0
*3.	Job-Site Material	$ 2,305,000
4.	Shop Labor	$ 0
5.	Job-Site Labor	$ 2,740,000
6.	Other Costs (design, field inspection, and contingency allowance)	$ 6,000,000
7.	General Overhead (Labor Only)	$ 1,115,000
	Total Job	$ 25,680,000

*Include estimated fair value of material or equipment acquired on site

Requester's Name and Phone No. G.A. (Jerry) Johnston, 372-3923 Date 1/6/97

FDH

Reviewed By:

Area Work Review Agent Gary Anderson Date 1/7/97

Company Work Review Agent *Gary Maxwell* Date *1/13/97*

DOE

The following determination has been made regarding applicability of the Davis-Bacon Act, as amended, to the work described above:

Applicable [XX] Construction Plant Forces

Not Applicable [ ]

Chairman *Original Signed by Dominic Sansotta* *1/15/97*

RL-Labor Standards Board Date

"Description of Work"

Briefly state the reason for this work activity:

Project W-460 is a Congressional Line Item to install a Plutonium Stabilization and Handling (PuSH) system. W-460 encompasses several related actions to assure the safe storage of plutonium remaining at Hanford's Plutonium Finishing Plant (PFP).

The scope of this project is to procure and install a Stabilization and Packaging System (SPS) via a DOE national procurement. Facility infrastructure will be modified to support the SPS and the new storage container configuration. Building 2736-ZB will be modified to house the SPS and accommodate the new process. Building 2736-Z will have the necessary vaults modified to handle the new standardized storage containers.

PROCUREMENT OF SPS

The project will implement a procurement action for the design, fabrication, and installation of glove box suite for the stabilization and repackaging of plutonium bearing items currently inventoried at the Plutonium Finishing Plant (PFP). This procurement will be part of a DOE national procurement action which is providing similar units for the Rocky Flats and Savannah River Facilities. The installation will cover the delivery, assembly, and setting of the glove box suite in the 2736-ZB and the technical support for the on site acceptance testing. The requirements for interface with the appropriate contractors on the Hanford Site to accomplish the

installation will have to be incorporated into the contract language of the procurement.

DESIGN

The on site Architect-Engineer Construction Manager (AECM) will develop the design for the infrastructure modifications needed to support the operation of the SPS in 2736-ZB.

Job summary:

Install power, water, HLAN, phone's, sewer and lift station, concrete sidewalks and fire protection for a new 60' x 70' modular office trailer. Building modification to 2736-ZB include; a new exterior vault rated double door for equipment access, demolish partition wall between 641 and 642, an access airlock, an enclosed control room area, relocate two existing HEPA filter housings for room exhaust, and remove the existing drop ceiling. See section "B" for more modifications.

Discuss all programmatic or physically associated work planned, underway, or recently completed in the work area:

The Project W-460 Conceptual Design has assumed that the electrical upgrades currently being installed in 2736-ZB by Project C-189 "PFP Diesel Generator Upgrade" will be completed prior to implementation of W-460.

Describe entire work scope. Fully describe complete job scope using a stepped work flow format. Describe and estimate the cost of labor and material on foundations, structures, utility systems, or other construction type activity. Provide sketches or measurements for all work:

CONSTRUCTION SCOPE

A) **Modular Office Trailer:**

Install a new 60' x 70' modular office trailer 60' East of 2736-ZB.

1. Connections will be made to nearby potable water and fire protection lines.
2. A new 50kva transformer will be placed on a new 4' x 4' concrete pad. Run 50' of new 13.8v primary line overhead from existing 13.8 distribution loop to one installed power pole at transformer location then tie-in primary power to transformer.
3. A new lift station and sewer line will be installed which will also accommodate the current sewage flow from 2736-ZB.

NOTE: If item 2 above is determined to be applicable in it's entireity, FDH is asking that the Electrical Hot Tie-In be performed by Dyncorp Electrical Utilities to protect those facilities down stream from the Hot Tie-in location, DOE Operating requirements, and to maintain configuration control of the main grid. The Hot Tie-in requires fuse links and disconnects within 5' of the energized 13.8 line.

B) **2736-ZB Modifications:**

The following building modifications are planned to 2736-ZB to accommodate the new system:

1. Modify Rooms 641 and 642 to house the glove box suite.
   - Install new exterior vault rated double door for equipment access.
   - Demolish partition wall between 641 and 642.
   - Install an access airlock and an enclosed control room area.
   - Relocate two existing HEPA filter housings for room exhaust.

- Remove the existing drop ceiling.

2. Relocate the Mardex® security access system to the 2736-ZB entrance and install an exterior airlock.
3. Install a new SPS exhaust system including redundant two stage HEPA filters and an auxiliary fan.
4. Modify 2736-ZB Stack 296-Z-5 and the associated monitoring equipment.
5. Provide and install three new NDA Laboratory calorimeters.
6. Install an airlock in Corridor 633.
7. Perform architectural modifications to approximately 13 rooms to accommodate new traffic patterns or change in office function.
8. Install a new gas bottle storage area on the exterior of 2736-ZB.
9. Demolish two air compressors, receiver tanks, and associated dry air system in Room 602.
10. Install a new supply breaker in an existing electrical panel and install a new feeder and MCC.
11. Demolish the existing glove box in Room 636.

C) **2736-Z Modifications**

The 2736-Z Vault Building will have three of the four vault rooms modified to one of two different concepts being proposed.

1. One concept will would start from scratch and gut the existing vault room and install a raised floor to be used for vertical "in-floor" storage of containers.
2. The other concept would use existing cubicles and provide new doors and internal racks for container storage.
3. Cabling and instrumentation for existing inventory monitoring systems would be demolished as part of each vault room modification.

D) **2731-ZA Modifications**

Existing general storage building 2731-ZA would be modified to have half of this building house a new dry air supply system for the SPS.

1. Insulate and finish the interior of the portion of the building housing the dry air system.
2. Install:
   - Two 150 scfm air compressors
   - Two desiccant air dryers
   - Six air filters
   - One receiver tank
   - One 480 V, 3 ph MCC
   - One 5KVA transformer
   - One 100A, 120/240V Panelboard
   - One 10KW 480V space heater

CONDITIONS

There will be radiological hazards associated the demolition of the glove box in Room 636. The remaining work activities should not involve radiological hazards. The work will be planned to have all inventory items removed from a vault prior to modification for radiological dose considerations. Many of the work areas will require cleared personnel or security escorts during the construction phase.

APPENDIX K

Human Factors Plan

TITLE: W-460
HUMAN FACTORS IMPLEMENTATION PLAN

SUMMARY

This plan provides guidance for Human Factors Design Criteria and Methodology for Human Factors Implementation into Facility Design

Revision: 0

SUBMITTED TO:

PREPARED BY:

TABLE OF CONTENTS

TABLES

PROJECT W-460

HUMAN FACTORS IMPLEMENTATION PLAN

1.0 INTRODUCTION

It is the Department of Energy (DOE) policy to ensure that appropriate Human Factors Technology is considered in design, operation and maintenance at department nonreactor nuclear facilities.

1.1 Scope

This Facility Human Factors Criteria Implementation Plan has been prepared for the Plutonium Finishing Plant. Human Factors Criteria are to be employed in order ensure a facility design that promotes safety, efficient operation, reduction in downtime, and orderly maintenance. This Implementation Plan has been formatted to be performed in four phases. The plan implementation will be commensurate with the level of importance of the system task and level of risk associated with system/task failure.

Programmatic Compliance:

I Design Guidance (Planning)

II Preliminary Assessment (Work Station Task) Title I

Detailed Compliance:

III Application (Equipment Selection Human/Machine Interface)

IV Compliance Assessment (Evaluation) Title II

1.2 Purpose

At the onset of Title I, the Implementation Plan provides design guidance to be utilized by all disciplines to ensure and demonstrate that Human Factors criteria are consciously applied to the design at the onset of the project. The objective will be to improve human performance and safety through subjective review of the facility in order to enhance the work environment and optimize human/machine interfaces.

Throughout Title I, a preliminary qualitative assessment of the design will be performed in accordance with Section 3.0. This will be documented in a Human Factors Assessment Report to be completed at the end of Title I.

During Title II, quantitative assessments will be performed using the methodology detailed in Section 4.0. These quantitative assessments will result in detailed design improvements and will form the basis

for Human Factors Criteria compliance documentation in the Title II detailed design report. The intent of the Facility Design Human Factors Criteria Compliance Assessment performed in Title II is to demonstrate and achieve compliance with the applicable Human Factors concepts in DOE Order 6430.1A (Reference 5.1) and WHC-SD-GN-DGS-30011 (Reference 5.2). Compliance will be demonstrated by comparison of the facility design with the specific criteria referenced in DOE Order 6430.1A and will be documented in the Human Factors Assessment Report to be completed at the end of Title II.

1.3 Implementation Plan Basis

The criteria for the incorporation of Human Factors considerations into the design of DOE facilities is described in DOE Order 6430.1A, "General Design Criteria," and WHC-SD-GN-DGS-30011. Section 1300-12 of DOE Order 6430.1A presents programmatic Human Factors requirements, General Human Factors Considerations, and refers to MIL-STD-1 472D (Reference 5.3) and NUREG 0700 (Reference 5.4) for detailed human factors design requirements.

2.0 GENERAL HUMAN FACTORS IMPLEMENTATION CRITERIA

The design guidance for the incorporation of human factors consideration are taken from criteria in documents referenced in Section 1.3, Design Criteria. The guidance has been summarized in five general areas (applicable to Title I and Title II activities).

- General Facility Human Factors Considerations
- Component Arrangement
- Work Space Environment (Work Space Design)
- Equipment Layout and Design
- Safety

The guidance below is intended to provide designers with general criteria to be incorporated in the design of the project W-460 facility. Specific design criteria detail may be found in the reference documents. In many cases, the facility may be designed in accordance with additional standards such as Occupational Safety and Health Administration (OSHA) [Reference 5.5]. Design requirements for these standards should be comparable in intent to those provided in this document. The guidance will be used in a preliminary human factors assessment at the end of Title I (See Section 3.0).

2.1 Facility Design Guidance

2.1.1 Human Dimension Considerations

Equipment that is to be used by personnel shall be designed or selected to accommodate the range of body dimension of the 5th percentile female to the 95th percentile male per MIL-STD-1 472D and WHC-SD-GN-DGS-30011. These dimensions are provided in Table 1. This equipment includes

control panels, work tables and counters, enclosures, seating, storage, and any other equipment designed for an operator.

Adequate space shall be provided for personnel, their equipment, and free volume for the movements and activities they are required to perform during operation and maintenance tasks under both normal and emergency conditions.

2.1.2 Environmental Considerations

Heating and air conditioning comfort systems shall maintain the corrected effective temperature above 18 °C (65 °F) and below 29.5 °C (80 °F).

Adequate ventilation shall be assured by introducing fresh air per ASHRAE 62 (Reference 5.8).

Ventilation or other protective measures shall be provided to keep gases, vapors, dust, and fumes within the permissible exposure limits as specified in the appropriate regulation.

Where equipment is to be used in an enclosure and is not subject to blackout or special low level lighting requirements, adequate illumination levels shall be provided. Emergency lighting shall be provided as required by NFPA 101 (Reference 5.6).

Noise levels shall be minimized where practical and shall not exceed the limits of DOE Order 5480.10 (Reference 5.7), as applicable.

Vibration shall be reduced to the extent practical to minimize operator irritation and distraction. Vibration considerations shall include equipment design, potential affects of vertical and horizontal vibrations on seated and standing operators, and use of appropriate protective devices (e.g., isolation, damping materials).

2.2 Component Arrangement

The arrangement of controls and displays shall promote efficient use of task-related components, rapid location of any given component, and maximum operator awareness of plant conditions.

Components shall be grouped together on the basis of specific criteria appropriate for the required task or tasks.

Component arrangement shall provide easy association of related controls and displays or other related components.

Displays shall be located and designed so that they may be read to the degree of accuracy required by personnel in the normal operating or servicing positions without requiring the operator to assume an uncomfortable, awkward, or unsafe position.

Visual displays shall be visually accessible without resorting to the use of ladders, flashlights, or other special equipment in order to read them.

2.3 Workspace Environment (Work Space Design)

2.3.1 General Workspace Design

All cabinets, consoles, and work surfaces that require an operator to stand or sit close to their front surfaces shall contain a kick space at least 100-mm (4-in.) high to allow for protective or specialized apparel, where applicable.

Whenever feasible, at least 1.220 m (4 ft) of free floor space shall be provided near operator consoles. For equipment racks, free floor space shall be provided to allow maintenance activities.

Clearance from the front of the rack to the nearest facing surface or obstacle shall not be less than 1.070 m (42 in.). The minimum space between rows of cabinets shall be 200 mm (8 in.) greater than the depth of the deepest drawer (equipment).

The minimum lateral workspace for racks having drawers or removable equipment shall be as follows (measured from the drawers or equipment in the extended position):

a. For racks having drawers or removable items weighing less than 20 kg (44 lbs): 460 mm (18 in.) on one side and 100 mm (4 in.) on the other.

b. For racks having drawers or removable items weighing over 20 kg (44 lbs): 460 mm (18 in.) on each side.

The minimum space between rows of cabinets shall be 200-mm (8-in.) greater than the depth of the deepest drawer or cabinet.

Adequate and suitable space shall be provided on consoles or immediate work space for the storage of manuals, worksheets, and other materials that are required for use by the operational or maintenance personnel.

2.3.2 Standing Operations

Unless otherwise specified, work surfaces to support job instruction manuals, worksheets, etc., shall be 915 ± 15 mm (36 ± 0.6 in.) above the floor.

Visual displays mounted on vertical panels and used in normal equipment operation shall be placed between 1.040 m (41 in.) and 1.780 m (70 in.) above the standing surface.

Displays requiring precise and frequent reading shall be placed between 1.270 m (50 in.) and 1.165 m (65 in.) above the standing surface.

All controls mounted on a vertical surface and used in normal equipment operation shall be located between 860 mm and 1.780 m (34 and 70 in.) above the standing surface.

Controls requiring precise or frequent operation and emergency controls shall be mounted between 860 mm and 1.350 m (34 and 53 in.) above the standing surface and no farther than 530 mm (21 in.) laterally from the centerline.

2.3.3 Seated Operation

A lateral workspace of at least 760-mm (30-in.) wide and 400-mm (16-in.) deep shall be provided whenever practicable.

Desk top and writing tables shall be 740 to 790 mm (29 to 31 in.) above the floor, unless otherwise specified.

Where a writing surface is required on equipment consoles, it shall be at least 400-mm (16-in.) deep and should be 610-mm (24-in.) wide, when consistent with operator reach requirements.

Knee and foot room that equals or exceeds the following minimum dimensions shall be provided beneath work surfaces:

a. Height: 640 mm (25 in.). If a fixed footrest or a foot-operated control is provided, this dimension shall be increased accordingly.

b. Width: 510 mm (20 in.)

c. Depth: 460 mm (18 in.)

Visual displays mounted on vertical panels and used in normal equipment operation shall be placed in an area between 150 and 1170 mm (6 and 46 in.) above the sitting surface.

Indicators that must be read precisely and frequently shall be placed in an area between 360 mm and 890 mm (14 and 35 in.) above the sitting surface, and no further than 530 mm (21 in.) laterally from the centerline.

For "sit" consoles requiring horizontal vision over the top, critical vision warning displays shall be mounted at least 570-mm (22.5-in.) above the sitting surface.

All controls mounted on a vertical surface and used in normal equipment operation shall be located between 200 and 860 mm (8 and 34 in.) above the sitting surface.

Controls requiring precise or frequent operation shall be mounted between 200 and 740 mm (8 and 29 in.) above the sitting surface.

2.4 Equipment Layout And Design

2.4.1 Standard Console Design

Standard console configurations are listed in Table 2. The configurations represented in the table may not be applicable to all design situations. In some cases, operational requirements may necessitate unique design solutions. However, because of the benefits and economies inherent in a standard console, design should conform with the standard configurations.

The selected console design shall accommodate the following requirements, as applicable:

a. Visibility over the top of the console

b. Operator mobility (e.g., "sit," "stand," or "sit-stand" requirements)

c. Panel Space (Note Table 2, columns "B" and "E")

d. Volume in the area below the writing surface

2.4.2 Special Purpose Console Design

When requirements for preferred panel space for a single seated operator exceed a panel width of 1.120 m (44 in.), a flat-surface, segmented, wrap-around console should be provided, so as to place all controls within reach.

The left and right segments shall be placed at an angle, measured from the frontal plane of the central segment, such that they can be reached by the stationary operator.

Where vision over the top is required (thereby limiting vertical panel space), the width of the central segment shall not exceed 1.120 m (44 in.), and that of the left and right segments shall not exceed 61 mm (24 in.).

Where vision over the top is not required, i.e., the total console height may exceed the seat height by more than 685 mm (27 in.), the width of the central segment shall not exceed 860 mm (34 in.), and that of the left and right segments shall not exceed 610 mm (24 in.).

The total required left-to-right viewing angle shall not exceed 190 degrees. This angle shall be reduced whenever possible through appropriate control-displays layout.

Where direct forward vision over the top of the console is not required by a seated operator, and when lateral space is limited, the panel shall be divided into three vertical/stacked segments whose surfaces shall be perpendicular to the operator's line of sight with little or no head movement.

The center of the central segment should be 800 mm (31.5 in.) above the seat reference point. The height of this segment shall not exceed 530 mm (21 in.).

Where personnel will work from standing or seated position, console dimensions should conform to those of Table 2.

2.4.3 Stairs, Stair-Ladders, Fixed Ladders, and Ramps

The selection of stairs, stair-ladders, fixed ladders, or ramps for specific applications, shall be based on the angle of ascent required and the criteria in Ref 5.6.

Ramps, elevators, or equivalent means shall be provided when equipment must be hand carried. Ladders shall not be selected in such cases, since both hands should be free to grasp the ladder. Stairs and steps should not be used where hand carrying bulky loads or loads in excess of 13 kg (29 lbs) is required.

Stairs, stair-ladders, fixed ladders, and ramps should be equipped with a handrail on each side. Where one or both sides are open, appropriate intermediate guardrails shall be provided to prevent personnel injury. Non-fixed vehicular-boarding ladders are neither stair ladders nor fixed ladders and are exempt from this requirement. Ladders shall not be selected in such cases, since both hands should be free to grasp the ladder; stairs and steps should not be used where hand-carrying bulky loads or loads in excess of 13 kg (29 lbs) is required.

Stair dimensions should conform with the recommended values and shall be within the minimum and maximum limits of Ref 5.6.

Stair ladder dimensions should conform with the recommended values and shall be within the specified minimum and maximum limits of Ref 5.6. The tread rise shall be open at the rear. Landings shall be provided every tenth or twelfth tread. The surface of treads on exterior stair ladders shall be constructed or open grating material or be treated with nonskid material. Stair ladders shall be of metal construction. Handrails shall have nonslip surfaces.

Fixed ladder dimensions should conform with the recommended values and shall be within the specified minimum and maximum limits of Ref 5.3, Section 5.7.7.4. Fixed ladders which are used to provide access to multiple levels should be offset at each successive level. Guardrails should be provided around the opening at the top of each fixed ladder. All fixed ladders more than 6 m (20 ft) high shall be equipped with, or include provision for, a safety device to provide positive protection from falls.

2.4.4 Personnel Platforms and Work Areas

The surfaces of exterior personnel platforms and work areas shall be constructed of open metal grating. Exterior personnel platforms, for which utilization of open grating is impractical, and interior walkways shall be treated with nonskid material. All open sides of personnel platforms shall be equipped with guardrails (with intermediate rails), with a top rail height not less than 1.070 m (42 in.) and a toe board or guard screen height not less than 75 mm (3 in.). Hand holds shall be furnished where needed. The distance between the platform edge and the centerline of the railing shall not exceed 65 mm (2.5 in.).

2.4.5 Elevators and Hydraulic-Operated Work Platforms

Where these items are required, the following shall be provided:

a. Maximum load signs, located where they can be easily seen.

b. Guards, to prevent accidental operation of the lift.

c. Limit stops, to prevent injury to personnel and damage to equipment.

d. An automatic fail-safe brake or other self-locking device in case of lift mechanism failure.

e. Provision for manually lowering the platform or elevator when feasible.

f. Surface construction or treatment of open platforms, in accordance with Section 2.4.4.

g. Compliance with the Washington Administrative Code (WAC) is also required.

2.4.6 Ingress and Egress

Sliding doors shall never be installed as the only personnel exit from a compartment. When a sliding door is used, a separate hinged door in the sliding door shall be provided for personnel use. Fixed equipment shall be at least 75 mm (3 in.) from the swept area of hinged doors.

Wall hatches shall be flush with the floor where structural considerations will permit this arrangement. Hatches shall open with a single motion of the hand or foot.

When a handle is used for unlocking a hatch, the unlocking force required shall not exceed 90 N (20 lb). Hatches placed in the overhead position shall require no more than 220 N (50 lb) force for opening and closing and shall be operable by a suitably equipped and clothed user with 5th percentile arm and hand strength. The force of gravity shall be used, where possible, for ease of opening.

Hatches shall accommodate suitably equipped and clothed user personnel in terms of limiting dimensions for location and operability, and clearance dimensions for size and passage factors. Where personnel must carry equipment through the hatch, allowance shall be made for clearance of suitably clothed 95th percentile hands and/or arms, as applicable.

Minimum diameter for circular hatches shall be 760-mm (30-in.). Where rescue of personnel may be required because of environmental hazards (e.g., toxic fumes) within the work place, larger access openings for two-person ingress and egress may be necessary. Where "step down" through a top access exceeds 690 mm (27 in.), appropriate foot rests or steps shall be provided.

2.5 Safety

2.5.1 General

As a part of system equipment design, safety factors shall be given major consideration, including as a minimum, the effective application of the human engineering criteria in other sections of this plan, together with the representative safety criteria herein.

2.5.2 Emergency Doors and Exits

Emergency doors and exits shall be constructed to meet the following criteria:

a. Simple to operate

b. Readily accessible

c. Unobstructed

d. Simple to locate and operate in the dark

e. Quick opening in 3 sec or less

f. Require 44 to 133 N (10 to 30 lb) of operating force to open

g. Do not themselves, or in operation, constitute a safety hazard

2.5.3 Stairs

Stairs, including incline, step risers, and treads, shall conform with standard safe design practice. Skid-proof flooring, stair, and stop treads shall be provided.

2.5.4 Obstructions

Workspace around area where maintenance is performed shall be free of obstructions which could cause injury to personnel, either through accidental contact with the obstruction or because the obstruction requires an awkward or dangerous body position.

2.5.5 Access

Units shall be so located and mounted that access to them can be achieved without danger to personnel from electrical charge, heat, moving parts, chemical contamination, radiation, or other hazards.

2.5.6 Platforms

Self-locking or other fail-safe devices shall be incorporated on elevating stands, work platforms, and "draw bridges" to prevent accidental or inadvertent collapsing or failing.

Handrails, safety bars, or chains shall be installed around platforms and across stair or stop openings in platforms, ledges, catwalks, etc. Such guards shall be placed 1.070 m (42 in.) above the standing surface. An intermediate guardrail shall be provided. Chains shall only be used where it is not feasible to install handrails or safety bars. Kickboards 180 mm (6 in.) high, shall be installed.

Screen or safety mesh shall be installed on the underside of open gratings, platforms, or flooring surfaces where there is a possibility that small tools, parts or debris may fall through the grating on workers or equipment beneath the platform.

2.5.7 Toxic Hazards

At a minimum, the design must ensure that personnel shall not be exposed to the concentrations of toxic substances in excess of the limits specified in either the Department of Defense (DOD); Occupational Safety and Health (OSH) standards or specialized standards applicable to military unique equipment, systems, or operations. Exposure to toxic hazards is to be ALARA (as low as reasonably achievable).

2.5.8 Radiation

Radiation emitting systems and equipment require special consideration to minimize hazards to operators and maintenance personnel. Ionizing radiation exposure rates produced by any device shall not exceed 0.5 milliroentgen/hr at a distance of 50 mm (2 in.) from any point on the external surface. Operators must be shielded from radiation emitted from waste/operations to ensure DOE dose rate requirements are met and are ALARA.

3.0 IMPLEMENTATION PLAN TITLE I

A preliminary qualitative assessment study of the design to verify that Human Factors requirements/criteria are being considered/applied will be completed at the end of Title I. This assessment will utilize the guidance provided in Section 2.0 to establish programmatic compliance. The review documents will include general arrangement drawings and mechanical flow diagrams (MFD).

The deliverable will be an overall assessment of operator workstations and general task analysis. The assessment will include checklists for programmatic compliance (example provided in Appendix A) of operator workstations, and specific design requirements to be included in Title II design. This assessment will be used by discipline engineers as guidance in equipment selection and human/machine interface.

4.0 IMPLEMENTATION PLAN TITLE II

A qualitative assessment study of the Design for Human Factors Requirements compliance will be completed at the and of Title II. This assessment will consist of an extensive comparison of Human Factors Criteria with detail design specifications and drawings.

A checklist approach will be utilized to evaluate compliance. Applicable sections of Ref 5.3 and 5.4 were extracted to form the basis of the checklist (See Appendix B).

5.0 REFERENCES

5.1 DOE 6430.1A, "General Design Criteria," April 6, 1989.

5.2 WHC-SD-GN-DGS-30011, "Radiological Design Guide," Appendix A, Rev 0, 1994.

5.3 MIL STD 1472D, "Human Factors Engineering Design Criteria for Military Systems, Equipment, and Facilities," March 14, 1991.

5.4 NUREG 0700, "Guidelines for Control Room Design Reviews," September 1981.

5.5 20 CFR 1910, "Occupational Safety and Health Standards," 1991.

5.6 ANSI/NFPA 101, "Life Safety Code," 1994.

5.7 DOE Order 5480.10.

5.8 ASHRAE 62, "Ventilation for Acceptable Indoor Air Quality," 1989.

TABLE 1

BODY DIMENSIONS				
Body Dimensions	PERCENTILE VALUES IN CENTIMETERS			
	5TH PERCENTILE		95TH PERCENTILE	
	MEN	WOMEN	MEN	WOMEN
STANDING				
1. Stature	162.8	152.4	185.6	174.1
2. Eye Height (Standing)	151.1	140.9	173.3	162.2
3. Shoulder Height	133.6	123.0	154.2	143.7
4. Chest Height	117.9	109.3	136.5	127.8
5. Elbow Height	101.0	94.9	117.8	110.7
6. Waist Height	96.6	93.1	115.2	110.3
7. Crotch Height	76.3	68.1	91.8	83.9
8. Gluteal Furrow Height	73.3	66.4	87.7	81.0
9. Kneecap Height	47.5	43.8	58.6	52.5
10. Calf Height	31.1	29.0	40.6	36.6
11. Functional Reach	72.6	64.0	90.9	80.4
12. Functional Reach, Extended	84.2	73.5	101.2	92.7
SEATED				
13. Vertical Arm Reach, Sitting	128.6	117.4	147.8	139.4
14. Sitting Height, Erect	83.5	79.0	96.9	90.9
15. Sitting Height, Relaxed	81.5	77.5	94.8	89.7
16. Eye Height, Sitting Erect	72.0	67.7	84.6	79.1
17. Eye Height, Sitting Relaxed	70.0	66.2	82.5	77.9
15. Mid-Shoulder	56.6	53.7	67.7	62.5
19. Shoulder Height, Sitting	54.2	49.9	65.4	60.3
20. Shoulder-Elbow Length	33.3	30.8	40.2	36.6
21. Elbow-Grip Length	31.7	29.6	38.3	35.4
22. Elbow-Fingertip Length	43.8	40.0	52.0	47.5
23. Elbow Rest Height	17.5	16.1	28.0	26.9
24. Thigh Clearance Height	10.4			17.5
25. Knee Height, Sitting	49.7	46.9	60.2	55.5
26. Popliteal Height	39.7	38.0	50.0	45.7
27. Buttock-Knee Length	54.9	53.1	65.8	63.2
28. Buttock-Popliteal Length	45.8	43.4	54.5	52.6
29. Functional Leg Length	110.6	99.6	127.7	118.6

TABLE 2

STANDARD CONSOLE DIMENSIONS AND KEY FOR FIGURE 1

Type of Console	Key and Dimensions				
	A[1] = Maximum Total Console Height from Standing Surface	B[1] = Suggested Vertical Dimension of Panel (including sills)	C[1] = Writing Surface: Shelf Height from Standing Surface	D[1] = Seat Height from Standing Surface at Midpoint of G	Maximum Console Width (not shown)
1. Sit (w/vision over top)[2]	1170 mm (46 in.) 1334 mm (52.5 in.) 1435 mm (56.5 in.)	520 mm (20.5 in.) 520 mm (20.5 in.) 520 mm (20.5 in.)	650 mm (25.5 in.) 810 mm (32 in.) 910 mm (36 in.)	435 mm (17 in.) 595 mm (23.5 in.) 695 mm (27.5 in.)	1120 mm (44 in.) 1120 mm (44 in.) 1120 mm (44 in.)
2. Sit (w/o vision over top)	1310 mm (51.5 in.) 1470 mm (58 in.) 1570 mm (62 in.)	660 mm (26 in.) 660 mm (26 in.) 660 mm (26 in.)	650 mm (25.5 in.) 810 mm (32 in.) 910 mm (36 in.)	435 mm (17 in.) 595 mm (23.5 in.) 695 mm (27.5 in.)	910 mm (36 in.) 910 mm (36 in.) 910 mm (36 in.)
3. Sit-Stand (w/standing vision over top)	1535 mm (60.5 in.)	620 mm (24.5 in.)	910 mm (36 in.)	695 mm (27.5 in.)	910 mm (36 in.)
4. Stand (w/vision over top)	1535 mm (60.5 in.)	620 mm (24.5 in.)	910 mm (36 in.)	N/A	1120 mm (44 in.)
5. Stand (w/o vision over top)	1830 mm (72 in.)	910 mm (36 in.)	910 mm (36 in.)	N/A	910 mm (36 in.)

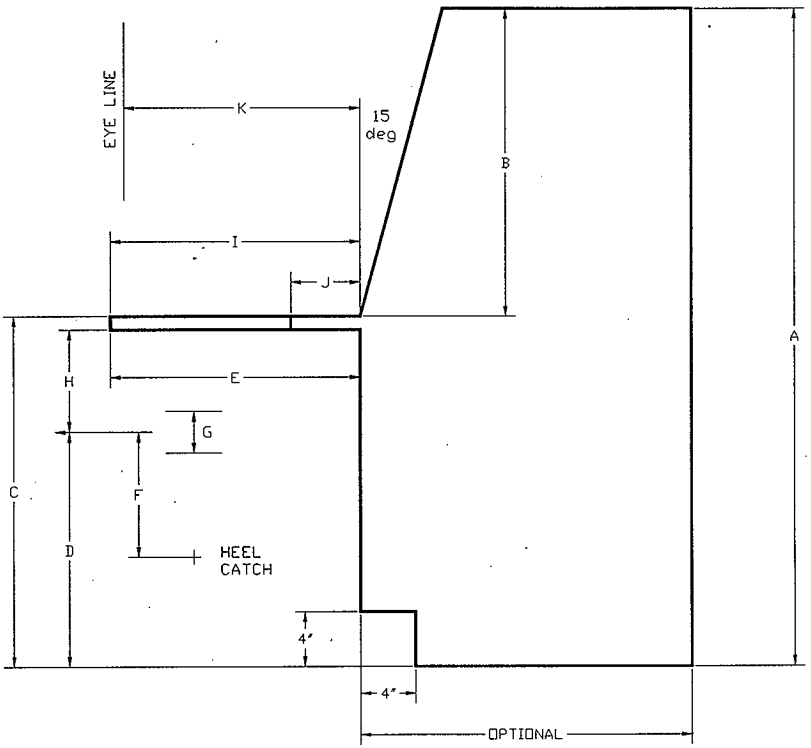
Key	Dimensions
E[3] = Minimum knee clearance	460 mm (18 in.)
F[3] = Foot support to sitting surface[4]	460 mm (18 in.)
G[3] = Seat adjustability	150 mm (6 in.)
H[3] = Miminum thigh clearance at midpoint of "G"	190 mm (7.5 in.)
I = Writing surface depth including shelf	400 mm (16 in.)
J = Minimum shelf depth	100 mm (4 in.)
K = Eye line-to-console front distance	400 mm (16 in.)

[1]See Figure 1.
[2]The range in Key A is provided to allow attitude in the volume of the lower part of the console, not in relationship to Keys C and D.
[3]Not applicable to console types 4 and 5 (listed above).
[4]Since this dimension must not be exceeded, a heel catch must be added to the chair if key D exceeds 460 mm (18 in.).

NOTE: A shelf thickness of 25 mm (1 in.) is assumed. For other shelf thicknesses, suitable adjustments should be made.

FIGURE 1

STANDARD CONSOLE DIMENSIONS



APPENDIX A

OPERATOR WORKSTATION TASK ANALYSIS OVERVIEW

OPERATOR WORKSTATION TASK ANALYSIS OVERVIEW
(Example of a Typical Checklist)

Operator:

Function:

Location:

	Criteria Met?				
	Y	N	N/A		
1. **Human Dimensions** Does the operator workstation/area design accommodate the proper range of body dimensions to perform required tasks?					
2. **Environmental** Does the operator workstation/area provide for adequate lighting/HVAC and minimize noise and vibration?					
3. **Work Space** Does the operator workstation/area provide adequate room for maintenance (including temporary shielding), protective gear, data information, accessibility and visibility?					
4. **Safety** Does the operator workstation/area design minimize hazards (radiological and toxic), provide for safe working conditions and an escape route?					

APPENDIX B

Human Factor Engineering Compliance Review Checklist

Design Considerations	Acceptance Criteria	Compliance Review			
		YES	NO	N/A	COMMENTS
1.1 Visual Displays 1.1.1 Present clear equipment and/or system conditions, including failure	General. Visual displays should be utilized to provide the operator with a clear indication of equipment or system conditions for operation under any eventuality commensurate with the operational and maintenance philosophy of the system under design (Ref. MIL STD 1472D, 5.2.1).				
1.1.2 Provide distinct warning awareness	Alerting/Warning. An alerting/warning display shall inform the operator of an approaching or existing abnormal condition (Ref. MIL STD 1472D, 5.2.1.1).				
1.2 Display illumination 1.2.1 Continuously variable	Display Illumination. When maximum dark adaptation is not required, low brightness white light (preferably integral and adjustable as appropriate) shall be used; however, when complete dark adaptation is required, low luminance (0.07-0.35 od/m^2 [0.02-0.10 fL]) red light (greater than 620 nM) shall be provided (Ref. MIL STD 1472D, 5.2.1.2.1.1).				
1.2.2 Balanced lighting across instrument panel	Light Distribution. Where multiple displays are grouped together, lighting shall be balanced across the instrument panel such that the mean indicator luminances of any two instruments shall not differ by more than 33% across the range of full ON to full OFF. Light distribution shall be sufficiently uniform within an integrally illuminated instrument such that the ratio of standard deviation of indicator element luminances to mean indicator luminance shall not be more than 0.25%, using eight or more equally spaced test measurements (Ref. MIL STD 1472D, 5.2.1.2.2).				
1.2.3 Provides contrast	Contrast. Sufficient contrast shall be provided between all displayed information and the display background to ensure that the required information can be perceived by the operator under all expected lighting conditions (Ref. MIL STD 1472D, 5.2.1.2.3).				

Design Considerations		Acceptance Criteria	Compliance Review			
			YES	NO	N/A	COMMENTS
1.3	Information	Information. (Ref. MIL STD 1472D, 5.2.1.3)				
1.3.1	Sufficient content	Content. The information displayed to an operator shall be sufficient to allow the operator to perform the intended mission, but shall be limited to that which is necessary to perform specific actions or to make decisions (Ref. MIL STD 1472D, 5.2.1.3.1).				
1.3.2	Adequate precision	Precision. Information shall be displayed only within the limits and precision required for specific operator actions or decisions (Ref. MIL STD 1472D, 5.2.1.3.2).				
1.3.3	Usable format	Format. Information shall be presented to the operator in a directly usable form. Requirements for transposing, computing, interpolating, or mentally translating into other units shall be avoided. Additional requirements for computer display formats are contained in 5.15 (Ref. MIL STD 1472D, 5.2.1.3.3).				
1.3.4	Redundancy only as required	Redundance. Redundancy in the display of information to a single operator shall be avoided unless it is required to achieve specified reliability (Ref. MIL STD 1472D, 5.2.1.3.4).				
1.3.5	Combining of information to suit application	Multi displays may be used, if appropriate.				
1.3.6	Display failure indication	Display Failure Clarity. Failure of a display or its circuit shall be immediately apparent to the operator (Ref. MIL STD 1472D, 5.2.1.3.6).				
1.3.7	Display and equipment circuit isolation	Display Circuit Failure. Failure of the display circuit shall not cause a failure in the equipment associated with the display (Ref. MIL STD 1472D, 5.2.1.3.8).				
1.3.8	Unrelated markings shall not be present	Unrelated Markings. Trademarks and company names or other similar markings not related to the panel function shall not be displayed on the panel face (Ref. MIL STD 1472D, 5.2.1.3.8).				
1.3.9	Duration of displayed information shall be sufficient for task	Duration. Signals and display information shall have durations of sufficient length to be reliably detected under expected operator workload and operational environment (Ref. MIL STD 1472D, 5.2.1.3.9).				

Design Considerations		Acceptance Criteria	Compliance Review			
			YES	NO	N/A	COMMENTS
1.3.10	Displays shall be timely and synchronous	Timeliness. Displays such as cathode ray tube displays, head-up displays, collimated displays and other displays requiring refreshed information shall be updated in a synchronous manner, where possible, and be refreshed to the degree of timeliness required by personnel in the normal operating or serving mode (Ref. MIL STD 1472D, 5.2.1.3.10).				
1.3.11	Display is advisory and alerting	Advisory and Alerting. Displays such as multifunction displays, cathode ray tube displays, head-up displays, collimated displays and other visual display devices displaying simultaneous and integrated information shall advise or alert operating personnel to information that becomes critical within the display (Ref. MIL STD 1472D, 5.2.1.3.12).				
1.3.12	Clearly visible while wearing a mask	NBC Contamination. As applicable, display characteristics (e.g., clarity, legibility) shall be compatible with viewing while wearing an NBC protective mask. Displays or indicators that show the presence of NBC agents shall also show when such agent concentrations decrease to safe levels (Ref. MIL STD 1472D, 5.2.1.3.12).				
1.3.13	Numeric digital displays held to a minimum	Numeric Digital Displays. Numeric digital displays shall not be used as the only display of information when perception of the pattern of variation is important to proper perception. Numeric digital displays shall not be used when rapid or slow digital display rates inhibit proper perception (Ref. MIL STD 1472D, 5.2.1.3.13).				

Design Considerations		Acceptance Criteria	Compliance Review			
			YES	NO	N/A	COMMENTS
1.4	Location and Arrangement	Location and Arrangement				
1.4.1	Located for Accuracy	Location. Displays shall be located and designed so that they may be read to the degree of accuracy required by personnel in the normal operating or servicing positions without requiring the operator to assume an uncomfortable, awkward or unsafe position (Ref. MIL STD 1472D, 5.2.1.4.1).				
1.4.2	In normal line of sight	Access. Visual displays should be visually accessible without resorting to use of ladders, flashlights or other special equipment in order to read the display (Ref. MIL STD 1472D, 5.2.1.4.2).				
1.4.3	Orientation not less than 45° from the normal line of sight	Orientation. Display faces shall be perpendicular to the operator's normal line of sight whenever feasible and shall not be less than 45° from the normal line of sight. Parallax shall be minimized (Ref. MIL STD 1472D, 5.2.1.4.3).				
1.4.4	Reflection shall be prevented	Reflection. Displays shall be constructed, arranged, and mounted to prevent reduction of information transfer due to the reflection of the ambient illumination from the display cover. If necessary, techniques (such as shield and filters) shall be employed to insure that system performance will not be degraded (Ref. MIL STD 1472D, 5.2.1.4.4).				
1.4.5	Vibration shall not degrade use	Vibration. Vibration of visual displays shall not degrade user performance below the level required for mission accomplishment (See 5.8.4.2) (Ref. MIL STD 1472D, 5.2.1.4.5).				
1.4.6	Proper grouping of activities	Grouping. All displays necessary to support an operator actively or sequence of activities, shall be grouped together (Ref. MIL STD 1472D, 5.2.1.4.6).				
1.4.7	Arranged for function and sequence	Function and Sequence. Displays shall be arranged in relation to one another according to their sequence of use or the functional relations of the components they represent. They shall be arranged in sequence within functional groups, whenever possible, to provide a viewing flow from left to right or top to bottom (Ref. MIL STD 1472D, 5.2.1.4.7).				

Design Considerations		Acceptance Criteria	Compliance Review			
			YES	NO	N/A	COMMENTS
1.4.8	Arranged for frequency of use	Frequency of Use. Displays used most frequently should be grouped together and placed in the optimum visual zone (See Figure 2) (Ref. MIL STD 1472D, 5.2.1.4.8).				
1.4.9	Important displays shall have privilege of position	Importance. Important displays shall have privilege of position. Important or critical displays shall be located in a privileged position in the optimum projected visual zone or otherwise highlighted (Ref. MIL STD 1472D, 5.2.1.4.9).				
1.4.10	Arrangement shall be consistent	Consistency. For a system which contains multiple, similar applications, the arrangement of displays within those similar applications shall be kept consistent (Ref. MIL STD 1472D, 5.2.1.4.10).				
1.4.11	Viewing distance 13" to 25"	Maximum Viewing Distance. The viewing distance from the eye reference point of the seated operator to displays located close to their associated controls shall not exceed 635 mm (25 in.). Otherwise, there is no maximum limit other than that imposed by legibility limitations, which shall be compensated for by proper design (Ref. MIL STD 1472D, 5.2.1.4.11). Minimum Viewing Distance. The effective viewing distance to displays, with the exception of cathode ray tube displays (See 5.2.4.2) and collimated displays, shall never be less than 330 mm (13 in.) and preferably not less than 510 mm (20 in.) (Ref. MIL STD 1472D, 5.2.1.4.1.2).				

Design Considerations	Acceptance Criteria	Compliance Review			
		YES	NO	N/A	COMMENTS
1.5 Coding	Coding				
1.5.1 Coding techniques	Objectives. Coding techniques shall be used to facilitate:				
1.5.1.1 Discrimination displays	a. Discrimination between individual displays				
1.5.1.2 Identification of functionally related displays	b. Identification of functionally related displays				
1.5.1.3 Identification of relationship	c. Indication of relationship between displays				
1.5.1.4 Identification of critical information	d. Identification of critical information within a display				
	(Ref. MIL STD 1472D, 5.2.1.5.1)				
1.5.2 Good use of color, size, shape, location or flash code	Techniques. Displays shall be coded by color, size, location, shape, or flash coding, as applicable (Ref. MIL STD 1472D, 5.2.1.5.2).				
1.5.3 Uniform and standardized coding	Standardization. All coding within the system shall be uniform and shall be established by agreement with the procuring activity (Ref. MIL STD 1472D, 5.2.1.5.3).				
1.6 Type of displays	Transilluminated Displays.				
1.6.1 Transilluminated	General. Three general types of transilluminated displays that may be used include: a. Single- and multiple-legend lights, which present information in the form of meaningful words, numbers, symbols, and abbreviations. b. Simple indicator lights. c. Transilluminated panel assemblies, which present qualitative status or system readiness information.				

Design Considerations	Acceptance Criteria	Compliance Review			
		YES	NO	N/A	COMMENTS
	Use. Transilluminated indicators should be used to display qualitative information to the operator requiring either an immediate reaction by the operator, or to draw attention to an important system status. Such indicators may also be used occasionally for maintenance and adjustment functions (Ref. MIL STD 1472D, 5.2.2.1.1). Equipment Response. Lights, including those used in illuminated pushbuttons, shall display equipment response and not merely control position. For example, a control action may be to turn on a motor and the light should indicate when the motor actually turns on (Ref. MIL STD 1472D, 5.2.2.1.2). Information. Lights and related indicators shall be used sparingly and shall display only that information necessary for effective system operation (Ref. MIL STD 1472D, 5.2.2.1.3). Positive Feedback. Changes in display status shall signify changes in functional status rather than results of control actuation alone. The absence or extinguishment of a signal or visual indication shall not be used to denote a "malfunction," "no go," or "out-of-tolerance" condition; only the absence of a "power on" signal or visual indication thereof may be used by the operator to assume a condition. that assumption would be "power off" (Ref. MIL STD 1472D, 5.2.2.1.4).				
	Lamp Testing. When indicator lights using incandescent bulbs are installed on a control panel, a master light test control shall be incorporated. When applicable, design shall allow testing of all control panels at one time. Panels containing three or fewer lights may be designed for individual press-to-test bulb testing. Circuitry should be designed to test the operation of the total indicator circuit. If dark adaptation is a factor, a means for reducing total indicator light brightness during test operation shall be provided (Ref. MIL STD 1472D, 5.2.2.1.14). Lamp Removal, Method. Where possible, lamps shall be removable and replaceable from the front of the display panel. The procedure for lamp removal and replacement shall not require the use of tools and shall be easily and rapidly accomplished (Ref. MIL STD 1472D, 5.2.2.1.15).				

Design Considerations	Acceptance Criteria	Compliance Review			
		YES	NO	N/A	COMMENTS
	Lamp Removal, Safety. Display circuit design shall permit lamp removal and replacement while power is applied without causing failure of indicator circuit components or imposing personnel safety hazards (Ref. MIL STD 1472D, 5.2.2.1.16). Indicator Covers. If design of legend screen or indicator covers do not prevent inadvertent interchange, a means shall be provided for checking the covers after installation to insure they are properly installed (Ref. MIL STD 1472D, 5.2.2.1.16). Color Coding. Transilluminated displays shall conform to the following color coding scheme, in accordance with Type I - Aviation colors of MIL-C-25050. a. RED shall be used to alert an operator that the system or any portion of the system is inoperative. Examples of indicators which should be coded RED are those which display such information as "no-go," "error," "failure," "malfunction," etc. b. FLASHING RED shall be used only to denote emergency conditions which require operator action to be taken without undue delay, or to avert impending personnel injury, equipment damage, or both. c. YELLOW shall be used to advise an operator that a condition exists which is marginal. YELLOW shall also be used to alert the operator to situations where caution, recheck, or unexpected delay is necessary. d. GREEN shall be used to indicate that the monitored equipment is in tolerance or a condition is satisfactory and that it is alright to proceed (e.g., "go-ahead," "intolerance," "ready," "function activated").				

Design Considerations	Acceptance Criteria	Compliance Review			
		YES	NO	N/A	COMMENTS
	e. WHITE shall be used to indicate system conditions that do not have "right" or "wrong" implications, such as alternative functions (e.g., Missile No. 1 selected for launch, etc.) or transitory conditions (e.g., action in progress, function available), provided such indication does not imply success or failure of operations. f. BLUE may be used for an advisory light, but preferential use of BLUE should be avoided. (Ref. MIL STD 1472D, 5.2.2.1.18) Flashing Lights. Flashing lights shall be used to call attention to a condition requiring immediate action. Flashing lights which could be simultaneously active should have synchronized flashes. If the indicator is energized and the flasher device fails, the light shall illuminate and burn steadily. An audible warning is often used along with the visual (Ref. ML STD 1472D, 5.3.2.4).				
1.6.2 Legend lights	Legend Lights. Use. Legend lights shall be used in preference to simple indicator lights except where design considerations demand that simple indicators be used. Color Coding. Legend lights shall be color coded in conformance with MIL STD 1472D, 5.2.2.1.18. Legend lights required to denote personnel or equipment disaster (FLASHING RED), caution or impending danger (YELLOW), and master summation go (GREEN) or no-go (RED) shall be discriminably larger, and preferably brighter, than all other legend lights. Lettering. The size and other characteristics of lettering shall conform to MIL STD 1472D, 5.5 herein, or as otherwise specified by the procuring activity. Visibility and Legibility. With the exception of warning and caution indicators, the lettering on single-legend indicators shall be visible and legible whether or not the indicator is energized.				

Design Considerations	Acceptance Criteria	Compliance Review			
		YES	NO	N/A	COMMENTS
	Multi-Function Legends. Indicators designed to provide alternately-presented legends shall present only one legend at a time, i.e., only the legend in use shall be visible. If the indicator device utilizes "stacked" legends, it shall be designed so that: a. When the rear legend is energized, it shall not be obscured by the front legend. b. Parallax is minimized. c. Rear legends have approximately equal brightness to front legends, and the contrast between rear legends and background is equal to that of the front legend and its background. (Ref. MIL STD 1472D, 5.2.2.2)				
1.6.3 Indicator lights	Simple Indicator Lights. Use. Simple indicator lights should be used when design considerations preclude the use of legend lights. Spacing. the spacing between adjacent edges of simple round indicator light fixtures shall be sufficient to permit unambiguous labeling, signal interpretation, and convenient bulb removal. Coding. Simple indicator lights shall be coded in conformance with Table 1 of Section 5.2.2.3 of MIL STD 1472D; however, the different sizes shown are intended only for the attention-getting value that larger lights of at least equal luminance provide in relation to indicator lights of lesser importance (Ref. MIL STD 1472D, 5.2.2.3).				

Design Considerations	Acceptance Criteria	Compliance Review			
		YES	NO	N/A	COMMENTS
1.6.4 Transilluminated panel assemblies	Transilluminated Panel Assemblies. Use. Transilluminated (integrally lighted) panel assemblies may be used to: a. Provide illuminated labels for a control panel. b. Provide a light source for illuminating transilluminated control knobs. c. Provide illuminated association markings on a control panel, e.g., connecting lines between controls, outlines around a functionally-related group of controls or displays, or both. d. Create a pictorialized representation of a system process, communication network, or other information/ component organization. Large, Single Pictorial Graphic Panels. Large, single pictorial graphic panels, used to display system processing, communications networks or similar applications, shall comply with requirements for visibility, legibility, color and illumination as specified herein. Re-Lamping. When replaceable incandescent lamps are used as the illuminant source for integral lighting of panel assemblies, lamps shall be readily accessible without disconnecting the panel(s). A sufficient number of lamps shall be provided so that failure of one lamp will not cause any part of the display to be unreadable. Brightness. Brightness of illuminated markings and transilluminated controls shall be compatible with the ambient environment and operating conditions (e.g., dark adaptation requirements). Brightness control (dimming) by the operator shall be provided where applicable to maintain appropriate visibility and operator dark adaptation level (Ref. MIL STD 1472D, 5.2.2.4).				

Design Considerations	Acceptance Criteria	Compliance Review			
		YES	NO	N/A	COMMENTS
1.6.5 Scale indicators	Scale Indicators. General. Type of Scale Indicators. The types of scale indicators that may be used include: a. Moving-pointer, fixed-scale, circular, curved (arc), horizontal straight, and vertical straight. b. Fixed-pointer, moving scale, circular, curved (arc), horizontal straight, and vertical straight. (Ref. NUREG-700, 6.5) Use. The use of scale indicators should conform to the specific criteria contained in this section. Moving-pointer, fixed-scale indicators are preferred to fixed-pointer, moving-scale indicators. The latter should be used only when necessitated by operational requirements or other conditions and when approved by the procuring activity. Type of Information. Scale indicators should be used to display quantitative information in combination with qualitative information (such as trend and direction-of-motion) and where only quantitative information is to be displayed and there is no requirement (such as speed and accuracy of response) which demands the use of printers or counters. An example would be the monitoring of process value, such as temperature where the operator may monitor the current valve plus whether it is increasing or decreasing. Linear Scales. Except where system requirements clearly dictate nonlinearity to satisfy operator information requirements, linear scales shall be used in preference to non-linear scales.				

Design Considerations	Acceptance Criteria	Compliance Review			
		YES	NO	N/A	COMMENTS
	Scale Markings. Graduations. Scale graduations shall progress by 1, 2, or 5. Intermediate Marks. The number of minor or intermediate marks between numbered scale pointers shall not exceed nine. Major Marks. Except for measurements that are normally expressed in decimals, whole numbers shall be used for major graduation marks. Starting Point. Display scale shall start at zero, except where this would be inappropriate for the function involved. For example, temperature ranges often begin at below or above zero.				
	Pointers. Length. the control or display pointer should extend to, but not overlap, the shortest scale graduation marks. Tip Configuration. The pointer tip should be tapered at a 350 mrad (20°) angle ([40°] included angle), terminating in a flat tip equal in width to the minor scale graduation. Mounting. The pointer shall be mounted as close as possible to the face of the dial to minimize parallax. Color. Pointer color from the tip to the center of the dial shall be the same color of the marks. The tail of the pointer shall be the same color as the dial face, unless the tail is used as an indicator itself or unless the pointer is used for horizontal alignment. Luminance Contrast. Luminance contrast of at least 3.0 shall be provided between the scale face and the markings and pointer. Calibration Information. Provision shall be made for placing calibration information on instruments without degrading dial legibility.				

Design Considerations	Acceptance Criteria	Compliance Review			
		YES	NO	N/A	COMMENTS
	Coding. Use. Coding on the face of scale indicators may be used to convey such information as desirable operating range, dangerous operating level, caution, undesirable, and inefficient. Pattern or Color-Coding. When certain operating conditions always fall within a given range on the scale, these areas shall be made readily identifiable by means of pattern or color-coding applied to the face of the instrument. Choice of Color. Red, yellow, and green may be applied, provided they conform to the meanings specified in 5.2.2.1.18 and are distinguishable under all expected lighting conditions.				
	Moving-Pointer, Fixed-Scale Indicators. Numerical Progression. The increase of numerical progression on fixed scales shall read clockwise, from left to right, or from the bottom up, depending on display design and orientation. Orientation. Numbers on stationary scales shall be oriented in the upright position. Circular Scales. Scale Reading and Pointer Movement. The magnitude of the scale reading shall increase with clockwise movement of the pointer.				
1.6.6 Cathode ray tube displays	Cathode Ray Tube (CRT) Displays. Viewing Distance. A 400 mm (16 in.) viewing distance shall be provided whenever practicable. When periods of scope observation will be short, or when dim signals must be detected the viewing distance may be reduced to 250 mm (10 in.). Design should permit the observer to view the scope from as close as desired. Displays which must be placed at viewing distances greater than 400 mm (16 in.) due to other considerations shall be appropriately modified in aspects such as display size, symbol size, brightness ranges, line-pair spacing, and resolution.				

Design Considerations	Acceptance Criteria	Compliance Review			
		YES	NO	N/A	COMMENTS
	Screen Luminance. Brightness and contrast adjustments shall be provided to permit optimum screen adjustment based upon surrounding lighting conditions (Ref. MIL STD 1472D, 5.2.4.3). Luminance Range of Adjacent Surfaces. With the exception of emergency indicators, no light source in the immediate surrounding area shall be of greater luminance than the CRT signal. Ambient Illuminance. The ambient illuminance in the CRT area shall be appropriate for other visual functions (e.g., setting controls, reading instruments, maintenance) but shall not degrade the visibility of signals on the CRT display. When a CRT display is used in variable ambient illuminance, illuminance controls shall be provided to dim all light sources, including illuminated panels, indicators and switches in the immediate surrounding area. Automatic adjustment of CRT brightness may be used if the CRT brightness is automatically adjusted as a function of ambient illuminance and the range of automatic adjustment is adequate for the full range of ambient illuminance.				
	Reflected Glare. Reflected glare shall be minimized by proper placement of the scope relative to the light source, use of a hood or shield, or optical coatings on the CRT or filter control over the light source. Adjacent Surfaces. Surfaces adjacent to the scope shall have a dull matte finish. Pictorial/Graphic Situation Formats. Pictorial or situation data such as plan position indicator data, shall be presented as luminous symbols/dark background. Font Legibility. Where alpha-numeric characters appear on CRT-like displays, the font style shall allow discrimination of similar characters, such as letter I and number 1; letter z and number 2 (Ref. MIL STD 1472D, 5.2.4.1 through 5.2.4.10).				

Design Considerations	Acceptance Criteria	Compliance Review			
		YES	NO	N/A	COMMENTS
1.6.7 Counters	Counters. Use. Counters should be used for presenting quantitative data when a quick, precise indjcation is required. Mounting. Counters shall be mounted as close as possible to the panel surface so as to minimize parallax and shadows and maximize the viewing angle. Spacing Between Numerals. the horizontal separation between numerals shall be between one-quarter and one-half the numeral width. Commas shall not be used.				
	Movement. a. Snap action. Numbers shall change by snap action in preference to continuous movement. b. Rate. Numbers shall follow each other not faster than 2 per second when the observer is expected to read the numbers consecutively. c. Direction. The rotation of the counter reset knob shall be clockwise to increase the counter indication or to reset the counter. d. Reset. Counters used to indicate the sequencing of equipment shall be designed to be reset automatically upon completion of the sequence. Provision shall also be made for manual resetting. Where pushbuttons are used to manually reset mechanical counters, actuating force required shall not exceed 16.7 N (60 z).				
	Illumination. Counters shall be self-illuminated when used in areas in which ambient illumination will provide display luminance below 3.5 dc/m_2 (1 ft-L). Finish. The surface of the counter drums and surrounding areas shall have a dull finish to minimize glare. Contrast. Color of the numerals and background shall provide high contrast (black on white or converse, as appropriate). (Ref. MIL STD 1472D, 5.2.6.2.1 through 5.2.5.2.4).				

Design Considerations	Acceptance Criteria	Compliance Review			
		YES	NO	N/A	COMMENTS
1.6.8 Printers	Printers. Use. Printers should be used when a visual record of data is necessary or desirable. Visibility. The printed matter shall not be hidden, masked, or obscured in a manner that impairs direct reading. Contrast. A minimum of 3.0 luminance contrast shall be provided between the printed material and the background on which it is printed. Illumination. The printer shall be provided with internal illumination if the printed matter is not legible in the planned operational ambient illumination. Take-up Provision. A take-up device for printed material shall be provided. Annotation. Where applicable, printers should be mounted so that the printed matter (e.g., paper, metalized paper) may be easily annotated while still in the printer. Legibility. The print output shall be free from character line mis-registration, character tilt or smear. Printed Tapes. The information on the tapes shall be printed in such a manner that it can be read as it is received from the machine without requiring the curing and pasting of tape sections. Control, Replenishment, and Service. Printers shall conform to the criteria of 5.2.6.4.8 (Ref. MIL STD 1472D, 5.2.3.6.1 through 5.2.6.3.9).				
1.6.9 Plotters and recorders	Plotters and Recorders. Use. Plotters and recorders may be used when a visual record of continuous graphic data is necessary or desirable. Visibility. Critical graphics (those points, curves and grids that must be observed when the recording is being made) shall not be obscured by pen assembly, arm or other hardware elements. Contrast. A minimum of 1.0 luminance contrast shall be provided between the plotted function and the background on which it is drawn.				

Design Considerations	Acceptance Criteria	Compliance Review			
		YES	NO	N/A	COMMENTS
	Take-up Device. A take-up device for extruded plotting materials shall be provided when necessary or desirable. Job Aids. Graphic overlays should be provided where these may be critical to proper interpretation of graphic data as it is being generated. Such aids shall not obscure or distort the data. Smudging/Smearing. The plot should be resistant to smudging or smearing under operational use. Annotation. Where applicable, plotters and recorders should be designed or mounted so that the operator can write on or mark the paper while it is still in the plotter/recorder.				
	Control, Replenishment, and Service. Plotters and recorders shall conform to criteria herein with regard to: a. Controls and displays used to start, stop or adjust the machine and critical operating elements. b. Positive indication of the remaining supply of plotting materials (e.g., paper, ink, ribbon). c. Insertion, adjustment for operation, and removal of paper, replenishment of ink supply, replacement of pen or other items determined to be operator tasks, without requiring disassembly, special equipment or tools. d. Minor servicing on site by a technician, e.g., adjustment of drive system, cleaning, or replacement of operating items that ordinarily would not be available to an operator (Ref. MIL STD 1472D, 5.2.6.4.1 through 5.2.6.4.2).				

Design Considerations	Acceptance Criteria	Compliance Review			
		YES	NO	N/A	COMMENTS
1.6.10 Light emitting diodes (LEDs)	Light Emitting Diodes (LEDs). General. In general, the standard for LEDs shall be the same as the requirements for transilluminated displays, paragraph 5.2.2 of MIL STD 1472D of this standard, unless specified below. Use. LEDs may be used for transilluminated displays, including legend and simple indicator lights, and for matrix (alphanumeric) displays, only if the display is bright enough to be readable in the environment of intended use (enclosure, bright sunlight, low temperature). Intensity Control. The dimming of LEDs should be compatible with the dimming of incandescent lamps. Color Coding. LED color coding shall conform to 5.2.2.1.18, herein, with the exception of red alphanumeric displays; however, red LEDs should not be located in the proximity of red lights used as outlined in 5.2.2.1.18. Lamp Testing. LED indicator lights with 100,000 h or longer MTBF (mean time between failure) shall not require the lamp test capability specified in 5.2.2.1.14 (Ref. MIL STD 1472D, 5.2.6.7.1 through 5.2.6.7.5).				

APPENDIX L

Engineering Study (DRAFT)

Plutonium Finishing Plant
Vault Storage Concept Comparison

DRAFT

ENGINEERING STUDY

PLUTONIUM FINISHING PLANT VAULT STORAGE CONCEPT COMPARISON

PROJECT W-460

Prepared for

B&W Hanford Company

January 1997

Issue A

For the U.S. Department of Energy
Contract _____

Prepared by

Fluor Daniel Northwest
Richland, Washington

_____ ES

DRAFT

_____ ES

ENGINEERING STUDY

FOR

PLUTONIUM FINISHING PLANT
VAULT STORAGE CONCEPT COMPARISON

PROJECT W-460

Prepared by

Fluor Daniel Northwest
Richland, Washington

for

B&W Hanford Company

_____ ___ _____ ___
Technical Documents Date

_____ ___ _____ ___
Environmental Engineering Date

_____ ___ _____ ___
Project Manager Date

Principal Lead Engineer Date

Safety Engineer Date

Quality Engineering Date

B&W Hanford Company

_____ ___
Department Date

Projects

i

TABLE OF CONTENTS

DRAFT

ENGINEERING STUDY

PLUTONIUM FINISHING PLANT VAULT STORAGE CONCEPT COMPARISON

PROJECT W-460

I. INTRODUCTION

The Plutonium Finishing Plant (PFP) is located in the 200-West Area on the Hanford Site. The production mission of the plant is completed and the new mission of the plant is environmental restoration. As part of the new mission, PFP will stabilize and suitably store or dispose of all plutonium-bearing special nuclear material (SNM). Stabilized SNM will be stored in the existing plutonium storage vaults located in the 2736-Z Building. The concrete storage cubicles located in the vaults are unsuitable for storing the new 3013 storage cans because of the physical dimensions of the new cans and changes to the security and safeguards issues associated with the new can design.

On September 4, 1996, ICF Kaiser Hanford Company conducted a facilitated Value Engineering (VE) session to evaluate various methods of solving the problem associated with the use of the new 3013 storage containers. There were twelve different storage methods considered by the VE team.

Three possible storage concepts were proposed for further evaluation by the VE report.

II. SUMMARY AND CONCLUSIONS

Supporting studies to date indicate that the cubicle concept is the best choice for the 3013 can storage configuration. Each cubicles will be limited to holding 20 of the 3013 storage containers.

The space required for storage of the PFP inventory will be three rooms within the 2736-Z Building vaults. This is based on an estimated requirement to store 2300 of the 3013 containers holding an average of about 3kg PuO_2. These values were based on criteria set forth in ref 8.

The fourth room will be used by International Atomic Energy Agency (IAEA) to store about 300 containers under their control.

III. DESCRIPTION OF ALTERNATIVES

The VE report recommended three alternatives for further evaluation:

1. **Concept 1:** (Vertical Pedestals Respaced) This is the baseline case and it consists of repositioning the internal support components within the existing concrete storage cubicles and making other modifications needed to make the cubicles compatible with current container storage criteria. The new 3013 storage containers would be stored in an upright or vertical orientation within the concrete cubicle.

   Advantages

   The advantage of this concept is that it has worked in the past. Operations is comfortable with the existing cubicles and the needed internal alterations are simple and doable.

   Disadvantages

   The disadvantages of this concept are related to the required 3013 container spacing within the cubicles and the traditional method of handling storage containers. The cubicles are about 8 ft in height and the storage containers are located at various levels and lateral spacing within the cubicle from bottom to top.

   Storage containers traditionally have been manually handled but the current ALARA objectives eliminate manual handling of the storage containers as an option. Machine handling is considered a necessity for the 3013 containers due to radiation exposure as well as potential container temperature. The configuration of the traditional storage cubicle will require a very versatile can manipulating machine capable of accessing each storage location within the cubicle.

   Personnel exposure is also considered to be higher with this concept unless additional modifications can be made to the door system to limit the number of containers exposing the operator during container manipulation activities.

2. **Concept 5:** (Horizontal Air Tube Cubicle) This concept is similar to concept 1 but it stores the 3013 container in a horizontal orientation within arrays of metal tubes installed in the existing storage cubicles.

   This concept is a variation of concept 1 and as such will not be considered independently. The advantages and disadvantages are essentially the same except that the addition of the storage tubes somewhat complicates container manipulation.

3. **Concept 10:** (Vertical CSB). This concept is a small version of the Canister Storage Building approach. In this concept, the 3013 storage containers would be stored in a vertical tube array beneath a 12-in. concrete deck or

floor. The storage tubes would be accessed through ports in the deck. The top of the deck would be about 4 ft above the level of the existing vault floor. The 3013 containers would be stacked three deep in each storage tube.

Advantages

All storage tube access ports have the same configuration and are located at a uniform elevation. This would allow the use of a simple container manipulator that can be positioned over any single access port using the same technique. The manipulator is envisioned to be a wheeled device or cart containing a turret having a capacity of three 3013 storage containers. All can or container manipulation would be in a vertical movement along the can axis into and out of the manipulator turret. The turret would provide adequate shielding to minimize radiation exposure to the operator. Each storage tube would contain a maximum of three 3013 containers. This would provide a higher level of security than the cubicle options because each secured cover will only provide access to three storage containers.

Disadvantages

Due to the raised floor, an additional 3013 can transfer operation would have to be made between the laboratory and the storage vault to get the storage can to the elevation of the deck. Cooling of the storage area below the floor would be handled by a cross flow ventilation system. On loss of forced ventilation, heat buildup would probably occur more rapidly than in the concepts based on cubicle storage. Natural convection would be very ineffective for heat removal due to the configuration and limited space below the floor deck. Temperature rise could be very significant, raising structural element temperatures to several hundred degrees F.

Based on preliminary information from criticality studies, neutron absorption materials will also be required under to floor deck. This would be achieved by using 1/8-in. cadmium plate sandwiched between 1/4-in. vertical steel plates between each row of storage tubes in the direction of air flow. An 1/8-in. cadmium plate would also be required on the surface of the existing concrete floor beneath the vertical storage tubes.

IV. IDENTIFICATION OF PREFERRED ALTERNATIVE

A. EVALUATION OF ALTERNATIVES

The following four issues were considered to be the minimum needed to evaluate the alternatives. At this time, several of these analysis or assessments are not completed.

1. **Hydraulic-Thermal Analysis**

2. **Criticality Assessment**

3.Radiation Exposure Analysis

4.Engineering/Construction Cost Estimate

Item 2 and Item 4 have been completed for both alternatives. Item 1 has been completed for the in-floor concept only and Item 3 has not been completed for either concept.

Preliminary data on the Hydraulic-Thermal Analysis for the cubicle concept indicates there is probably no clear advantage in this category for either concept.

The criticality assessment indicates that the cubicle storage concept would allow storage of about 60% more 3013 containers for a given floor space than will the in-floor concept, without resorting to neutron absorbers such as Cd in the storage area.

The study estimates show a clear advantage in using the cubicle concept. The estimated cost to use the cubicle concept was $4.5M versus $6.1M for the in-floor concept.

B. **PREFERRED ALTERNATIVE**

Based on the information available at this time, the preferred alternative appears to be the cubicle concept. This preference is driven by cost and criticality issues. It is not anticipated that the results of the other analysis being completed would significantly affect this choice.

C. **UNCERTAINTIES**

Final outcome of the pending study completions will provide a more complete picture of the concepts being compared. This study should be completed during the advanced conceptual design (ACD) stage including all the information being developed.

V. REQUIRED CHANGES TO IMPLEMENT PREFERRED ALTERNATIVE

Following completion of the advanced conceptual design report (ACDR) final detailed changes to the existing cubicles can be worked out. These details will have minimal impact on the estimated costs used in this study.

Design will also need to be done on the can handling unit that will deliver the can from the laboratory area to its final storage position. This unit will also provide proper shielding to minimize operator exposure.

Air handling modifications will include a redundant 6000 cfm fan and filter unit.

Security features will be included in the modifications and as a minimum will include otic cable seals in the ductwork and steel rebar grid works at wall penetrations.

VI. REFERENCES

1. Functional Design Criteria-Plutonium Stabilization and Handling (PuSH), Project W-460

2. Project W-460 Conceptual Design Report Input, CDR Safeguards and Security Narrative Section (Attached as Appendix __)

3. LOI #96-W460-004 (File No. 15C00-96-GAJ-067)

4. Results of Thermal-Hydraulic Assessment for the 2736Z Building Vault #2 with the Proposed In-Floor Storage Vault (Lockheed Martin Hanford Corporation, November 12, 1996, 74350-96-FJH-025).

5. In Floor Storage Concept Study Estimate-Project Cost Summary (Flour Daniel Northwest, Inc. - Babcock & Wilcox Hanford Job No. W-460/P8W712 File No. W460SAD1)

6. Cubicle Storage Concept Study Estimate-Project Cost Summary (Flour Daniel Northwest, Inc. - Babcock & Wilcox Hanford Job No. W-460/P8W712 File No. W460SAD2)

7. Criticality Assessment of two Plutonium Oxide 2736Z Vault Storage Concepts, by W. Todd Watson, Fluor Daniel Northwest, Dated 1/27/97.

8. WHC, 1996b, DNFSB Recommendation 94-1 Hanford Site Integrated Stabilization Management Plan, WHC-EP-0853, Revision 2, March 1996, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

COST ESTIMATE SUMMARIES

COST CODE	DESCRIPTION	ESCALATED TOTAL COST	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
501	BUILDINGS	3,320,000	35	1,160,000	4,480,000
700	SPECIAL EQUIP/PROCESS SYSTEMS	390,000	47	180,000	570,000
810	DEMOLITION	760,000	35	260,000	1,020,000
	(ADJUSTED TO MEET DOE 5100.4)	30,000		0	30,000
	PROJECT TOTAL	4,500,000	36	1,600,000	6,100,000

TYPE OF ESTIMATE	STUDY ESTIMATE	FEBRUARY 4, 1997
ARCHITECT ENGINEER	Lee Chadwick	
PHMC CONTRACTOR		

REMARKS:
CONSTRUCTION ONLY

(ROUNDED/ADJUSTED TO THE NEAREST " 10,000 / 100,000 " - PERCENTAGES NOT RECALCULATED TO REFLECT ROUNDING)

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
322101	VAULT #1	1398237	0	1398237	0.00	0	1398237	35	489384	1887621
322116	ROOM 1 MODS BLDG 2736-Z	46672	0	46672	0.00	0	46672	35	16335	63007
	SUBTOTAL 3221 VAULT #1 MODS	1444909	0	1444909	0.00	0	1444909	35	505719	1950628
322201	VAULT #2	1122326	0	1122326	0.00	0	1122326	35	392815	1515141
322216	ROOM 2 MODS BLDG 2736-Z	18494	0	18494	0.00	0	18494	35	6473	24967
	SUBTOTAL 3222 VAULT #2 MODS	1140820	0	1140820	0.00	0	1140820	35	399288	1540108
322301	VAULT #4	1398237	0	1398237	0.00	0	1398237	35	489384	1887621
322316	ROOM 4 MODS BLDG 2736-Z	58465	0	58465	0.00	0	58465	35	20463	78928
	SUBTOTAL 3223 VAULT #4 MODS	1456702	0	1456702	0.00	0	1456702	35	509847	1966549
322400	VAULT 2 (HVAC - IN THE FLOOR VER.)	26393	0	26393	0.00	0	26393	35	9237	35630
322402	VAULT 4 (HVAC - IN THE FLOOR VER.)	26378	0	26378	0.00	0	26378	35	9232	35610
322403	VAULT 1 (HVAC - IN THE FLOOR VER.)	50472	0	50472	0.00	0	50472	35	17665	68137
	SUBTOTAL 3224 VAULT HVAC MODS	103243	0	103243	0.00	0	103243	35	36134	139377
322600	Pu CANNISTER HANDLING MACHINES	300000	0	300000	0.00	0	300000	50	150000	450000
	SUBTOTAL 322 BUILDING 2736-Z MODS - VAUL	4445674	0	4445674	0.00	0	4445674	36	1600988	6046662
	SUBTOTAL 32 CONSTRUCTION-FIXED PRICE	4445674	0	4445674	0.00	0	4445674	36	1600988	6046662
330000	CONSTRUCTION-O/C	19337	0	19337	0.00	0	19337	35	6768	26105
	SUBTOTAL 33 CONSTRUCTION-O/C	19337	0	19337	0.00	0	19337	35	6768	26105
	SUBTOTAL 3 CONSTRUCTION	4465011	0	4465011	0.00	0	4465011	36	1607756	6072767
	PROJECT TOTAL	4,465,011	0	4,465,011	0.00	0	4,465,011	36	1,607,756	6,072,767

1. DOCUMENTS AND DRAWINGS

DOCUMENTS: PROJECT W-460 CONCEPTUAL DESIGN REPORT, PRELIMINARY DRAFT, DATED 12/13/96

DRAWINGS: ES-W460-S2, SHEET 1 & 2

2. MATERIAL PRICES

UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL.

3. LABOR RATES

BASE CRAFT RATES INCLUDE FRINGE BENEFITS, LABOR INSURANCE, TAXES AND TRAVEL WHERE APPLICABLE, PER HANFORD SITE STABILIZATION AGREEMENT, APPENDIX A (EFFECTIVE 09-06-96).

4. GENERAL REQUIREMENTS/TECHNICAL SERVICES/OVERHEADS

FIXED PRICE CONTRACTOR OVERHEAD, PROFIT, BOND AND INSURANCE COSTS HAVE BEEN APPLIED AT THE FOLLOWING PERCENTAGES AND ARE REFLECTED IN THE "OH&P/B&I" COLUMN OF THE ESTIMATE DETAIL:
LABOR - 26.5 TO 39% MATERIAL - 20 TO 39% EQUIPMENT USAGE - 20 TO 26.5% SUBCONTRACTS - 15 TO 20%

5. ESCALATION

NO ESCALATION HAS BEEN APPLIED TO THIS ESTIMATE BECAUSE IT IS TO BE USED FOR CONSTRUCTION COST COMPARISON ONLY.

6. ROUNDING

THE PROJECT COST SUMMARY REPORT (DOE_R01) IS SUMMARIZED AND ADJUSTED/ROUNDED AS FOLLOWS:

THE TOTAL COST COLUMN, CONTINGENCY TOTAL COLUMN AND TOTAL DOLLARS COLUMN DOE COST CODE SUB-TOTAL IS SUMMARIZED BY CONSTRUCTION. THE COLUMN SUBTOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $10,000.

THE PROJECT TOTAL SUMMARY LINE TOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $100,000.

7. REMARKS

A.) THIS ESTIMATE IS FOR CONSTRUCTION ONLY AND DOES NOT INCLUDE ANY COST FOR DESIGN, E&I DURING CONSTRUCTION, PROJECT MANAGEMENT, CONSTRUCTION MANAGEMENT, BID PACKAGE PREP, OR OTHER PROJECT COSTS.
B.) ASSUME THAT ALL VAULTS HAVE BEEN EMPTIED AND COMPLETELY DECONTAMINATED PRIOR TO ANY CONSTRUCTION ACTIVITIES.
C.) COST FOR Pu HANDLING MACHINES HAS BEEN PROVIDED BY FDNW P.E..

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
501	BUILDINGS									
322101	VAULT #1	1087232	0	1087232	0.00	0	1087232	35	380532	1467764
322116	ROOM 1 MODS BLDG 2736-Z	18494	0	18494	0.00	0	18494	35	6473	24967
322201	VAULT #2	1087232	0	1087232	0.00	0	1087232	35	380532	1467764
322216	ROOM 2 MODS BLDG 2736-Z	18494	0	18494	0.00	0	18494	35	6473	24967
322301	VAULT #4	1087232	0	1087232	0.00	0	1087232	35	380532	1467764
322316	ROOM 4 MODS BLDG 2736-Z	18494	0	18494	0.00	0	18494	35	6473	24967
TOTAL 501	BUILDINGS	3317178	0	3317178	0.00	0	3317178	35	1161015	4478193
700	SPECIAL EQUIP/PROCESS SYSTEMS									
322400	VAULT 2 (HVAC - IN THE FLOOR VER.)	22369	0	22369	0.00	0	22369	35	7829	30198
322402	VAULT 4 (HVAC - IN THE FLOOR VER.)	22369	0	22369	0.00	0	22369	35	7829	30198
322403	VAULT 1 (HVAC - IN THE FLOOR VER.)	46463	0	46463	0.00	0	46463	35	16262	62725
322600	Pu CANNISTER HANDLING MACHINES	300000	0	300000	0.00	0	300000	50	150000	450000
TOTAL 700	SPECIAL EQUIP/PROCESS SYSTEM	391201	0	391201	0.00	0	391201	47	181920	573121
810	DEMOLITION									
322101	VAULT #1	311005	0	311005	0.00	0	311005	35	108852	419857
322116	ROOM 1 MODS BLDG 2736-Z	28178	0	28178	0.00	0	28178	35	9862	38040
322201	VAULT #2	35094	0	35094	0.00	0	35094	35	12283	47377
322301	VAULT #4	311005	0	311005	0.00	0	311005	35	108852	419857
322316	ROOM 4 MODS BLDG 2736-Z	39971	0	39971	0.00	0	39971	35	13990	53961
322400	VAULT 2 (HVAC - IN THE FLOOR VER.)	4024	0	4024	0.00	0	4024	35	1408	5432
322402	VAULT 4 (HVAC - IN THE FLOOR VER.)	4009	0	4009	0.00	0	4009	35	1403	5412
322403	VAULT 1 (HVAC - IN THE FLOOR VER.)	4009	0	4009	0.00	0	4009	35	1403	5412
330000	CONSTRUCTION-O/C	19337	0	19337	0.00	0	19337	35	6768	26105
TOTAL 810	DEMOLITION	756632	0	756632	0.00	0	756632	35	264821	1021453
PROJECT TOTAL		4,465,011	0	4,465,011	0.00	0	4,465,011	36	1,607,756	6,072,767

CSI	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
CONSTRUCTION										
01	GENERAL REQUIRMENTS	120750	0	120750	0.00	0	120750	35	42264	163014
02	SITEWORK	657104	0	657104	0.00	0	657104	35	229987	887091
03	CONCRETE	258393	0	258393	0.00	0	258393	35	90438	348831
05	METALS	2882553	0	2882553	0.00	0	2882553	35	1008894	3891447
13	SPECIAL CONSTRUCTION	300000	0	300000	0.00	0	300000	50	150000	450000
15	MECHANICAL	122580	0	122580	0.00	0	122580	35	42902	165482
16	ELECTRICAL	123631	0	123631	0.00	0	123631	35	43271	166902
TOTAL CONSTRUCTION		4,465,011	0	4,465,011	0.00	0	4,465,011	36	1,607,756	6,072,767
PROJECT TOTAL		4,465,011	0	4,465,011	0.00	0	4,465,011	36	1,607,756	6,072,767

REFERENCE: ESTIMATE BASIS SHEET PAGE OF
COST CODE ACCOUNT SUMMARY PAGE OF

THE U.S. DEPARTMENT OF ENERGY - RICHLAND ORDER 5700.3 "COST ESTIMATING, ANALYSIS AND STANDARDIZATION" DATED 3-27-85, PROVIDES GUIDELINES FOR ESTIMATE CONTINGENCIES. THE GUIDELINE FOR A STUDY ESTIMATE SHOULD HAVE AN OVERALL RANGE OF 20 TO 30% AND UP TO 50% FOR EXPERIMENTAL OR SPECIAL CONDITIONS.

CONTINGENCY IS EVALUATED AT THE THIRD COST CODE LEVEL AND SUMMARIZED AT THE PRIMARY AND SECONDARY COST CODE LEVEL OF THE DETAILED COST ESTIMATE.

ENGINEERING: N/A

AVERAGE ENGINEERING CONTINGENCY %

CONSTRUCTION: 35% CONTINGENCY HAS BEEN APPLIED TO ALL CONSTRUCTION DUE TO THE UNIQUE TYPE OF WORK THAT IS TO BE DONE. ALSO UNKNOWNS AND UNCERTAINTIES CONCERNING THE METHOD OF PERFORMANCE, AVAILABILITY OF ACCESS DUE TO SECURITY, AND THE STANDARD SHORTFALLS AND PROBLEMS THAT ARE ALMOST ALWAYS ENCOUNTERED WHEN DOING RENOVATION AND REMODEL PROJECTS.

50% CONTINGENCY HAS BEEN APPLIED TO THE Pu CANNISTER HANDLING MACHINES DUE TO THE LACK OF ANY DESIGN AT THIS TIME.

AVERAGE CONSTRUCTION CONTINGENCY 36%

AVERAGE PROJECT CONTINGENCY 36%

FLUOR DANIEL NORTHWEST, INC.
BABCOCK & WILCOX HANFORD
JOB NO. W-460/P8W712
FILE NO. W460SAD1

** IEST - INTERACTIVE ESTIMATING **
IN FLOOR STORAGE CONCEPT
STUDY ESTIMATE
DOE_R07 - ONSITE INDIRECT COSTS BY WBS

DATE 01/07/97 11:26:47
BY SMP/CDL/DKH

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	CONTRACT ADMINISTRATION %	CONTRACT ADMINISTRATION TOTAL	BID PACK PREP.	OTHER INDIRECTS	TOTAL INDIRECTS
322101	VAULT #1	1398237	0.00	0	0	0	0
322116	ROOM 1 MODS BLDG 2736-Z	46672	0.00	0	0	0	0
322201	VAULT #2	1122326	0.00	0	0	0	0
322216	ROOM 2 MODS BLDG 2736-Z	18494	0.00	0	0	0	0
322301	VAULT #4	1398237	0.00	0	0	0	0
322316	ROOM 4 MODS BLDG 2736-Z	58465	0.00	0	0	0	0
322400	VAULT 2 (HVAC - IN THE FLOOR VER.)	26393	0.00	0	0	0	0
322402	VAULT 4 (HVAC - IN THE FLOOR VER.)	26378	0.00	0	0	0	0
322403	VAULT 1 (HVAC - IN THE FLOOR VER.)	50472	0.00	0	0	0	0
322600	Pu CANNISTER HANDLING MACHINES	300000	0.00	0	0	0	0
330000	CONSTRUCTION-O/C	19337	0.00	0	0	0	0
PROJECT TOTAL		4,465,011		0	0	0	0

FLUOR DANIEL NORTHWEST, INC.
BABCOCK & WILCOX HANFORD
JOB NO. W-460/P8W712
FILE NO. W460SAE2

** IEST - INTERACTIVE ESTIMATING **
CUBICLE STORAGE CONCEPT
STUDY ESTIMATE
DOE_R01 - PROJECT COST SUMMARY

DATE 02/04/97 15:27:34
BY SMF/CDL/DKH

COST CODE	DESCRIPTION	ESCALATED TOTAL COST	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
501	BUILDINGS	2,520,000	35	880,000	3,400,000
700	SPECIAL EQUIP/PROCESS SYSTEMS	430,000	46	190,000	620,000
810	DEMOLITION	360,000	35	130,000	490,000
	(ADJUSTED TO MEET DOE 5100.4)	-10,000		0	-10,000
	PROJECT TOTAL	3,300,000	36	1,200,000	4,500,000

L-17

TYPE OF ESTIMATE	STUDY ESTIMATE	FEBRUARY 4, 1997
ARCHITECT ENGINEER		
PHMC CONTRACTOR		

REMARKS: CONSTRUCTION ONLY

(ROUNDED/ADJUSTED TO THE NEAREST " 10,000 / 100,000 " - PERCENTAGES NOT RECALCULATED TO REFLECT ROUNDING)

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
322102	VAULT #1	442795	0	442795	0.00	0	442795	35	154979	597774
322116	ROOM 1 MODS BLDG 2736-Z	46672	0	46672	0.00	0	46672	35	16335	63007
	SUBTOTAL 3221 VAULT #1 MODS	489467	0	489467	0.00	0	489467	35	171314	660781
322202	VAULT #2	1222021	0	1222021	0.00	0	1222021	35	427708	1649729
322216	ROOM 2 MODS BLDG 2736-Z	18494	0	18494	0.00	0	18494	35	6473	24967
	SUBTOTAL 3222 VAULT #2 MODS	1240515	0	1240515	0.00	0	1240515	35	434181	1674696
322302	VAULT #4	1073668	0	1073668	0.00	0	1073668	35	375784	1449452
322316	ROOM 4 MODS BLDG 2736-Z	58465	0	58465	0.00	0	58465	35	20463	78928
	SUBTOTAL 3223 VAULT #4 MODS	1132133	0	1132133	0.00	0	1132133	35	396247	1528380
322400	VAULT 2 (HVAC - CUBICLE VER.)	38938	0	38938	0.00	0	38938	35	13629	52567
322402	VAULT 4 (HVAC - CUBICLE VER.)	41559	0	41559	0.00	0	41559	35	14547	56106
322403	VAULT 1 (HVAC - CUBICLE VER.)	52362	0	52362	0.00	0	52362	35	18328	70690
	SUBTOTAL 3224 HVAC FOR VAULTS (CUBICLE V	132859	0	132859	0.00	0	132859	35	46504	179363
322600	Pu CANNISTER HANDLING MACHINE	300000	0	300000	0.00	0	300000	50	150000	450000
	SUBTOTAL 322 BUILDING 2736-Z MODS - VAUL	3294974	0	3294974	0.00	0	3294974	36	1198246	4493220
	SUBTOTAL 32 CONSTRUCTION-FIXED PRICE	3294974	0	3294974	0.00	0	3294974	36	1198246	4493220
330000	CONSTRUCTION-O/C	10248	0	10248	0.00	0	10248	35	3587	13835
	SUBTOTAL 33 CONSTRUCTION-O/C	10248	0	10248	0.00	0	10248	35	3587	13835
	SUBTOTAL 3 CONSTRUCTION	3305222	0	3305222	0.00	0	3305222	36	1201833	4507055
PROJECT TOTAL		3,305,222	0	3,305,222	0.00	0	3,305,222	36	1,201,833	4,507,055

1. DOCUMENTS AND DRAWINGS

DOCUMENTS: PROJECT W-460 CONCEPTUAL DESIGN REPORT, PRELIMINARY DRAFT, DATED 12/13/96

DRAWINGS: ES-W460-S3, SHEET 1 & 2

2. MATERIAL PRICES

UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL.

3. LABOR RATES

BASE CRAFT RATES INCLUDE FRINGE BENEFITS, LABOR INSURANCE, TAXES AND TRAVEL WHERE APPLICABLE, PER HANFORD SITE STABILIZATION AGREEMENT, APPENDIX A (EFFECTIVE 09-06-96).

4. GENERAL REQUIREMENTS/TECHNICAL SERVICES/OVERHEADS

FIXED PRICE CONTRACTOR OVERHEAD, PROFIT, BOND AND INSURANCE COSTS HAVE BEEN APPLIED AT THE FOLLOWING PERCENTAGES AND ARE REFLECTED IN THE "OH&P/B&I" COLUMN OF THE ESTIMATE DETAIL:
LABOR - 26.5 TO 39% MATERIAL - 20 TO 39% EQUIPMENT USAGE - 20 TO 26.5% SUBCONTRACTS - 15 TO 20%

5. ESCALATION

NO ESCALATION HAS BEEN APPLIED TO THIS ESTIMATE BECAUSE IT IS TO BE USED FOR CONSTRUCTION COST COMPARISON ONLY.

6. ROUNDING

THE PROJECT COST SUMMARY REPORT (DOE_R01) IS SUMMARIZED AND ADJUSTED/ROUNDED AS FOLLOWS:

THE TOTAL COST COLUMN, CONTINGENCY TOTAL COLUMN AND TOTAL DOLLARS COLUMN DOE COST CODE SUB-TOTAL IS SUMMARIZED BY CONSTRUCTION. THE COLUMN SUBTOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $10,000.

THE PROJECT TOTAL SUMMARY LINE TOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $100,000.

7. REMARKS

A.) THIS ESTIMATE IS FOR CONSTRUCTION ONLY AND DOES NOT INCLUDE ANY COST FOR DESIGN, E&I DURING CONSTRUCTION, PROJECT MANAGEMENT, CONSTRUCTION MANAGEMENT, BID PACKAGE PREP, OR OTHER PROJECT COSTS.
B.) ASSUME THAT ALL VAULTS HAVE BEEN EMPTIED AND COMPLETELY DECONTAMINATED PRIOR TO ANY CONSTRUCTION ACTIVITIES.
C.) COST FOR Pu HANDLING MACHINES HAS BEEN PROVIDED BY FDNW P.E..

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
501	BUILDINGS									
322102	VAULT #1	416267	0	416267	0.00	0	416267	35	145694	561961
322116	ROOM 1 MODS BLDG 2736-Z	18494	0	18494	0.00	0	18494	35	6473	24967
322202	VAULT #2	1186927	0	1186927	0.00	0	1186927	35	415425	1602352
322216	ROOM 2 MODS BLDG 2736-Z	18494	0	18494	0.00	0	18494	35	6473	24967
322302	VAULT #4	861041	0	861041	0.00	0	861041	35	301365	1162406
322316	ROOM 4 MODS BLDG 2736-Z	18494	0	18494	0.00	0	18494	35	6473	24967
TOTAL 501	BUILDINGS	2519717	0	2519717	0.00	0	2519717	35	881903	3401620
700	SPECIAL EQUIP/PROCESS SYSTEMS									
322400	VAULT 2 (HVAC - CUBICLE VER.)	38252	0	38252	0.00	0	38252	35	13389	51641
322402	VAULT 4 (HVAC - CUBICLE VER.)	38252	0	38252	0.00	0	38252	35	13389	51641
322403	VAULT 1 (HVAC - CUBICLE VER.)	49055	0	49055	0.00	0	49055	35	17170	66225
322600	Pu CANNISTER HANDLING MACHINE	300000	0	300000	0.00	0	300000	50	150000	450000
TOTAL 700	SPECIAL EQUIP/PROCESS SYSTEM	425559	0	425559	0.00	0	425559	46	193948	619507
810	DEMOLITION									
322102	VAULT #1	26528	0	26528	0.00	0	26528	35	9285	35813
322116	ROOM 1 MODS BLDG 2736-Z	28178	0	28178	0.00	0	28178	35	9862	38040
322202	VAULT #2	35094	0	35094	0.00	0	35094	35	12283	47377
322302	VAULT #4	212627	0	212627	0.00	0	212627	35	74419	287046
322316	ROOM 4 MODS BLDG 2736-Z	39971	0	39971	0.00	0	39971	35	13990	53961
322400	VAULT 2 (HVAC - CUBICLE VER.)	686	0	686	0.00	0	686	35	240	926
322402	VAULT 4 (HVAC - CUBICLE VER.)	3307	0	3307	0.00	0	3307	35	1158	4465
322403	VAULT 1 (HVAC - CUBICLE VER.)	3307	0	3307	0.00	0	3307	35	1158	4465
330000	CONSTRUCTION-O/C	10248	0	10248	0.00	0	10248	35	3587	13835
TOTAL 810	DEMOLITION	359946	0	359946	0.00	0	359946	35	125982	485928
PROJECT TOTAL		3,305,222	0	3,305,222	0.00	0	3,305,222	36	1,201,833	4,507,055

CSI	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
CONSTRUCTION										
01	GENERAL REQUIRMENTS	120750	0	120750	0.00	0	120750	35	42264	163014
02	SITEWORK	274249	0	274249	0.00	0	274249	35	95987	370236
03	CONCRETE	934334	0	934334	0.00	0	934334	35	327017	1261351
05	METALS	1409151	0	1409151	0.00	0	1409151	35	493203	1902354
13	SPECIAL CONSTRUCTION	300000	0	300000	0.00	0	300000	50	150000	450000
15	MECHANICAL	143107	0	143107	0.00	0	143107	35	50091	193198
16	ELECTRICAL	123631	0	123631	0.00	0	123631	35	43271	166902
	TOTAL CONSTRUCTION	3,305,222	0	3,305,222	0.00	0	3,305,222	36	1,201,833	4,507,055
	PROJECT TOTAL	3,305,222	0	3,305,222	0.00	0	3,305,222	36	1,201,833	4,507,055

REFERENCE: ESTIMATE BASIS SHEET PAGE 3 OF 7
COST CODE ACCOUNT SUMMARY PAGE 4 OF 7

THE U.S. DEPARTMENT OF ENERGY - RICHLAND ORDER 5700.3 "COST ESTIMATING, ANALYSIS AND STANDARDIZATION" DATED 3-27-85, PROVIDES GUIDELINES FOR ESTIMATE CONTINGENCIES. THE GUIDELINE FOR A STUDY ESTIMATE SHOULD HAVE AN OVERALL RANGE OF 20 TO 30% AND UP TO 50% FOR EXPERIMENTAL OR SPECIAL CONDITIONS.

CONTINGENCY IS EVALUATED AT THE THIRD COST CODE LEVEL AND SUMMARIZED AT THE PRIMARY AND SECONDARY COST CODE LEVEL OF THE DETAILED COST ESTIMATE.

ENGINEERING: N/A

AVERAGE ENGINEERING CONTINGENCY %

CONSTRUCTION: 35% CONTINGENCY HAS BEEN APPLIED TO ALL CONSTRUCTION DUE TO THE UNIQUE TYPE OF WORK THAT IS TO BE DONE. ALSO UNKNOWNS AND UNCERTAINTIES CONCERNING THE METHOD OF PERFORMANCE, AVALABILITY OF ACCESS DUE TO SECURITY, AND THE STANDARD SHORTFALLS AND PROBLEMS THAT ARE ALMOST ALWAYS ENCOUNTERED WHEN DOING RENOVATION AND REMODEL PROJECTS.

50% CONTINGENCY HAS BEEN APPLIED TO THE Pu CANNISTER HANDLING MACHINES DUE TO THE LACK OF ANY DESIGN AT THIS TIME.

AVERAGE CONSTRUCTION CONTINGENCY 36%

AVERAGE PROJECT CONTINGENCY 36%

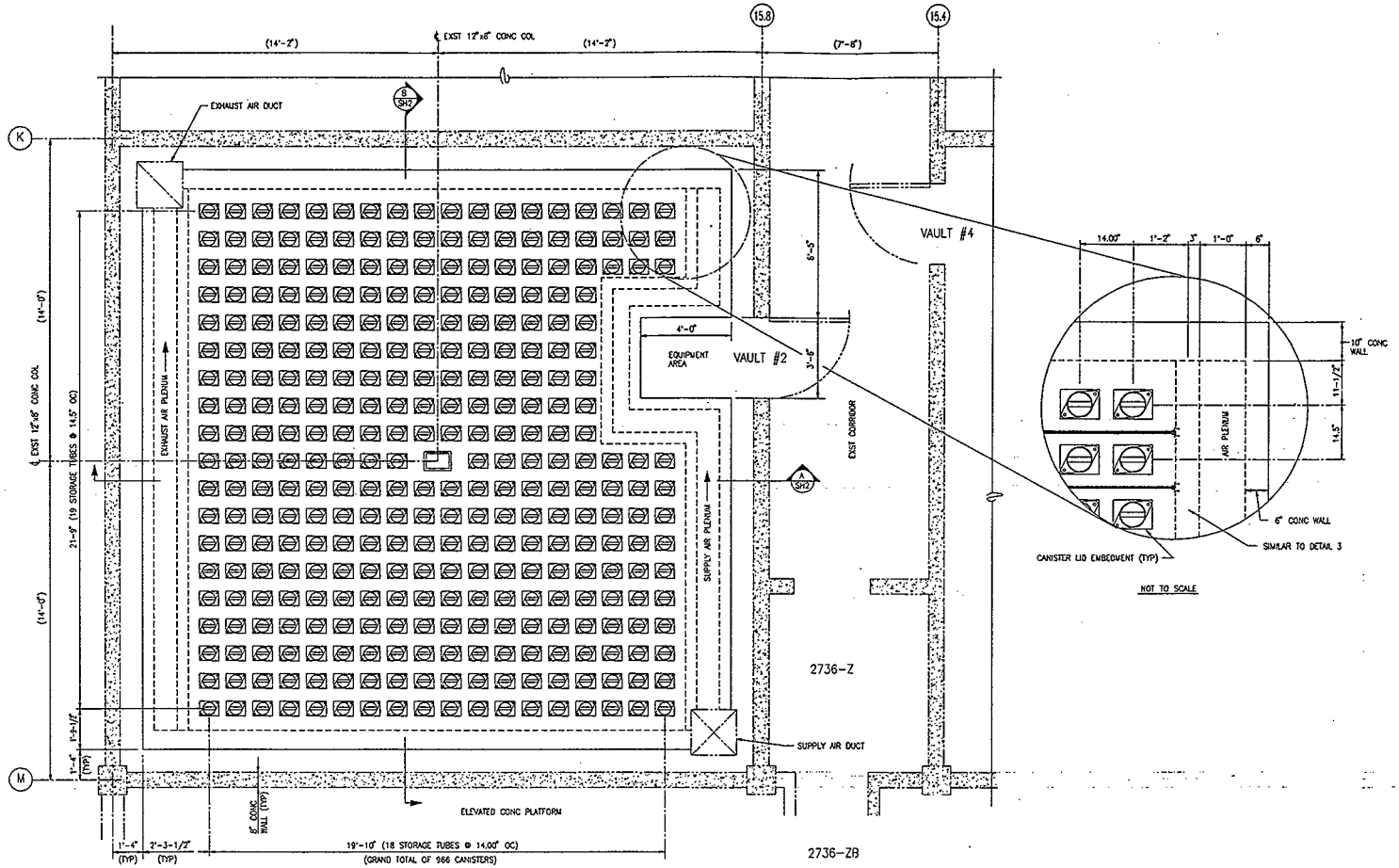
FLUOR DANIEL NORTHWEST, INC.
BABCOCK & WILCOX HANFORD
JOB NO. W-460/P8W712
FILE NO. W460SAD2

** IEST - INTERACTIVE ESTIMATING **
CUBICLE STORAGE CONCEPT
STUDY ESTIMATE
DOE_R07 - ONSITE INDIRECT COSTS BY WBS

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	CONTRACT ADMINISTRATION %	CONTRACT ADMINISTRATION TOTAL	BID PACK PREP.	OTHER INDIRECTS	TOTAL INDIRECTS
322102	VAULT #1	442795	0.00	0	0	0	0
322116	ROOM 1 MODS BLDG 2736-Z	46672	0.00	0	0	0	0
322202	VAULT #2	1222021	0.00	0	0	0	0
322216	ROOM 2 MODS BLDG 2736-Z	18494	0.00	0	0	0	0
322302	VAULT #4	1073668	0.00	0	0	0	0
322316	ROOM 4 MODS BLDG 2736-Z	58465	0.00	0	0	0	0
322400	VAULT 2 (HVAC - CUBICLE VER.)	38938	0.00	0	0	0	0
322402	VAULT 4 (HVAC - CUBICLE VER.)	41559	0.00	0	0	0	0
322403	VAULT 1 (HVAC - CUBICLE VER.)	52362	0.00	0	0	0	0
322600	Pu CANNISTER HANDLING MACHINE	300000	0.00	0	0	0	0
330000	CONSTRUCTION-O/C	10248	0.00	0	0	0	0
	PROJECT TOTAL	3,305,222		0	0	0	0

APPENDIX B

SKETCHES



PARTIAL FLOOR PLAN

SCALE: 1/2" = 1'-0"

DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		REFERENCES	
		NEXT USED ON	

NO	DESCRIPTION	DATE
REVISIONS		

CADFILE W460S2A | CADCODE WIN95>ACD2:12.0:S

Drawn BY RS CHRISTENSEN
Design Chkr
Checked
Safety SEE DR/AT FORM
Dsgn Auth SEE DR/AT FORM
Dsgn Chkr SEE DR/AT FORM
Lead Engr
Cog Engr
Project Engr BWHC
QA
Safety

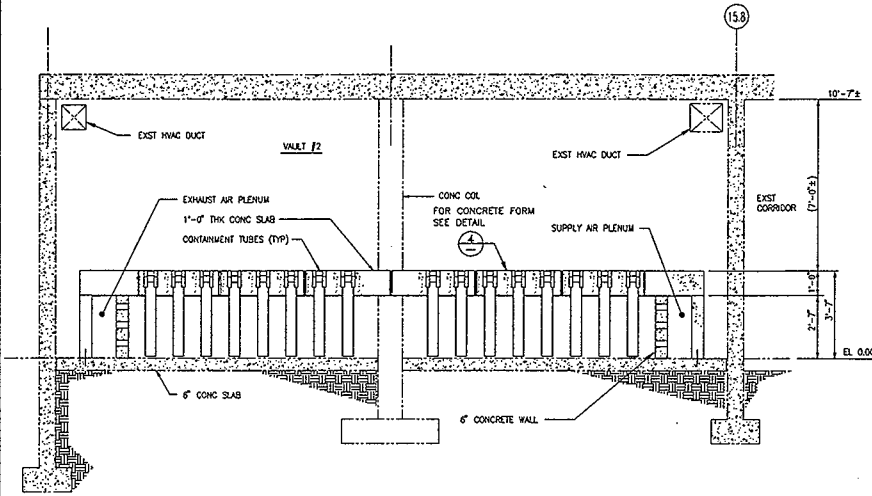
USE PRELIMINARY
SAFETY CLASS | REVISION NO. 0 | DATE 7/4/97

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC

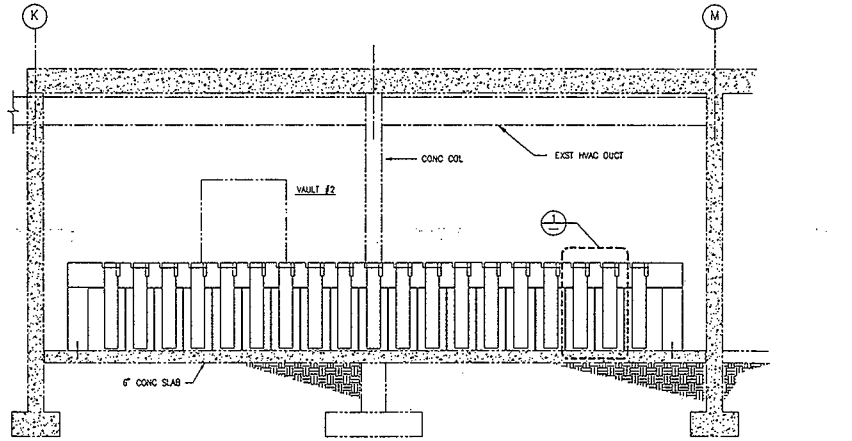
STRUCTURAL
ENLARGED PLAN
FLOOR STORAGE CONCEPT

PROJECT W460 Pu STORAGE & HANDLING
BLDG NO. 2736-Z | DWG NO. ES-W460-S2 | REV NO. 0
SCALE SHOWN | SHEET 1 OF 2

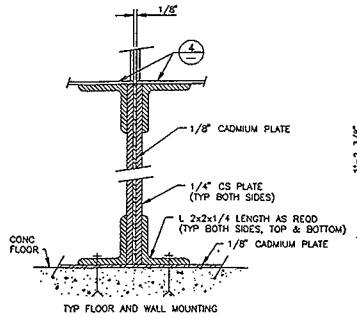
2 PLOT SCALE: 1=24



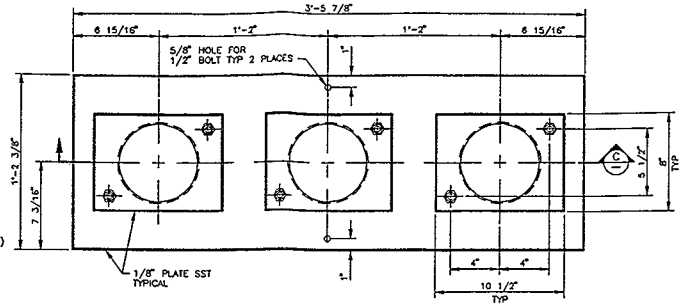
SECTION
SCALE: 1/2" = 1'-0"
A SH 1



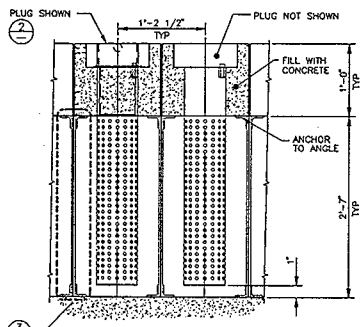
SECTION
SCALE: 1/2" = 1'-0"
B SH 1



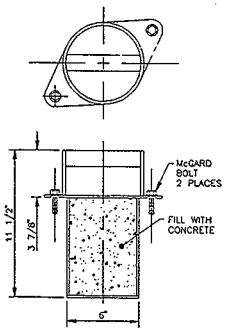
3 DETAIL
SCALE: NONE



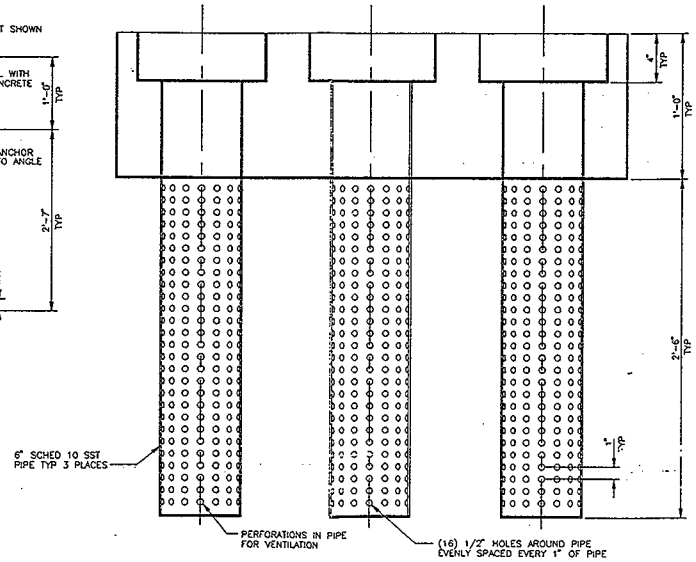
4 DETAIL
SCALE: 1/4



1 DETAIL
SCALE: 1/8



2 DETAIL
SCALE: 1/4



C SECTION
SCALE: 1/4

DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		REFERENCES	
		NEXT USED ON	

NO	REV	DESCRIPTION	DATE	CODE
REVISIONS				

CADFILE W460S2B CADCODE WIN95;ACD2;12.0;S

DESIGN BY RS CHRISTENSEN
DRAWN BY
CHECKED
SAFETY SEE DR/AT FORM
STRUCT SEE DR/AT FORM
DUAL ENGR SEE DR/AT FORM
LEAD DSGN
CUSTODIAN
COMPANY RWHC
PHONE
PHONE

PRELIMINARY
REVISION NO. 7 DATE 2/4/97

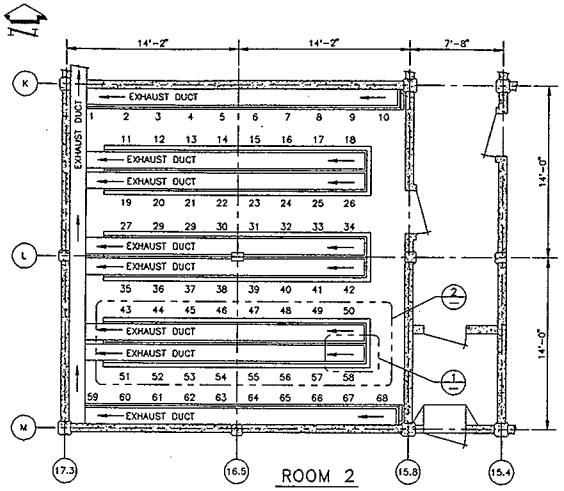
U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC

STRUCTURAL
SECTION & DETAILS
FLOOR STORAGE CONCEPT

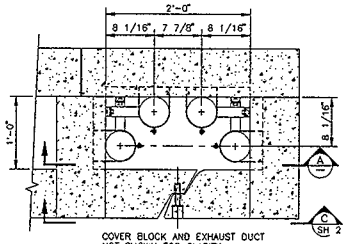
PROJECT W460 Pu STORAGE & HANDLING
BLDG NO 2736-2 DWG NO 0801 ES-W460-S2 REV 0
SCALE SHOWN SHEET 2 OF

2 PLOT SCALE: 1=24

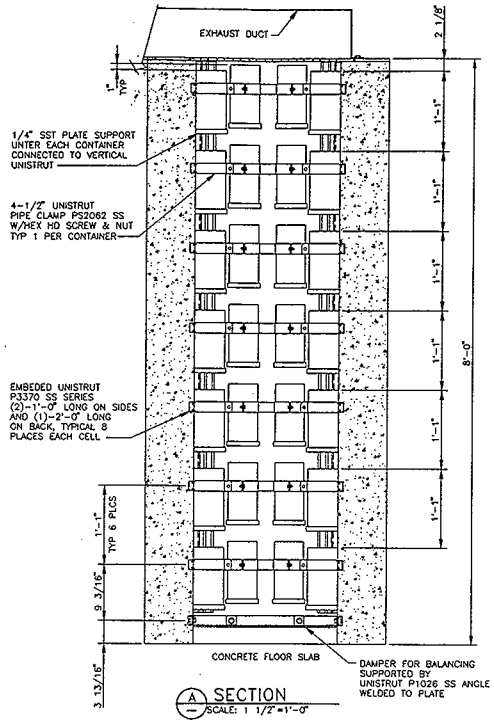
1 L-26



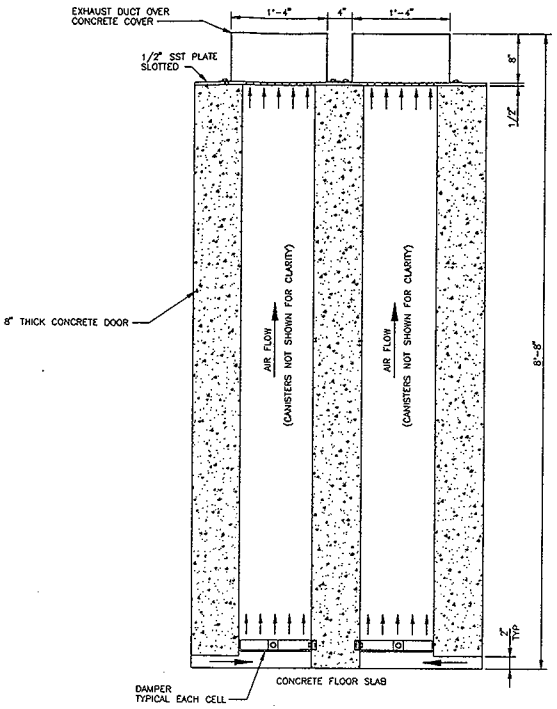
FLOOR PLAN 2736-Z BLDG
SCALE: 1/4"=1'-0"



1 ENLARGED DETAIL
SCALE: 1 1/2"=1'-0"



A SECTION
SCALE: 1 1/2"=1'-0"



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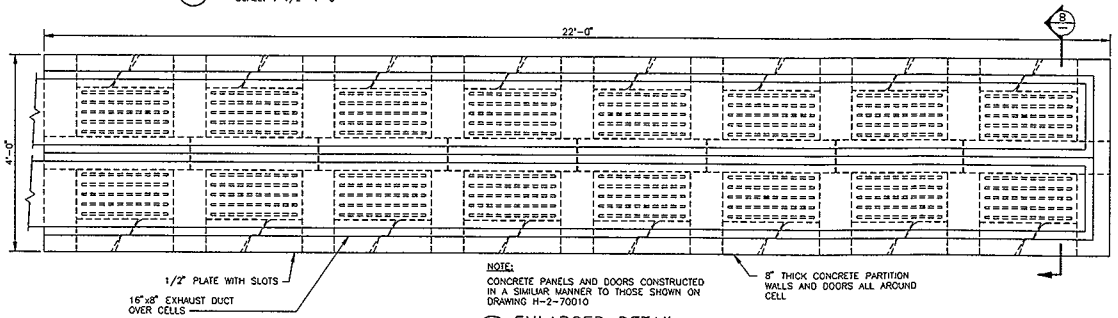


NOTE:
CONCRETE PANELS AND DOORS CONSTRUCTED IN A SIMILIAR MANNER TO THOSE SHOWN ON DRAWING H-2-70010

2 ENLARGED DETAIL
SCALE: 1"=1'-0"

NOTE:
1. EIGHT STORAGE POSITIONS PER CUBICLE WILL TYPICALLY BE BLANKED TO CONFORM TO CURRENT CRITICALITY CRITERIA.

DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		NEXT USED ON	REFERENCES

NO	REV NO	DESCRIPTION	REV DATE	ENGR
REVISIONS				

CADFILE f/i460S3A
CADCODE DOS:6.22;ACD2:12.0:SS

DRAWN BY	RS CHRISTENSEN
SERR CHKR	
CHECKED	
SAFETY	SEE DR/AT FORM
ENGR	SEE DR/AT FORM
QUAL ENGR	SEE DR/AT FORM
LDD CHKR	
CUSTODIAN	
DRAFTING	GWHC
APD	
APD	

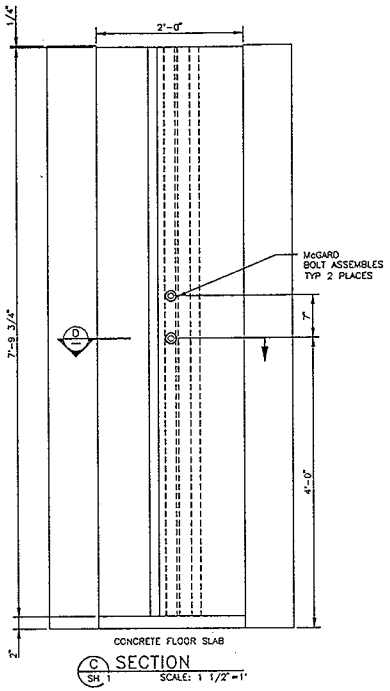
USE: PRELIMINARY
SAFETY CLASS
REVISION NO. 11 DATE 1/27/97

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC

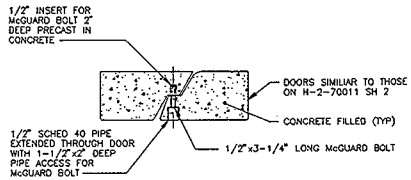
STRUCTURAL
CUBICAL CONCEPT
PLAN, SECT & DETAILS

PROJECT W460 Pu STORAGE & HANDLING
BLDG NO F 2736-Z | DOE NO 0660 6661 | DWG NO ES-W460-S3 | REV 0
SCALE SHOWN | SHEET 1 OF 2

2 PLOT SCALE: 1=1



C SH 1 SECTION
SCALE: 1 1/2"=1'



D SECTION
SCALE: 1 1/2"=1'-0"

DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		NEXT USED ON	

REVISIONS					
NTS	REV	DESCRIPTION	REV DATE	TYPE	CHANGE NUMBER
CADFILE	W460AS7B	CADCODE DOS:6.22/ACD2-12.0:SS			

DRAWN BY	RS CHRISTENSEN
DESIGN OWNER	
CHECKED	
SAFETY	SEE DR/AT FORM
QUALITY	SEE DR/AT FORM
QUAL. ENGINEER	SEE DR/AT FORM
LEAD ENGR	
ELECTRONICS	
EQUIPMENT	@WHC
HVAC	
PIPING	

USE: PRELIMINARY
SAFETY CLASS | REVISION NO. 2 DATE 2/4/97

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC.

STRUCTURAL
LOCKING DOORS
PLAN, SECT & DETAILS

PROJECT: W460 Pu STORAGE & HANDLING
BLDG NO: F 2736-Z | PAGE NO | DWG NO: ES-W460-S7 | REV: 0
SCALE: SHOWN | SHEET: 2 OF

2 PLOT SCALE: 1=1

APPENDIX M

Sketches

CIVIL

ES-W460-C1	Site Plan Services & Location
ES-W460-C2	Lift Station Plan, Section & Details
ES-W460-C3	Misc Details
ES-W460-C4	Stairway to Roof Plan, Sect & Details

ARCHITECTURAL

ES-W460-A1	Drawing List
ES-W460-A2	2736-ZB Floor Plan
ES-W460-A3	2736-ZB Floor Plan Demolition
ES-W460-A4	Enlarged Plan Room 641/642
ES-W460-A5	2731-ZA Floor Plan Air Compressor Bldg
ES-W460-A6	Floor Plan Office Structure

HEATING, VENTILATING, AND AIR CONDITIONING

ES-W460-H1	Floor Plan Zone Layout
ES-W460-H2, Sh 1	Floor Plan New Modification
ES-W460-H2, Sh 2	Roof Plan New Modification
ES-W460-H2, Sh 3	Enlarged Plan & Section Rm 600
ES-W460-H2, Sh 4	Enlarged Plan & Section Rm 639/640
ES-W460-H5, Sh 1	Airflow & Control Composite Diagram
ES-W460-H5, Sh 2	Airflow & Control Composite Diagram
ES-W460-H5, Sh 3	Airflow & Control Composite Diagram
ES-W460-H5, Sh 4	Airflow & Control Composite Diagram

ELECTRICAL

ES-W460-E3	One Line Diagram

PIPING

ES-W460-P1	P & ID Dry Air System
ES-W460-P2	P & ID Helium Distribution

PROJECT TITLE:

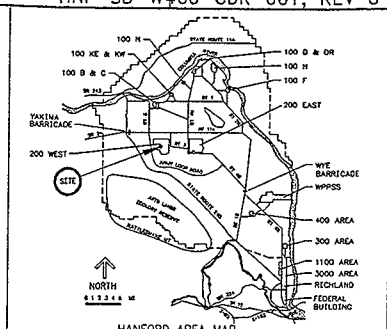
W-460, PLUTONIUM STABILIZATION AND HANDLING SYSTEM

FOR:

B&W Hanford Co.

BY:

FLUOR DANIEL NORTHWEST, INC



HANFORD AREA MAP

CIVIL

DRAWING NO	INDEX NO	TITLE
ES-W460-C1	0110	SITE PLAN SERVICES & LOCATION
ES-W460-C2	0110	LIFT STATION PLAN, SECTION & DETAILS
ES-W460-C3	0110	MISC DETAILS
ES-W460-C4	1000	STAIRWAY TO ROOF PLAN, SECT & DETAILS

ARCHITECTURAL

DRAWING NO	INDEX NO	TITLE
ES-W460-A1	0000	DRAWING LIST
ES-W460-A2	0800	2736-ZB FLOOR PLAN
ES-W460-A3	0800	2736-ZB FLOOR PLAN DEMOLITION
ES-W460-A4	0800	ENLARGED PLAN ROOM 641/642
ES-W460-A5	0800	2731-ZA FLOOR PLAN AIR COMPRESSOR BLDG
ES-W460-A6	0800	FLOOR PLAN OFFICE STRUCTURE

HVAC

DRAWING NO	INDEX NO	TITLE
ES-W460-H1	0803	FLOOR PLAN ZONE LAYOUT
ES-W460-H2 SH1	0800	FLOOR PLAN NEW MODIFICATION
ES-W460-H2 SH2	0800	ROOF PLAN NEW MODIFICATION
ES-W460-H2 SH3	0800	ENLARGED PLAN & SECTION RM 600
ES-W460-H2 SH4	0800	ENLARGED PLAN & SECTION RM 639/640
ES-W460-H5 SH1	8900	AIRFLOW & CONTROL COMPOSITE DIAGRAM
ES-W460-H5 SH2	8900	AIRFLOW & CONTROL COMPOSITE DIAGRAM
ES-W460-H5 SH3	8900	AIRFLOW & CONTROL COMPOSITE DIAGRAM
ES-W460-H5 SH4	8900	AIRFLOW & CONTROL COMPOSITE DIAGRAM

ELECTRICAL

DRAWING NO	INDEX NO	TITLE
ES-W460-E3	7201	ONE LINE DIAGRAM

PIPING

DRAWING NO	INDEX NO	TITLE
ES-W460-P1	7004	P & ID DRY AIR SYSTEM
ES-W460-P2	7004	P & ID HELIUM DISTRIBUTION

PRELIMINARY

PCN NO. 9 DATE 1/27/97

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC.

ARCHITECTURAL DRAWING LIST

W460 Pu STORAGE & HANDLING

F 2736-ZB 0000 ES-W460-A1 0

SCALE NONE

DWG NO / TITLE / DRAWING TRACEABILITY LIST

REF NUMBER / TITLE / REFERENCES

NEXT USED ON

REVISIONS

CADFILE W460A1A CADCODE DOS:6.22:ACD2:12.0:SS

DRAWN BY DJ. KOLAR

CHECKED

QUALITY SEE DR/AT FORM

ENGR SEE DR/AT FORM

FUNC ENGR SEE DR/AT FORM

LEAD ENGR

PROJECT BWHC

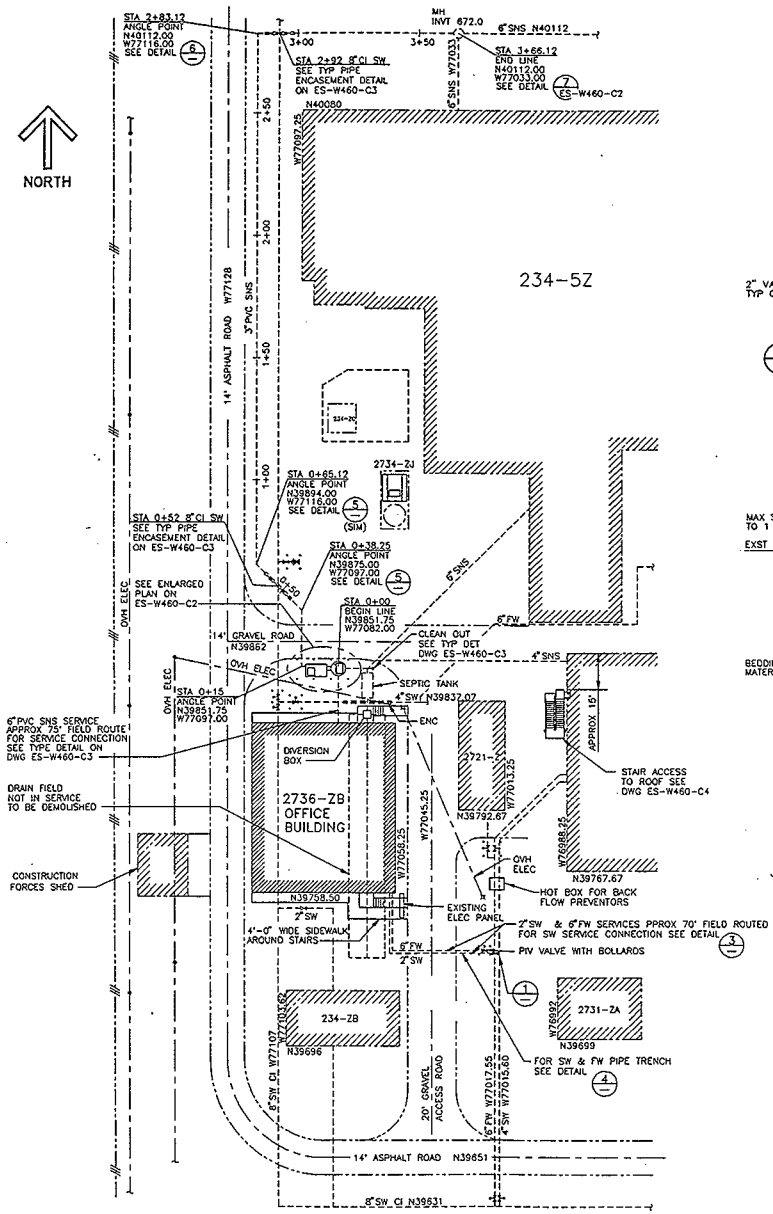
COMPANY

APPD

2 PLOT SCALE: 1=1

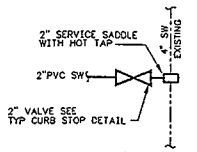
1 M-1

ES-W460-A1 REV 0 SH 1 OF 1



SITE PLAN
SCALE: 1"=20'

20 0 20 40
SCALE IN FEET



1 DETAIL
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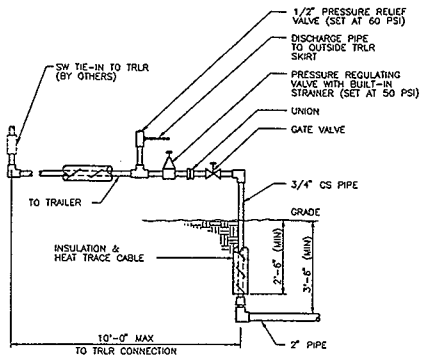
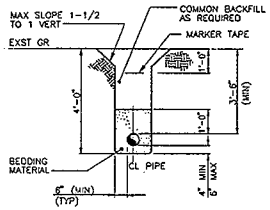
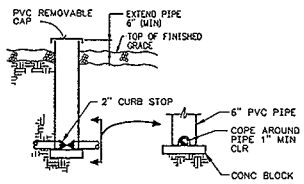


3 DETAIL
SCALE: NTS



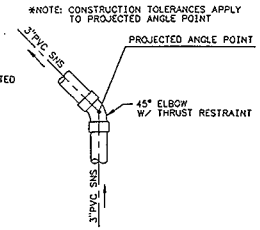
TYP SANITARY WATER PIPE TRENCH

4 DETAIL
SCALE: NTS



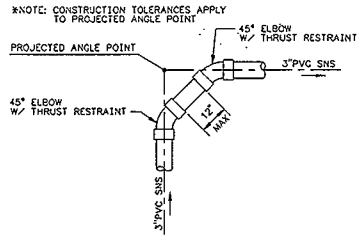
TYP CURB STOP DETAIL
SCALE: NTS

*NOTE: CONSTRUCTION TOLERANCES APPLY TO PROJECTED ANGLE POINT

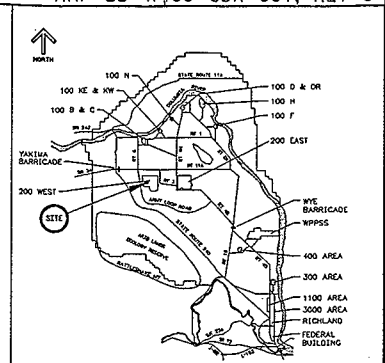


5 DETAIL
SCALE: NTS

*NOTE: CONSTRUCTION TOLERANCES APPLY TO PROJECTED ANGLE POINT



6 DETAIL
SCALE: NTS



HANFORD SITE

LEGEND:

- EXISTING FENCE
- PIV VALVE
- VALVE
- FIRE HYDRANT
- LIGHT POLE
- BOLLARD
- POWER POLE
- EXISTING STRUCTURE
- NEW STRUCTURE
- NEW UNDERGROUND LINE
- EXISTING UNDERGROUND LINE
- OVERHEAD POWER LINE

ABBREVIATIONS:

ABBREVIATIONS ARE IAW ASME Y1.1.
ANY ABBREVIATIONS USED THAT ARE NOT IAW ASME Y1.1 ARE LISTED BELOW

DI	DUCTILE IRON
EMB	EMBEDMENT
ENC	ENCASEMENT
FW	FIRE WATER
LAR	LENGTH AS REQUIRED
MJ	MECHANICAL JOINT
OVH	OVERHEAD LINE
SNS	SANITARY SEWER
SW	SANITARY WATER

GENERAL NOTES:

1. CONSTRUCTION TOLERANCES
   HORIZONTAL: ±.10'
   VERTICAL: ±.10'
2. REPAIR GRAVEL ROAD SURFACE IAW TYPICAL GRAVEL ROAD REPAIR DETAIL, DWG ES-W460-C3.
3. REPAIR ASPHALT ROAD DISTURBED DURING CONSTRUCTION IAW TYPICAL ASPHALT ROAD REPAIR DETAIL, DWG ES-W460-C3.
4. NEW SANITARY SEWER LINE SHALL BE PLACE IAW TYP PIPE TRENCH SECT. DWG ES-W460-C3.

DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		NEXT USED ON	REFERENCES

NO	DESCRIPTION	BY	CHK	APP	DATE
	REVISIONS				

CADFILE W460C1A FCADCODE WIN95:ACC2:12.0:NN

PRELIMINARY
SAFETY CLASS REVISION NO. 9 DATE 1/27/97

Drawn BY RS CHRISTENSEN
DESIGN LEAD
CHECKER
SAFETY SEE DR/AT FORM
CHARGE SEE DR/AT FORM
QUAL ENGR SEE DR/AT FORM
LEAD ENGR

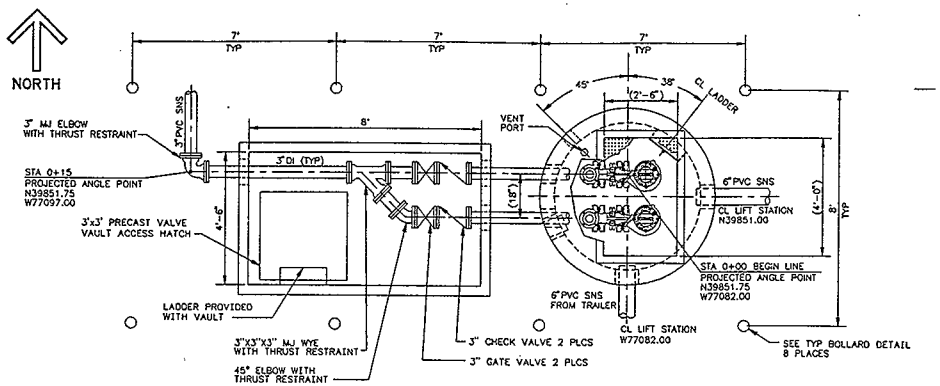
U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC.

CIVIL
SITE PLAN
SERVICES & LOCATION

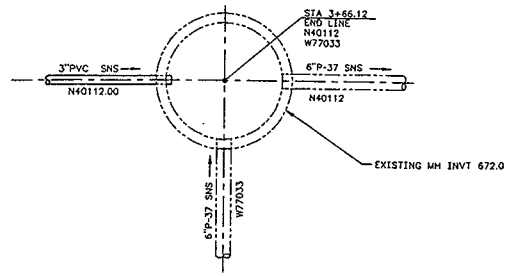
PROJECT W460 Pu STORAGE & HANDLING
JOB NO 2736-ZB BLDG NO 0110 WORK NO DWG NO ES-W460-C1 REV 0
SCALE 1"=20' SHEET 1 OF 1

CUSTOMER
CONTRACT BWHC
DATE

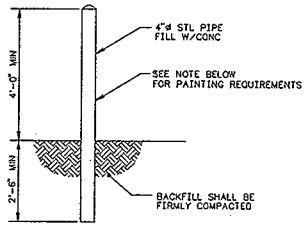
2 PLOT SCALE: 1=1 1 MYLAR (10/90)



ENLARGED PLAN
ES-W460-C1 SCALE:NTS



7 DETAIL
ES-W460-C1 SCALE: NTS



NOTE:

PRIOR TO PAINTING, POSTS SHALL BE THOROUGHLY WIREBRUSHED TO REMOVE ALL DIRT, RUST, AND OTHER FOREIGN MATERIAL. OIL, GREASE, AND SIMILIAR SUBSTANCES SHALL BE REMOVED WITH SOLVENTS PRIOR TO WIREBRUSHING.

PAINT ABOVE-GROUND PORTION OF EACH POST WITH ONE PRIME COAT AND TWO FINISH COATS YELLOW ENAMAL. COLORS SHALL BE AS DEFINED IN ANSI Z53.1, SAFETY COLOR CODE FOR MARKING PHYSICAL HAZARDS. PRIMER SHALL MEET FEDERAL SPECIFICATION TT-P-645. FINISH ENAMEL SHALL MEET FEDERAL SPECIFICATION TT-E-489 F, CLASS A

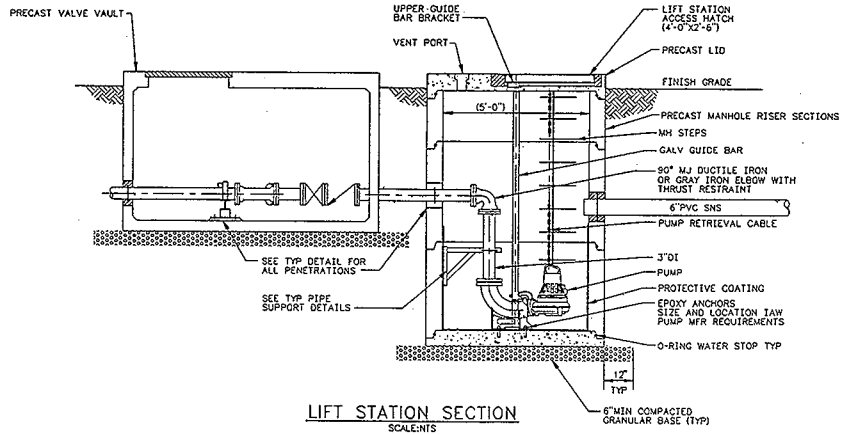
TYP BOLLARD DETAIL
SCALE: NTS

NOTES

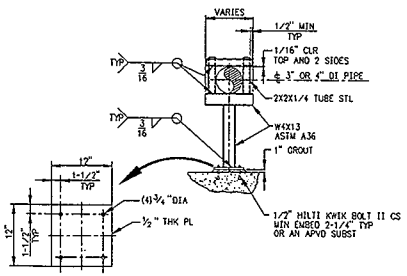
1. ALL CONC SURFACES WITHIN THE LIFT STA BELOW INLET SHALL BE COATED W/SPECIAL PROTECTIVE COATING.
2. PRECAST LID SHALL BE FABRICATED TO ACCEPT THE ACCESS COVER & UPPER GUIDE BAR BRACKET ASSEMBLY. THE ACCESS COVER & UPPER GUIDE BAR BRACKET ASSEMBLY SHALL BE INSTALLED IAW MFR RECOMMENDATIONS
3. FLANGED FITTINGS SHALL BE DUCTILE IRON OR GRAY IRON AND FLANGED PIPING SHALL BE DUCTILE IRON.
4. FITTINGS WITHIN LIFT STATION VALVE VAULT SHALL BE FLANGED UNLESS OTHERWISE NOTED.
5. INSTALL ONE HOOK FOR EACH PUMP IN PRECAST LID FOR PUMP RETRIEVAL CABLE. LOCATE ON NORTH AND SOUTH SIDES OF ACCESS HATCH.

MANHOLE NOTES

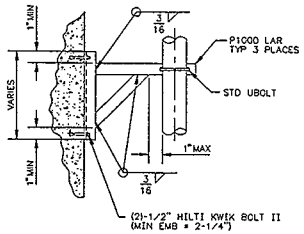
1. MANHOLES SHALL BE CONSTRUCTED IAW AASHTO M-199 (ASTM C47893) UNLESS OTHERWISE SHOWN ON PLANS.
2. PRECAST RISERS SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS & HAVE A 2" MIN WALL THICKNESS.
3. NON-REINFORCED CONCRETE IN CHANNEL & SHELF SHALL HAVE A 28 DAY STRENGTH OF 3000 PSI. ALL PRECAST CONCRETE SHALL HAVE A 28 DAY STRENGTH OF 4000 PSI.
4. HANDHOLDS IN ADJUSTMENT SECTION SHALL HAVE 3" MIN CLEARANCE. STEPS IN MANHOLE SHALL HAVE 6" MIN CLEARANCE. AT TOP OF MH INSTALL LADDER-UP SAFETY POST (NOT SHOWN IN DETAIL FOR CLARITY).
5. KNOCKOUT OR CUTOUT HOLE SIZE SHALL BE EQUAL TO PIPE OUTER DIAMETER PLUS MANHOLE WALL THICKNESS UNLESS OTHERWISE SHOWN. MAX HOLE SIZE SHALL BE 48" FOR 60" MANHOLE. MIN DISTANCE BETWEEN HOLES SHALL BE 12".
6. MANHOLE RINGS & COVERS SHALL MEET THE STRENGTH REQUIREMENTS OF FEDERAL SPECIFICATION RR-F-621D. MATING SURFACES SHALL BE FINISHED TO ASSURE NONROCKING FIT WITH ANY COVER POSITION.
7. MANHOLE RINGS & COVERS SHALL BE TYPE 1 OF STANDARD PLAN B-25 OF WSDOT M21-01 1992 STANDARD PLANS FOR ROAD, BRIDGE & MUNICIPAL CONSTRUCTION.



LIFT STATION SECTION
SCALE:NTS

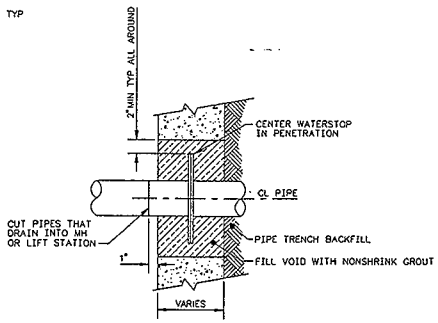


VALVE VAULT PIPE SUPPORT



PRECAST LIFTSTATION PIPE SUPPORT

TYP PIPE SUPPORT DETAILS



TYP PRECAST CONCRETE PENETRATION DETAIL

DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		NEXT USED ON	REFERENCES

REVISIONS

NO	DESCRIPTION	DATE	APPROVED
6	PRELIMINARY	1/27/97	RSC

CAOFILE W460C2A CADCODE W.NGS:ACD2:12.0:NN

DRAWN BY	RS CHRISTENSEN
DSN CHK	
CHECKED	
ENVIR	SEE OR/AT FORM
SAFETY	SEE OR/AT FORM
QUAL ENGR	SEE OR/AT FORM
LEAD CHGR	
ELECTRICAL	
EQUIPMENT	BWHC
MFG	

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC.

CIVIL
LIFT STATION PLAN, SECTION & DETAILS

W460 Pu STORAGE & HANDLING

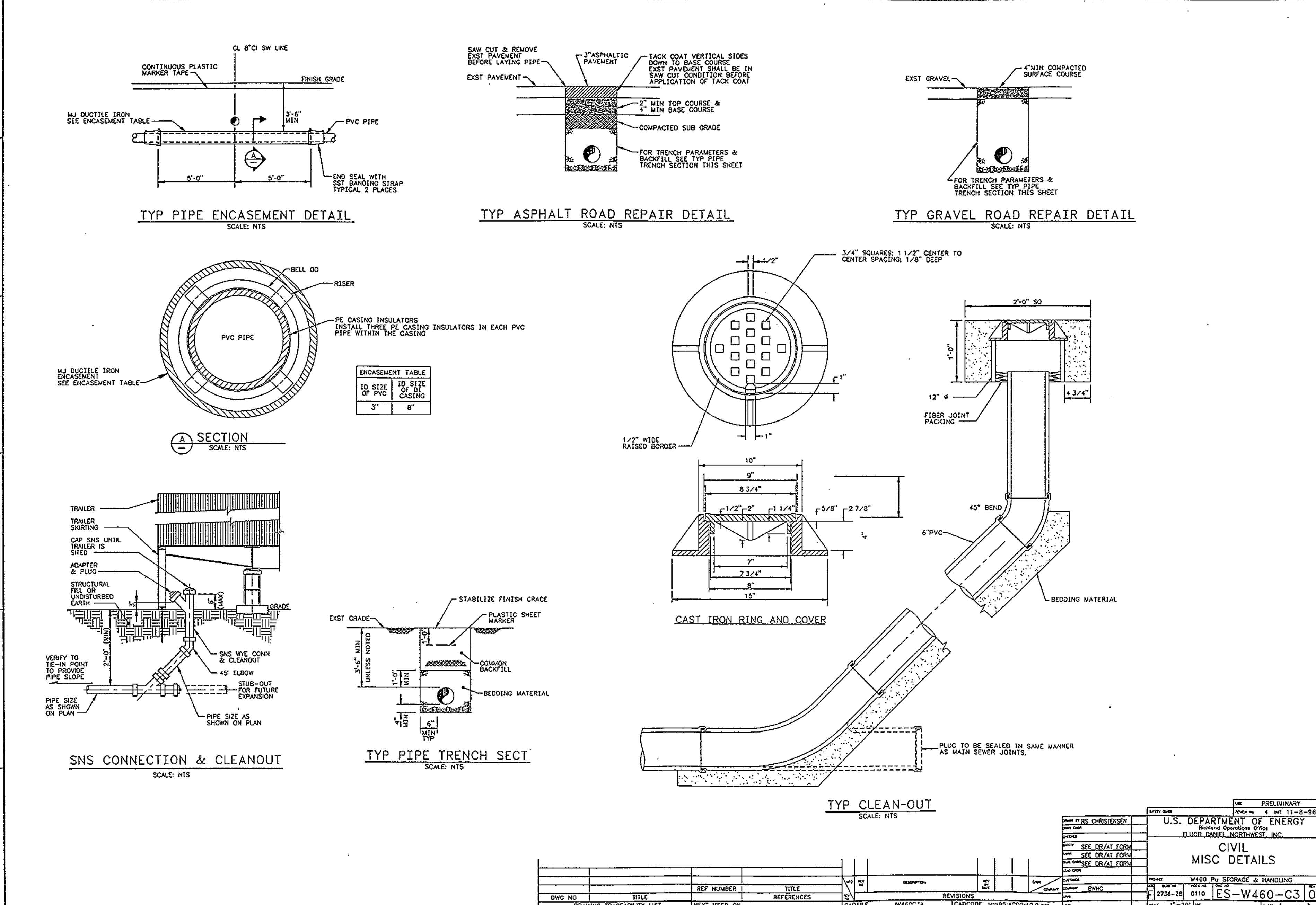
PROJECT	BLDG NO	DRAWING NO	REV NO
F 2736-28	0110	ES-W460-C2	0

SCALE 1"=20' | SHEET 1 of 1

2 PLOT SCALE: 1=1

M-31 CNTLE.DWG (10/96)

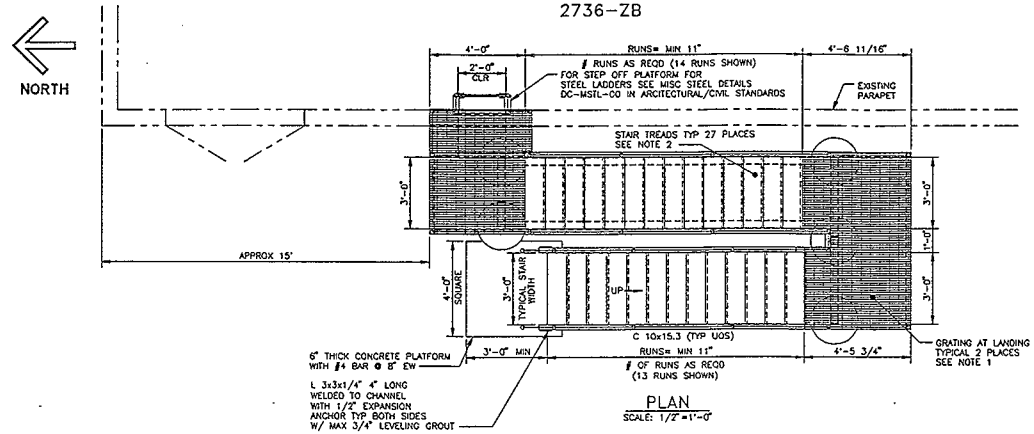
05 40 ES-W460-C1 Sh 1 of 1 Rev 0



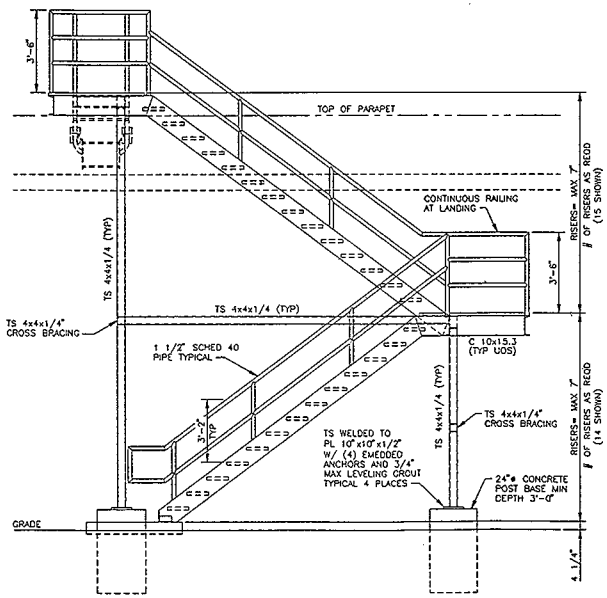
TYP PIPE ENCASEMENT DETAIL
SCALE: NTS
CL 8"CI SW LINE
CONTINUOUS PLASTIC MARKER TAPE
FINISH GRADE
MJ DUCTILE IRON SEE ENCASEMENT TABLE
3'-6" MIN
PVC PIPE
END SEAL WITH SST BANDING STRAP TYPICAL 2 PLACES
5'-0"
5'-0"
TYP ASPHALT ROAD REPAIR DETAIL
SCALE: NTS
SAW CUT & REMOVE EXST PAVEMENT BEFORE LAYING PIPE
EXST PAVEMENT
3"ASPHALTIC PAVEMENT
TACK COAT VERTICAL SIDES DOWN TO BASE COURSE EXST PAVEMENT SHALL BE IN SAW CUT CONDITION BEFORE APPLICATION OF TACK COAT
2" MIN TOP COURSE & 4" MIN BASE COURSE
COMPACTED SUB GRADE
FOR TRENCH PARAMETERS & BACKFILL SEE TYP PIPE TRENCH SECTION THIS SHEET
TYP GRAVEL ROAD REPAIR DETAIL
SCALE: NTS
EXST GRAVEL
4"MIN COMPACTED SURFACE COURSE
FOR TRENCH PARAMETERS & BACKFILL SEE TYP PIPE TRENCH SECTION THIS SHEET
SECTION
SCALE: NTS
BELL OD
RISER
PVC PIPE
PE CASING INSULATORS INSTALL THREE PE CASING INSULATORS IN EACH PVC PIPE WITHIN THE CASING
MJ DUCTILE IRON ENCASEMENT SEE ENCASEMENT TABLE
ENCASEMENT TABLE
ID SIZE OF PVC
ID SIZE OF DI CASING
3"
8"
3/4" SQUARES: 1 1/2" CENTER TO CENTER SPACING; 1/8" DEEP
1/2" WIDE RAISED BORDER
CAST IRON RING AND COVER
10"
9"
8 3/4"
1/2"
2"
1 1/4"
5/8"
2 7/8"
7"
7 3/4"
8"
15"
TYP CLEAN-OUT
SCALE: NTS
2'-0" SQ
1'-0"
4 3/4"
12" ø
FIBER JOINT PACKING
45° BEND
6"PVC
BEDDING MATERIAL
PLUG TO BE SEALED IN SAME MANNER AS MAIN SEWER JOINTS.
SNS CONNECTION & CLEANOUT
SCALE: NTS
TRAILER
TRAILER SKIRTING
CAP SNS UNTIL TRAILER IS SITED
ADAPTER & PLUG
STRUCTURAL FILL OR UNDISTURBED EARTH
GRADE
6"(MAX)
2'-0" (MIN)
VERIFY TO TIE-IN POINT TO PROVIDE PIPE SLOPE
PIPE SIZE AS SHOWN ON PLAN
SNS WYE CONN & CLEANOUT
45° ELBOW
STUB-OUT FOR FUTURE EXPANSION
PIPE SIZE AS SHOWN ON PLAN
TYP PIPE TRENCH SECT
SCALE: NTS
EXST GRADE
STABILIZE FINISH GRADE
PLASTIC SHEET MARKER
COMMON BACKFILL
BEDDING MATERIAL
3'-6" MIN UNLESS NOTED
1'-0"
1'-0" MIN
4" MIN
6" MIN TYP
PRELIMINARY
4 11-8-96
RS CHRISTENSEN
SEE DR/AT FORM
SEE DR/AT FORM
SEE DR/AT FORM
U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC.
CIVIL
MISC DETAILS
W460 Pu STORAGE & HANDLING
BWHC
F 2736-28 0110 ES-W460-C3 0
1"=20'
1 of 1
DWG NO
TITLE
REF NUMBER
TITLE
REFERENCES
DRAWING TRACEABILITY LIST
NEXT USED ON
REVISIONS
CADFILE W46OC3A
CADCODE WIN95:AC02:12.0:NN
PLOT SCALE: 1=1
GTITLE.DWG (10/96)

M-4

2736-ZB



PLAN
SCALE: 1/2"=1'-0"



ELEVATION
SCALE: 1/2"=1'-0"

NOTES:

1. GALV STEEL GRATING, 1 1/2"x3/16" BAR AT 1 3/16" CC. ALLOWABLE LOAD 125 PSF.
2. STAIR TREADS ARE GALVANIZED STEEL WITH ALUMINUM ABRASIVE NOSES. BEARING BARS ARE 1"x3/16" WITH SUPPORTING END ANGLES FOR ATTACHING TO CHANNEL.
3. ALL STRUCTURAL STEEL TO BE GALV STEEL.

DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		REFERENCES	NEXT USED ON

REVISIONS

NO	DESCRIPTION	DATE	CHK
3		1/27/97	

CADFILE W460C4A | CADCODE WIN95ACD2:12.0:NN

DESIGN CHIEF	RS CHRISTENSEN
CHECKED	
SAFETY	SEE DR/AT FORM
QUALITY	SEE DR/AT FORM
QUAL. CHECK	SEE DR/AT FORM
LEAD CHIEF	
ELECTRICAL	
COMPANY	BWHC

USE: PRELIMINARY
SAFETY CLASS | PERMIT NO. | DATE 1/27/97

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC.

CIVIL
STAIRWAY TO ROOF
PLAN, SECT & DETAILS

PROJECT: W460 Pu STORAGE & HANDLING

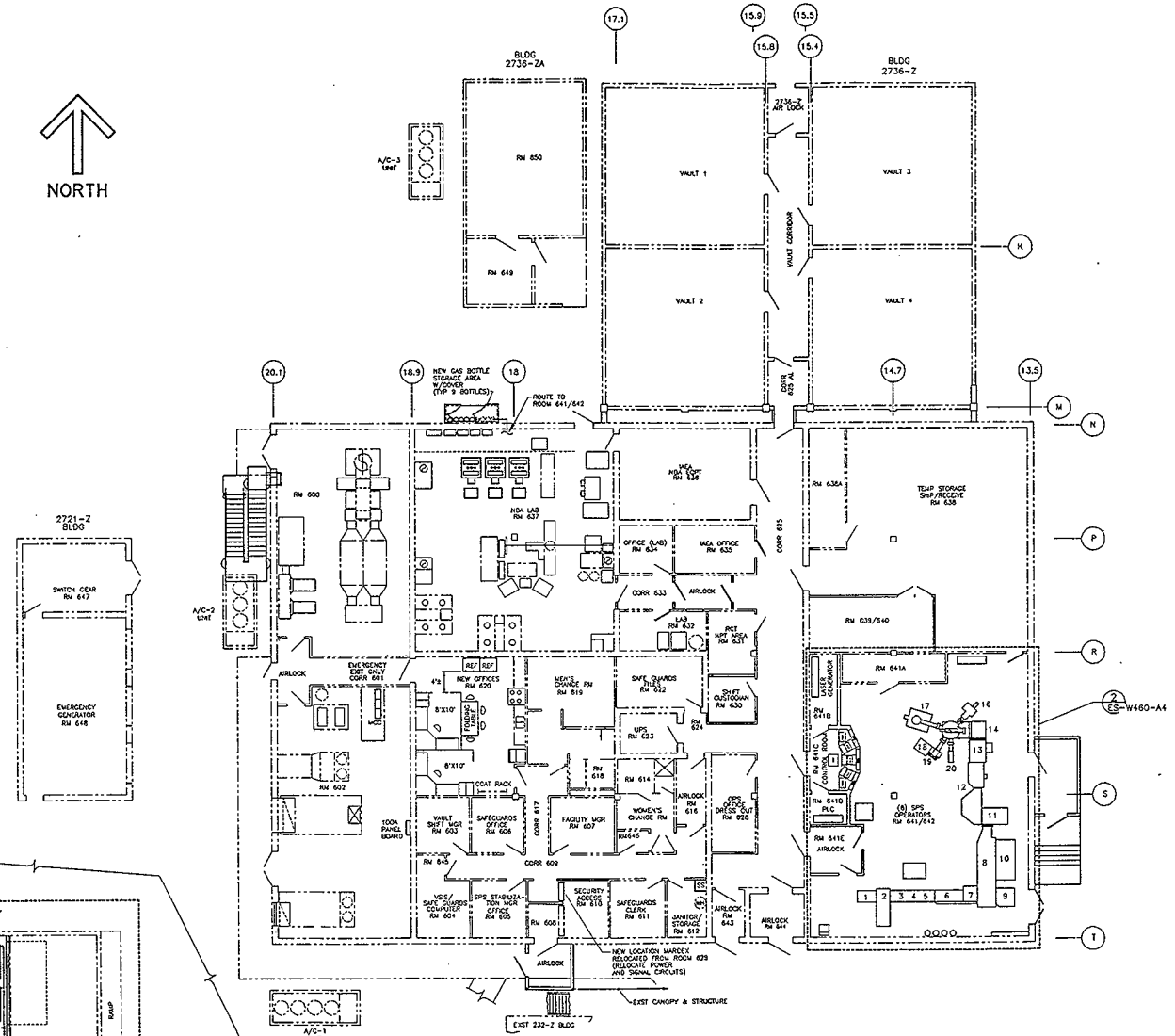
ACS	BLDG NO	FACILITY NO	DWG NO	REV
F	2736-ZB	1000	ES-W460-C4	0

SCALE 1/2" = 1'-0" | SHEET 1 OF 1

2 PLOT SCALE: 1=1

1 M-5

DWG NO ES-W460-C4 REV 0 SH 1 OF 1



SPS in Rooms 641 and 642

LEGEND

1. Receipt Hood
2. Material Transfer Ports
3. Container Assay Device
4. Container Compactor
5. Decontamination Station
6. Metal Brushing
7. Powder Dispenser Station
8. Transport Area
9. LOI Test Area
10. Stabilization Furnace Area
11. Tipping/Dispense/Fill Area
12. Can Weigh and Cap Insertion Area
13. Intermediate Can Handling Area (Laser)
14. Inner Can Leak Check/Outer Can Helium Fill, Lid Fitment
15. Turn Table
16. Outer Can Laser Welder
17. Contamination Check Unit
18. Mass Spectrometer
19. Outer Can Leak Test
20. Lag Storage Unit

DRAWING TRACEABILITY LIST			
DWG NO	TITLE	REFERENCES	
H-2-80169	HVAC PLAN-EAST/SECTION		
H-2-80168	HVAC PLAN-WEST/SECTION		
H-2-80249 SH2	ROOM & DOOR NUMBERS (1ST FLR)		
H-2-80125	ARCH PART FLOOR PLAN		
H-2-80123	ARCH FLOOR PLAN		

REF NUMBER	TITLE
NEXT USED ON	

REVISIONS					
NO	DESCRIPTION	DATE	CHK	COMPANY
CAD/FILE	W460A2A	CADCODE DOS:6.22:ACD2:12.0:SS		

PRELIMINARY

DATE 1/28/97

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC

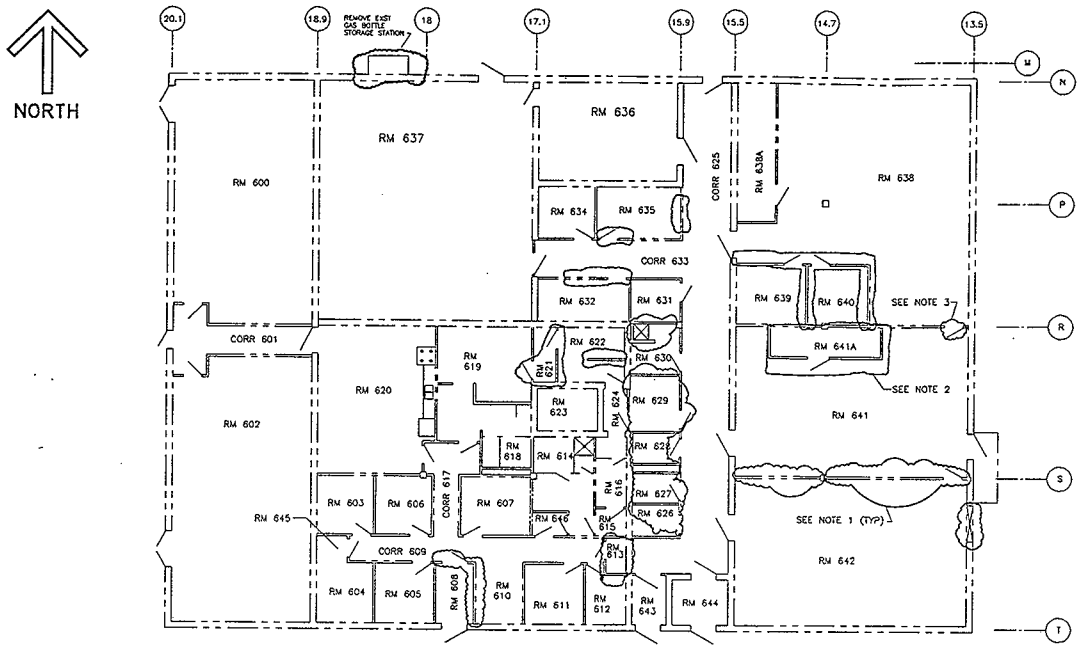
DRAWN BY DJ KOLAR
DESIGN CHECK
CHECKED
QUALITY SEE QR/AT FORM
DESIGN SEE QR/AT FORM
PLANT ENGR SEE QR/AT FORM
LOAD CHECK
ELECTRICAL
CONSTRUCT BWHC
PROJ
APVD

ARCHITECTURAL
2736-ZB FLOOR
PLAN

PROJECT W460 PU STORAGE & HANDLING
BLDG 2736-ZB | BLDG NO 0600 | DWG NO ES-W460-A2 | REV 0
SCALE 1/8" = 1'-0" | SHEET 1 OF 1

2 PLOT SCALE: 1=96

1 M-6



NOTES:

1. CLOUDED ITEMS TO BE REMOVED OR MODIFIED.
2. TO BE TAKEN OUT IN FUTURE.
3. DOOR TO BE REMOVED AND REINSTALLED.

H-2-80249 SH2	ROOM & DOOR NUMBERS (1ST FLR)		
H-2-80125	ARCH PART FLOOR PLAN		
H-2-80123	ARCH FLOOR PLAN	REF NUMBER	TITLE
DWG NO	TITLE	REFERENCES	
DRAWING TRACEABILITY LIST		NEXT USED ON	

REVISIONS				
NO	REV BY	DESCRIPTION	REV BY DATE	ENGR COMPANY
CADFILE	W460A3A	CADCODE DOS:6.22:ACD2:12.0:SS		

PRELIMINARY
REVISION NO. 10 DATE 1/27/97

Drawn By DJ KOLAR
DRAFTING
CHECKED
SAFETY SEE DR/AT FORM
QA SEE DR/AT FORM
ENGINEER
COMPANY RWHC

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC.

ARCHITECTURAL
2736-ZB FLOOR PLAN
DEMOLITION

PROJECT W460 Pu STORAGE & HANDLING

BLDG NO	PLAN NO	DWG NO	REV
2736-ZB	0600	ES-W460-A3	0

SCALE 1/8" = 1'-0" FULL | SHEET 1 OF 1

2 PLOT SCALE: 1=96

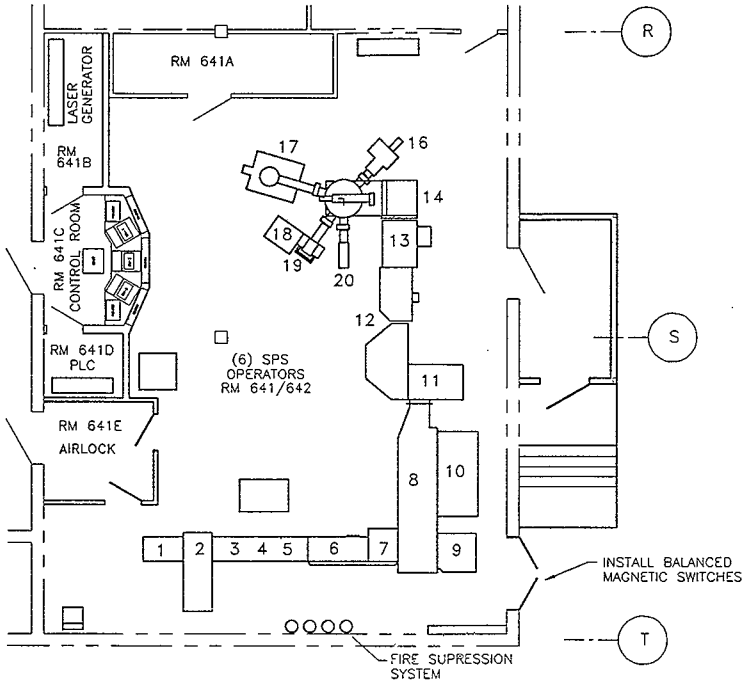
1 M-7

ES-W460-A3 | SH 1 of 1 | REV 0

SPS in Rooms 641 and 642

LEGEND

1. Receipt Hood
2. Material Transfer Ports
3. Container Assay Device
4. Container Compactor
5. Decontamination Station
6. Metal Brushing
7. Powder Dispenser Station
8. Transport Area
9. LGI Test Area
10. Stabilization Furnace Area
11. Tipping/Dispense/Fill Area
12. Can Weigh and Cap Insertion Area
13. Intermediate Can Handling Area (Laser)
14. Inner Can Leak Check/Outer Can Helium Fill, Lid Fitment
15. Turn Table
16. Outer Can Laser Welder
17. Contamination Check Unit
18. Mass Spectrometer
19. Outer Can Leak Test
20. Lag Storage Unit



ENLARGED PLAN

2 DETAIL
ES-W460-A1 SH1 SCALE: NONE

DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		NEXT USED ON	REFERENCES

REVISIONS

NO	REV NO	DESCRIPTION	REV DATE	CHK

CADFILE IW460A4A [CADCODE DOS:6.22;ACD2:12.0;SS

USE PRELIMINARY
SAFETY CLASS REVISION NO. 0 DATE 1/28/97

DRAWN BY DJ KOLAR
DESIGN OWNER
CHECKED
SAFETY SEE OR/AT FORM
OWNER SEE OR/AT FORM
CIVIL ENGR SEE OR/AT FORM
LEAD DSGN
CUSTOMER
CONTRACT BWHC
PROJECT

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC

ARCHITECTURAL
ENLARGED PLAN
ROOM 641/642

W460 Pu STORAGE & HANDLING

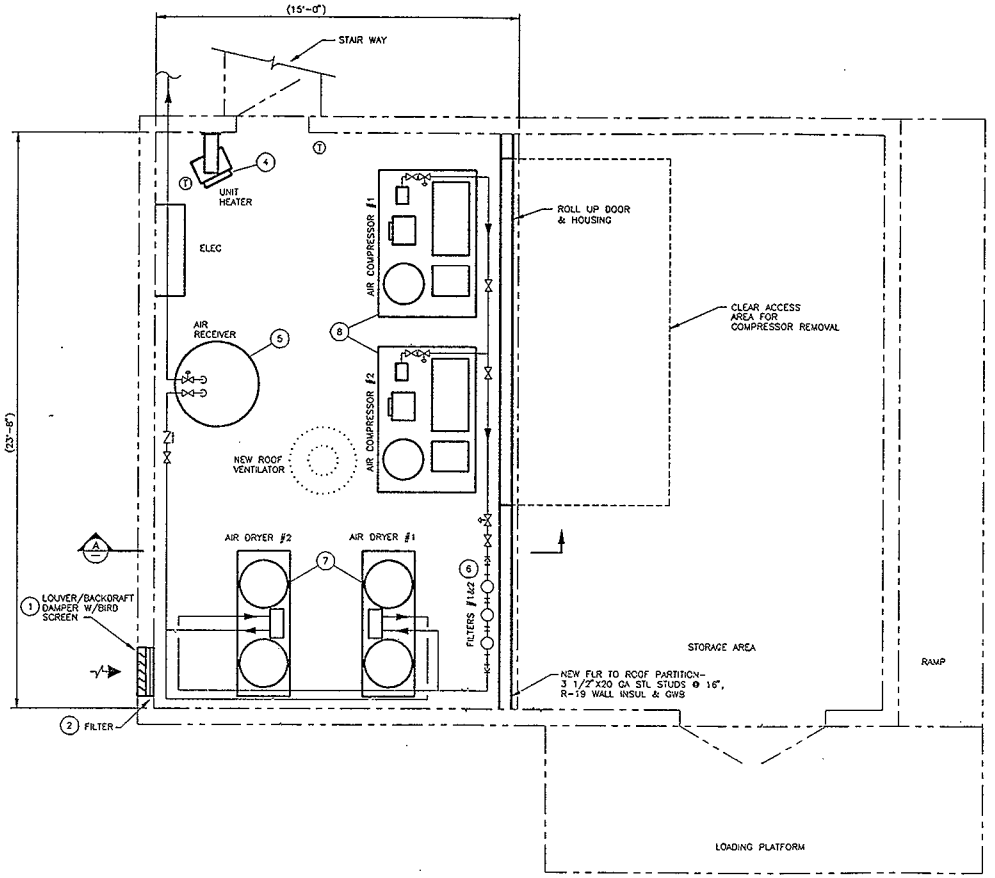
PLOT	BLDG NO	HEAVY WT	DWG NO	REV
F	2736-ZB	0800	ES-W460-A4	0

SCALE 1/4"=1'-0" LIST SHEET 1 OF 1

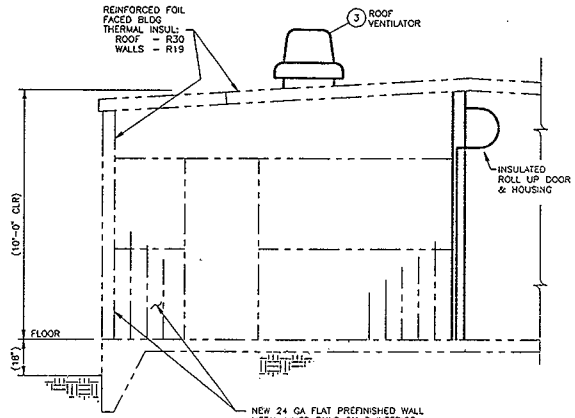
2 PLOT SCALE: 1=48

EQUIPMENT LIST

1. LOUVER/BACKDRAFT DAMPER
   RUSK ELM8110 ADJUSTABLE LOUVER DRAINABLE BLADE W/BIRD SCREEN (24X24X4)
2. FILTER
   FARR XL/PH 24X24X12 RIGA-FLO/PH
3. ROOF VENTILATOR
   OOMEX UNIT DX-149 1/2 HP
4. ELECTRIC UNIT HEATER
   CHROMALOX LUH-10 HORIZONTAL UNIT HEATER 10KW W/ WUH-02 WALL MOUNTING BRACKETS
5. AIR RECEIVER
   BRUNNER VERTICAL AIR RECEIVER 660 GAL 42"ø
6. FILTERS
   GREAT LAKES AIR GC-350
7. AIR DRYERS
   GREAT LAKES AIR GEH-250
8. AIR COMPRESSOR UNITS
   SULLAIR LS-12, 12-40L



3 ENLARGED PLAN
ES-W460-A2 SCALE: 1/2"=1'-0"



EQUIPMENT NOT SHOWN FOR CLARITY

A SECTION
SCALE: 1/2"=1'-0"

DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		NEXT USED ON	REFERENCES

REV NO	REV DATE	DESCRIPTION	CHECK
REVISIONS			

CADFILE W460A5A | CADCODE DOS:6.22:ACD2:12.0:SS

DRAWN BY OJ KOLAR
DESIGN CHECK
CHECKED
SAFETY SEE DR/AT FORM
QUAL ENGR SEE DR/AT FORM
LEAD CHECK SEE DR/AT FORM
CUSTOMER
COMPANY BWHC
UPG
UPG

USE PRELIMINARY
SAFETY CLASS | REVISION NO. 11 | DATE 1/27/97

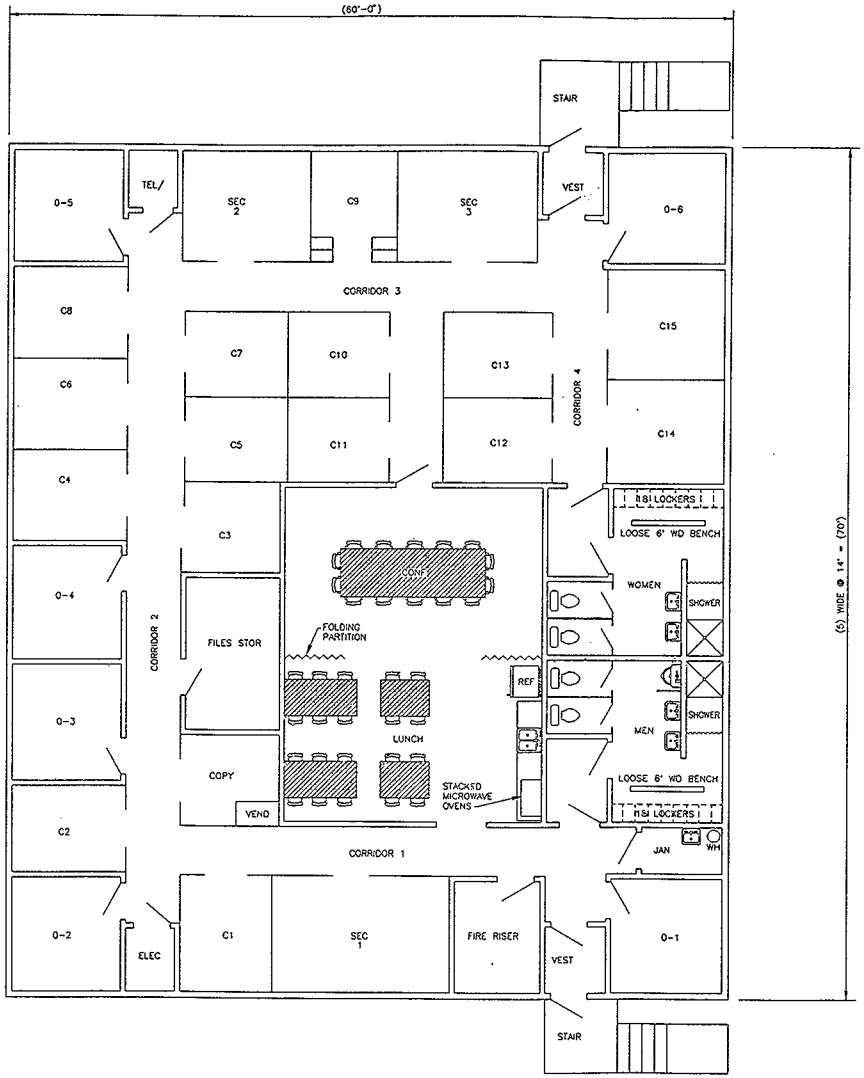
U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC

ARCHITECTURAL
2731-ZA FLOOR PLAN
AIR COMPRESSOR BLDG

PROJECT W460 Pu STORAGE & HANDLING
DWG NO ES-W460-A5 | REV 0
SCALE 1/2"=1'-0" | SHEET 1 OF 1

2 PLOT SCALE: 1=24

1 M-9



OFFICE STRUCTURE FLOOR PLAN

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

LEGEND

C1 TO C16	OFFICE CUBICLES, 64 SQ FT MIN, 6 FT HIGH MAX DIVIDERS STABILIZATION ENGINEER VAULT COG ENGINEER SUPPORT ENGINEER CHEMISTS SNM CUSTODIANS SAFEGUARDS STAFF LAB TECHS CLERKS RCTS
CONF	CONFERENCE ROOM
FILES STOR	HEAVY FILE CABINETS
FILES	FILES SPACE
FIRE RISER	FIRE RISER ROOM
MEN	MEN'S ROOM
WOMEN	WOMEN'S ROOM
0-1 TO 0-6	CLOSED OFFICES FACILITY MANAGERS STABILIZATION MANAGERS SHIFT MANAGERS MAINTENANCE LEAD/SHIFT MANAGER
SEC	SECRETARIAL CUBICLE, 6 FT HIGH MAX DIVIDERS
STOR	STORAGE ROOM
TEL/ELEC	TELEPHONE/ELECTRICAL ROOM
VEST	VESTIBULE

DWG NO TITLE
DRAWING TRACEABILITY LIST

REF NUMBER TITLE
REFERENCES

NEXT USED ON

REVISIONS
DESCRIPTION

CADFILE W460A6A | CADCODE DOS:6.22:AC02:12.0:SS

2 PLOT SCALE: 1=48

1 M-10

USE PRELIMINARY
REVISION NO. 11 DATE 1/27/97

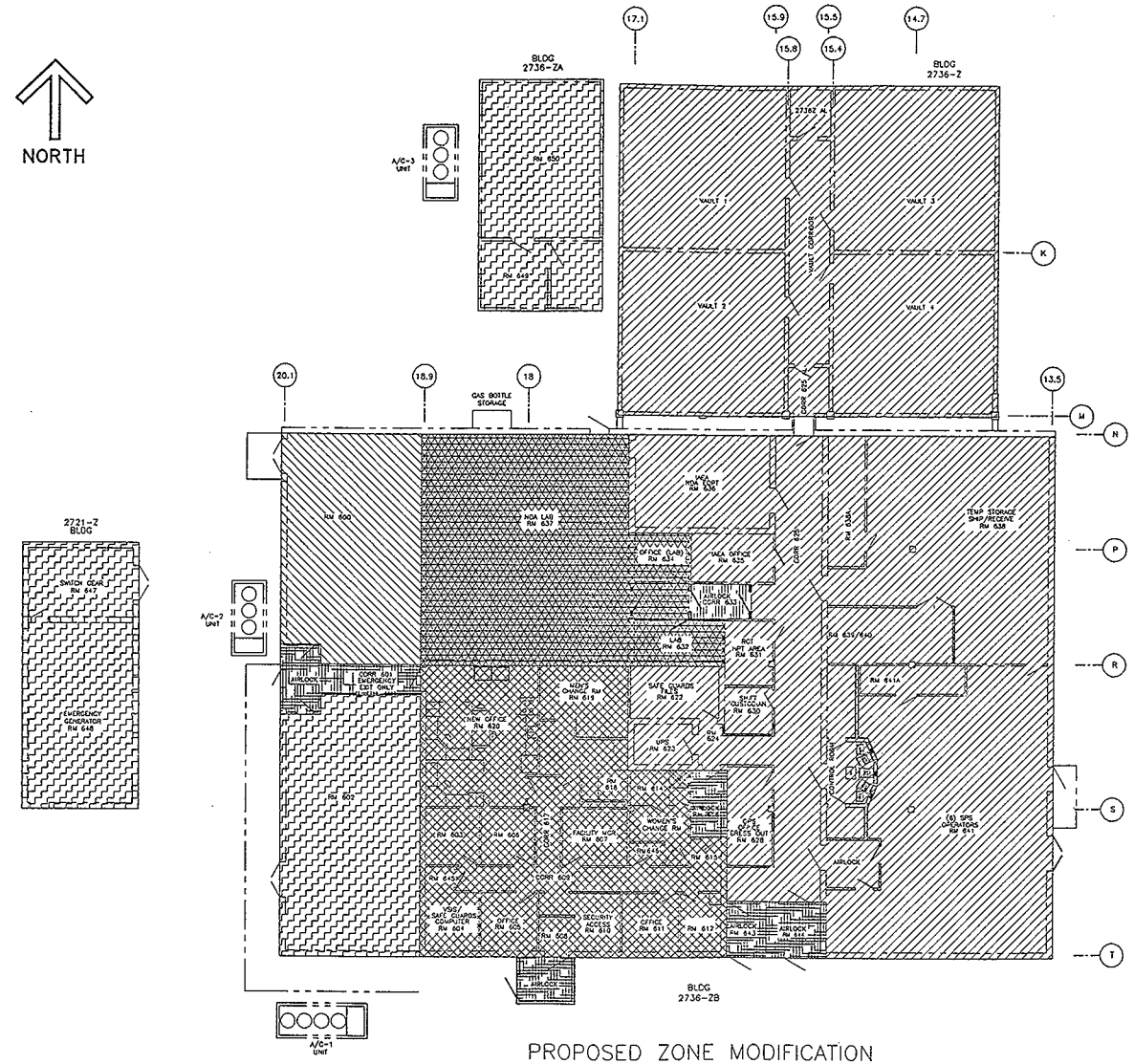
DRAWN BY O.B. JOYCE
DESIGN OVER
CHECKED
SAFETY SEE DR/AT FORM
OTHER SEE DR/AT FORM
QUAL ENGR SEE DR/AT FORM
LEAD ENGR

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC

ARCHITECTURAL
FLOOR PLAN
OFFICE STRUCTURE

PROJECT W460 Pu STORAGE & HANDLING
BLDG NO 0600
DWG NO ES-W460-A6
REV 0
SCALE 1/4" = 1'-0"
SHEET 1 OF 1

DOC NO ES-W460-A6 | SH 1 | OF 1 | REV 0



PROPOSED ZONE MODIFICATION

PRELIMINARY

REVISION NO. 10 DATE 1/27/97

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC

HVAC
FLOOR PLAN
ZONE LAYOUT

W460 Pu STORAGE & HANDLING

DRAWN BY DJ KOLAR
SEE DR/AT FORM
SEE DR/AT FORM
SEE DR/AT FORM
COMPANY BWHC

BLDG NO 2736-Z, 2736-ZA, 2736-ZB
DWG NO 0803
ES-W460-H1 0

SCALE 1/8" = 1'-0"
SHEET 1 OF 1

DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		REFERENCES	
		NEXT USED ON	

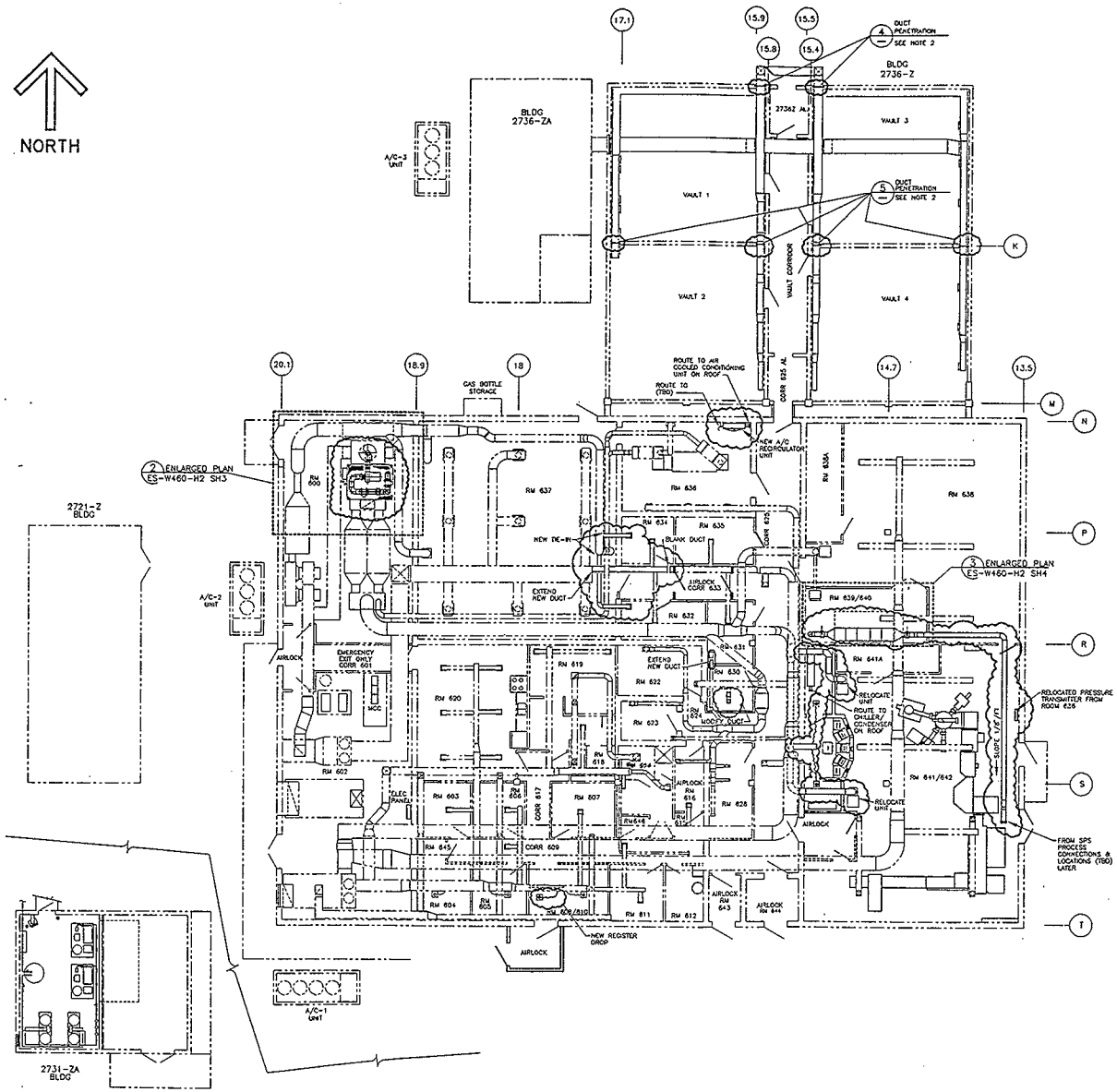
REVISIONS

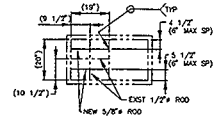
CADFILE IW460H1A | CADCODE DOS:6.22;AC02:12.0;SS

2 PLOT SCALE: 1=96

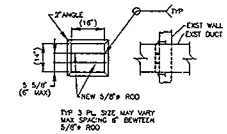
1 M-11

NOTES:
1. CLOUDED ITEMS TO BE NEW, MODIFIED, RELOCATED OR REMOVED.
2. INSTALL BARRIERS INSIDE AIR DUCTS. PROVIDE INSPECTION HATCHES WITH PROVISIONS FOR TAMPER-INDICATING SEALS (TYP 8 PL).





4 DETAIL
SCALE: NONE



5 DETAIL
SCALE: NONE

DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		REFERENCES	
		NEXT USED ON	

NO	REV BY	DESCRIPTION	REV DATE	CHECK
		REVISIONS		

CADFILE IW46CH2A CAOCODE DOS:6.22;ACD2:12.6;SS

Drawn BY	DJ KOLAR
Design Check	
Checked	
Safety	SEE DR/AT FORM
Quality Assurance	SEE DR/AT FORM
Environmental	SEE DR/AT FORM
Lead Discipline	
Project Engineer	
Cognizant Engineer	GWHC
Approved	
Approved	

USE: PRELIMINARY
RELEASE NO. 22 DATE 1/27/97

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC

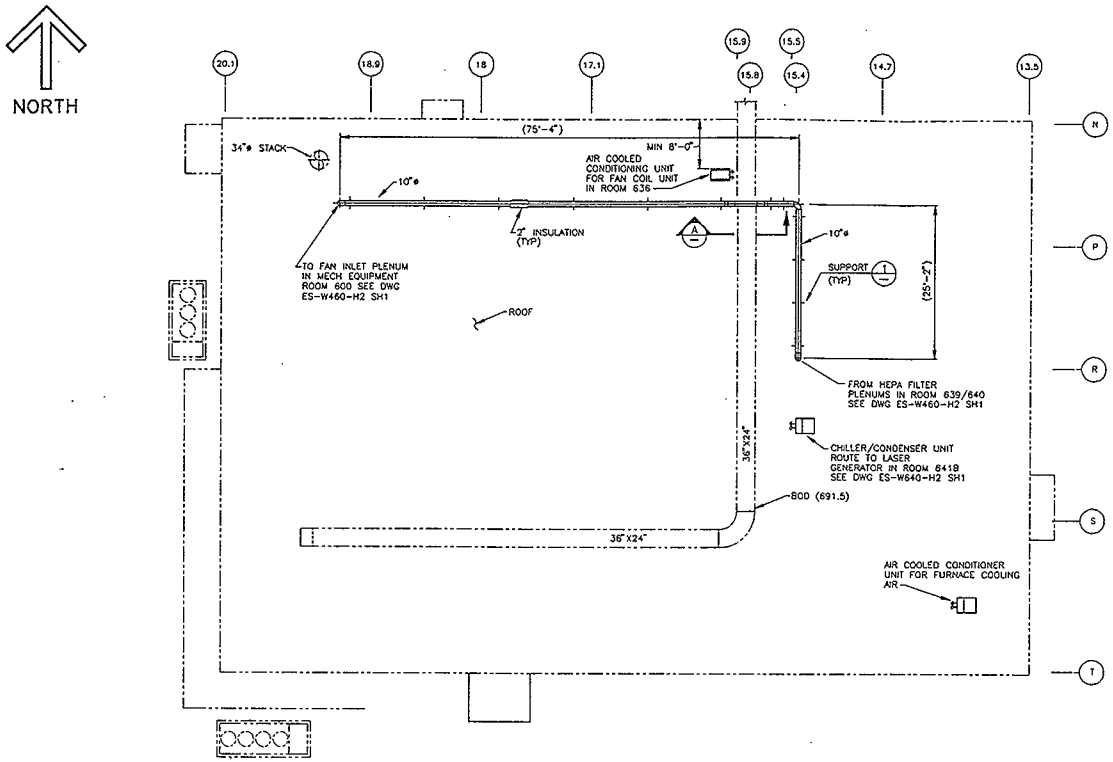
HVAC
FLOOR PLAN
NEW MODIFICATION

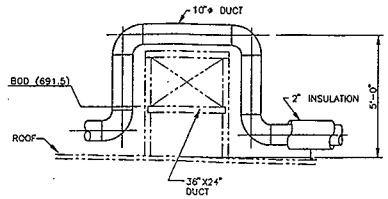
PROJECT: W460 Pu STORAGE & HANDLING

DOE BLDG NO	HOOD NO	DWG NO	REV
2736-ZB	0800	ES-W460-H2	0

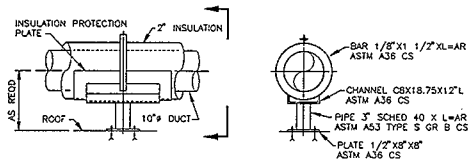
SCALE 1/8" = 1'-0" (1:96) SHEET 1 OF 4

2 PLOT SCALE: 1=96





A SECTION
SCALE: NONE



TYP DUCT SUPPORT

1 DETAIL
SCALE: NONE

DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		REFERENCES	
		NEXT USED ON	

REV NO	DESCRIPTION	REV DATE	ENGR
	REVISIONS		

CADFILE IW460H2B CADCODE DOS:6.22:ACD2:17.0-SS

Drawn BY DJ KOLAR
DESIGN ENGR
CHECKED
SAFETY SEE DR/AT FORM
ENGR SEE DR/AT FORM
QUALITY SEE DR/AT FORM
LEAD ENGR
QUALITY
EQUIPMENT BWHC
APD
APD

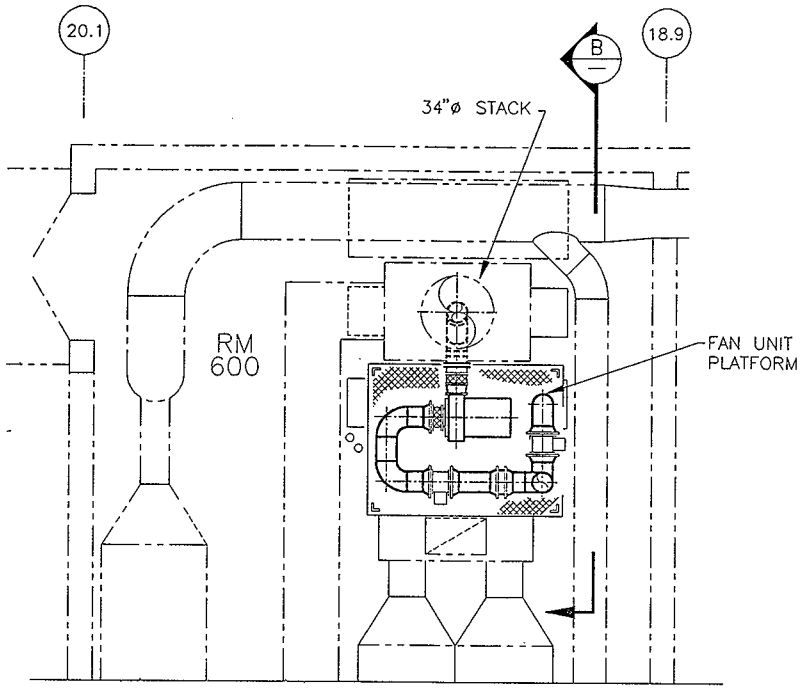
USE PRELIMINARY
SAFETY CLASS REVISION NO. 17 DATE 1/28/97

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC.

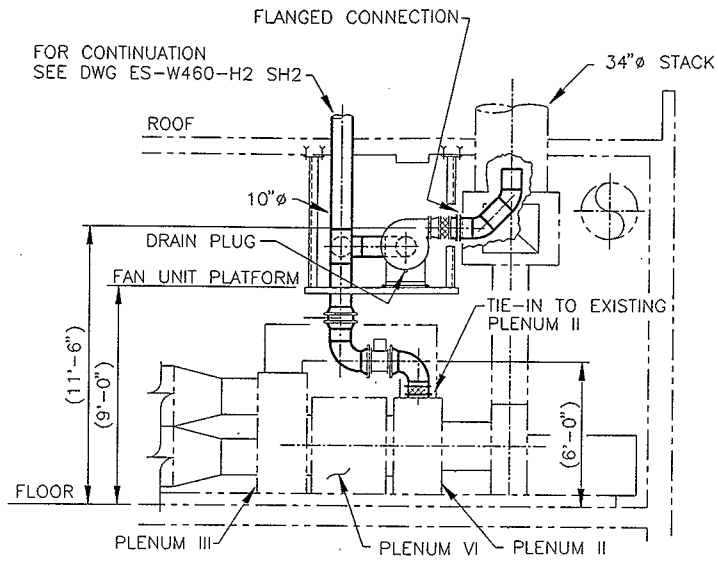
HVAC
ROOF PLAN
NEW MODIFICATION

PROJECT W460 Pu STORAGE & HANDLING
BLDG NO F | INDEX NO 2736-ZB | DWG NO 0800 | REV NO ES-W460-H2 | 0
SCALE 1/8"=1'-0" | SHT 2 OF

2 PLOT SCALE: 1=96



2 ENLARGED PLAN
ES-W460-H2 SH1 SCALE: NONE



B SECTION
SCALE: NONE

PRELIMINARY

DRAWN BY DJ KOLAR
SAFETY SEE DR/AT FORM
QUAL SEE DR/AT FORM
QUAL SEE DR/AT FORM

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC

HVAC
ENLARGED PLAN
& SECTION RM 600

W460 Pu STORAGE & HANDLING

F 2736-ZB 0800 ES-W460-H2 0

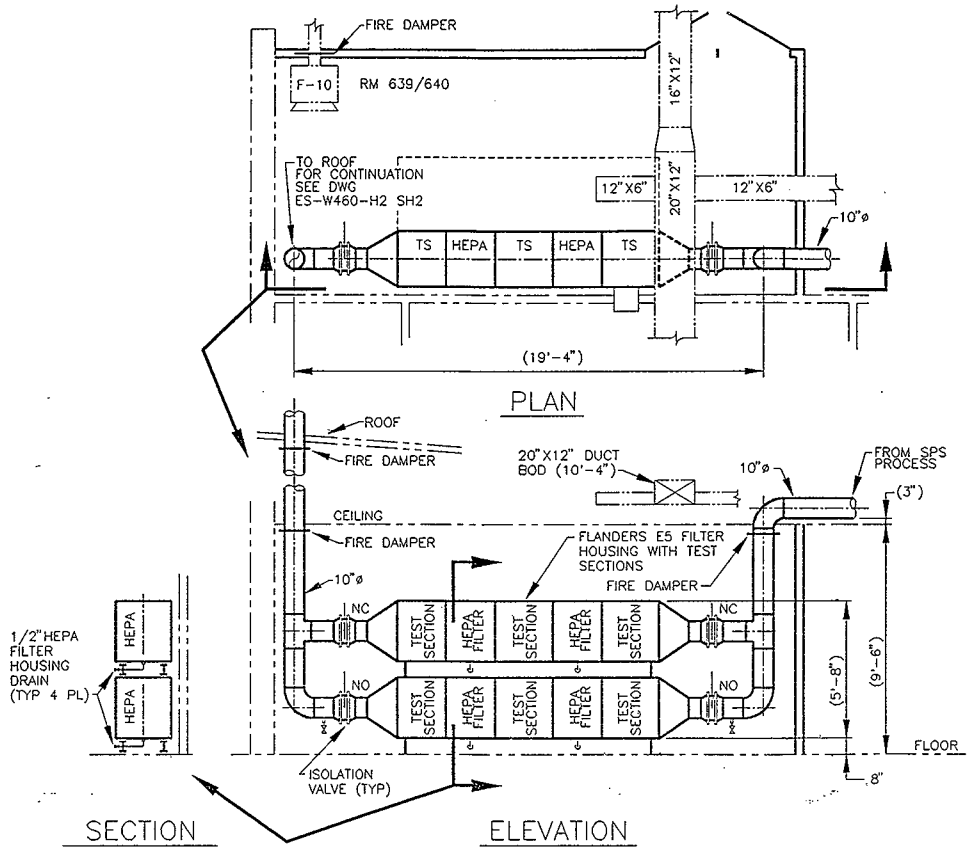
SCALE NONE SHEET 3 OF

DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		REFERENCES	
		NEXT USED ON	

REVISIONS

CADFILE W460H2C CADCODE DOS:6.22:AC02:12.0:SS

2 PLOT SCALE: 1=24



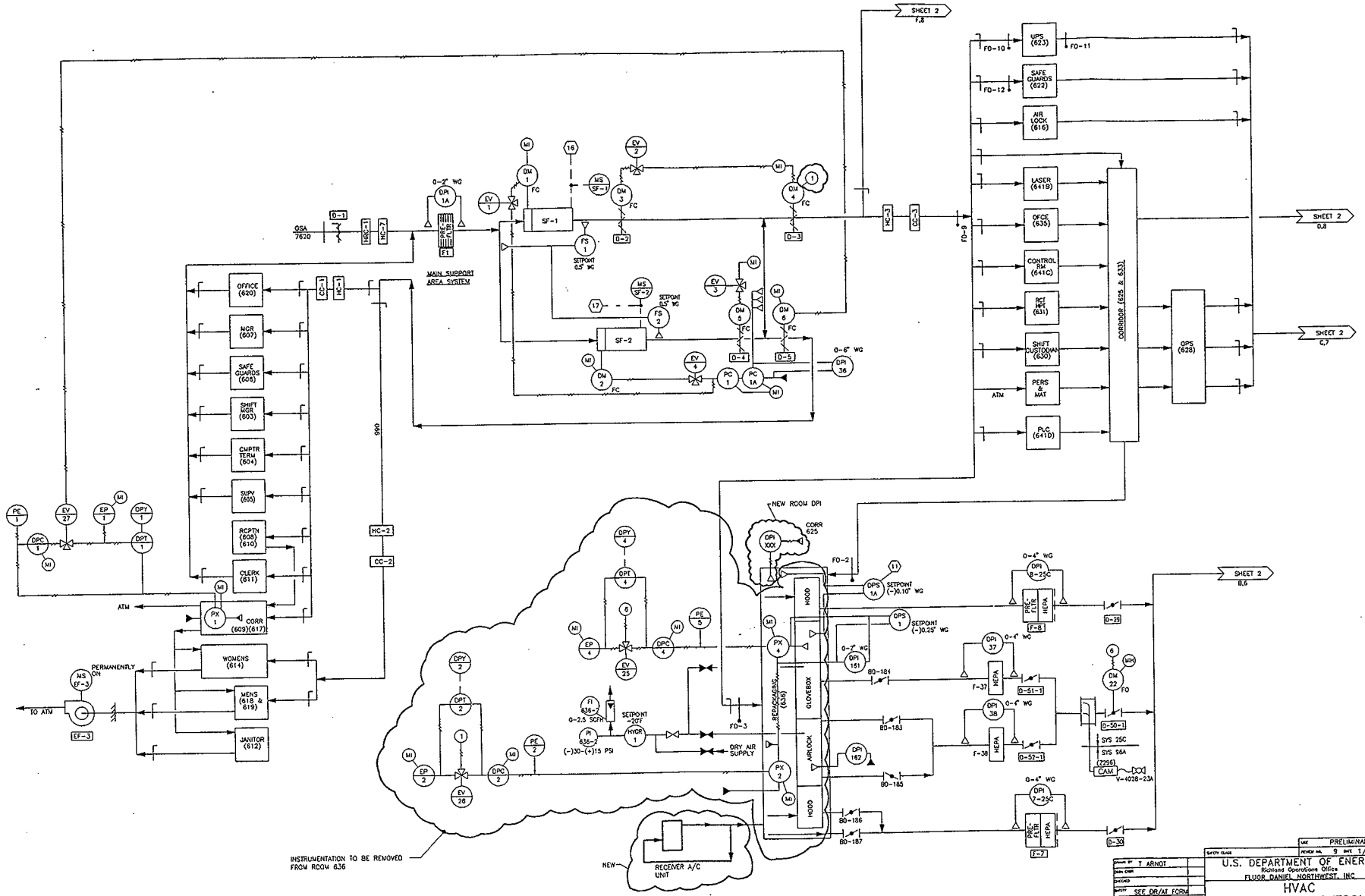
3 ENLARGED PLAN

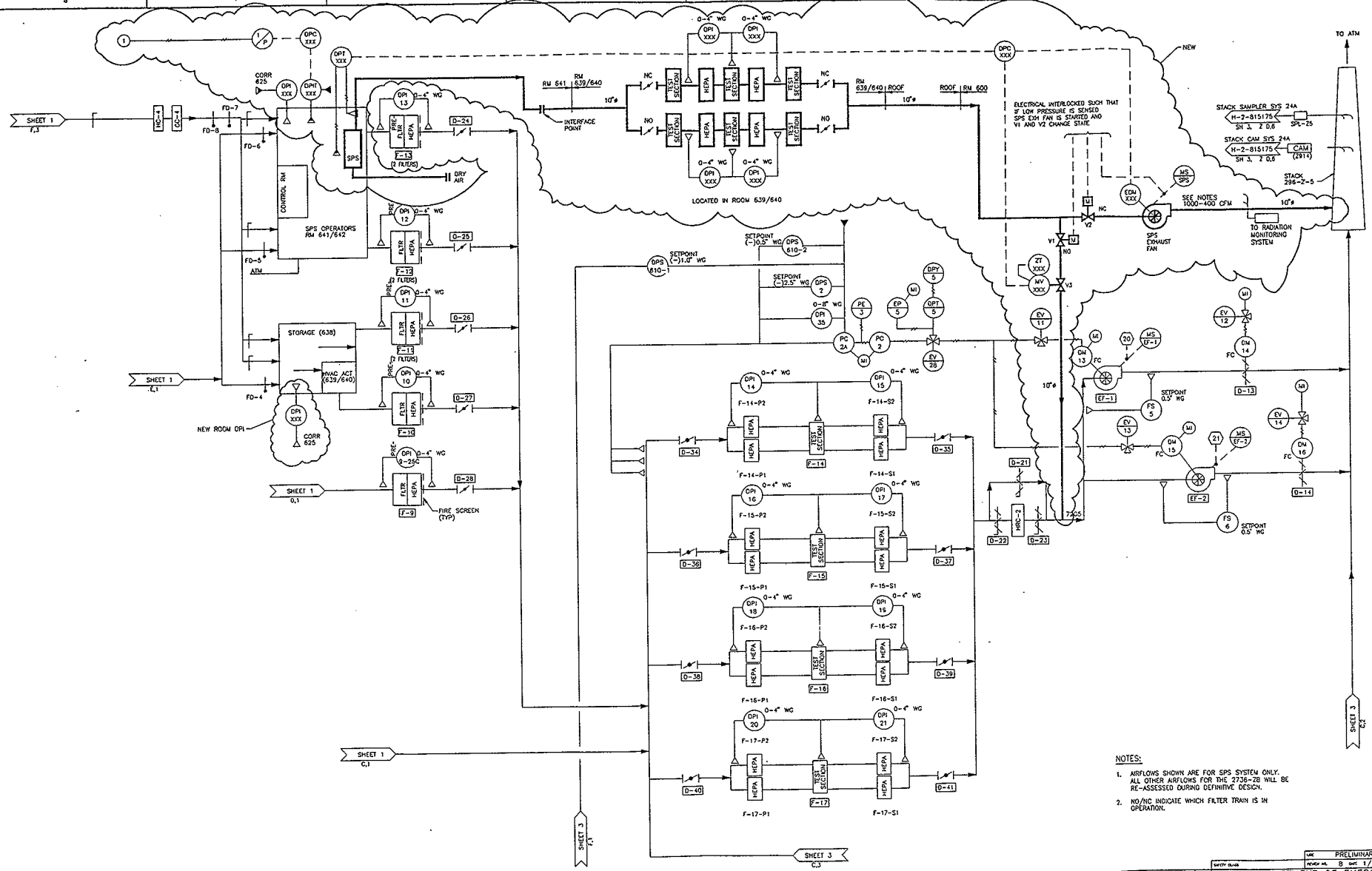
ES-W460-H2 SH1 SCALE: NONE

Drawn BY DJ KOLAR						PRELIMINARY	
DESIGN LEAD						REVISION NO. 11 DATE 1/27/97	
CHECKED						U.S. DEPARTMENT OF ENERGY	
SAFETY	SEE DR/AT FORM					Richland Operations Office	
QUALITY	SEE DR/AT FORM					FLUOR DANIEL NORTHWEST, INC	
ENG DISCIPLINE	DR/AT FORM					HVAC	
ENG LEAD						ENLARGED PLAN	
ENG						& SECTION RM 639/640	
CUSTODIAN						PROJECT W460 Pu STORAGE & HANDLING	
DISCIPLINE	BWHC					DWG NO ES-W460-H2 REV 0	
CAD/CADD						SCALE NONE SHEET 4 OF	

DWG NO	TITLE	REF NUMBER	TITLE	NO	REV	DESCRIPTION	REV BY	DATE
DRAWING TRACEABILITY LIST		NEXT USED ON		REFERENCES		REVISIONS		
				CADFILE	W460H2D	CADCODE DOS:6.22;ACD2:12.0;SS		

2 PLOT SCALE: 1=48


SHEET 2 F,8
UPS (623)
SAFE GUARDS (622)
AIR LOCK (616)
LASER (641B)
OFCE (635)
CONTROL RM (641C)
RCT HPT (631)
SHIFT CUSTODIAN (630)
PERS & MAT
PLC (641D)
CORRIDOR (625 & 633)
OPS (628)
SHEET 2 D,8
SHEET 2 C,7
OSA 7620
MAIN SUPPORT AREA SYSTEM
SF-1
SF-2
SETPOINT 0.5" WG
OFFICE (620)
MGR (607)
SAFE GUARDS (606)
SHIFT MGR (603)
CMPTR TERM (604)
SUPV (605)
RCPTN (608) (610)
CLERK (611)
CORR (609)(617)
WOMENS (614)
MENS (618 & 619)
JANITOR (612)
PERMANENTLY ON
TO ATM
EF-3
ATM
990
NEW ROOM DPI
CORR 625
HOOD
GLOVEBOX
AIRLOCK
HOOD
SETPOINT (-)0.10" WG
SETPOINT (-)0.25" WG
SETPOINT -207
0-2.5 SCFH
(-)30-(+)15 PSI
DRY AIR SUPPLY
INSTRUMENTATION TO BE REMOVED FROM ROOM 636
NEW
RECEIVER A/C UNIT
SHEET 2 B,6
SYS 25C
SYS 86A
CAM
V-4028-23A
PRELIMINARY
U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC.
HVAC
AIRFLOW & CONTROL
COMPOSITE DIAGRAM
W460 Pu STORAGE & HANDLING
ES-W460-H5
0
DRAWN BY T ARNOT
CHECKED
SEE DR/AT FORM
BWHC
DWG NO
TITLE
REF NUMBER
TITLE
REFERENCES
NEXT USED ON
REVISIONS
CADFILE
W460H5A
CADCODE
005:6.22:ACD2:12.0:SS
2 PLOT SCALE: 1=1
SCALE NONE
M-16



NOTES:

1. AIRFLOWS SHOWN ARE FOR SPS SYSTEM ONLY. ALL OTHER AIRFLOWS FOR THE 2736-ZB WILL BE RE-ASSESSED DURING DEFINITIVE DESIGN.
2. NO/NC INDICATE WHICH FILTER TRAIN IS IN OPERATION.

DWG NO TITLE	REF NUMBER TITLE
DRAWING TRACEABILITY LIST	NEXT USED ON

REVISIONS					
NO	REV	DESCRIPTION	ECN	CHECK	COMPANY
F	8	PRELIMINARY			

CADFILE W460H5B CADCODE DOS:6.22;ACD2:12.0;SS

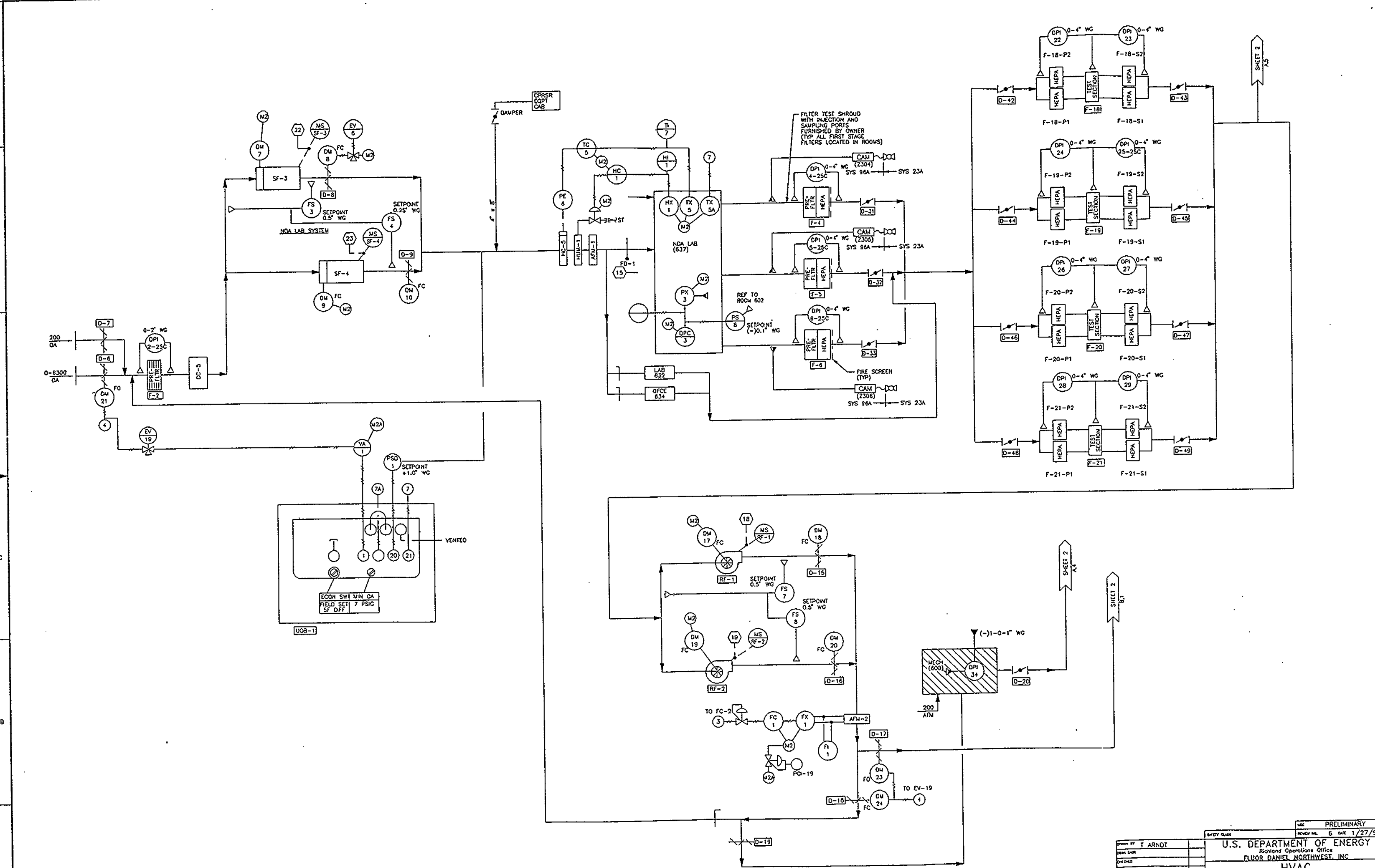
DRAWN BY	T ARNOT
DESIGN LEAD	
CHECKED	
SAFETY	SEE DR/AT FORM
ENVIR	SEE DR/AT FORM
QUAL ENGR	SEE DR/AT FORM
LEAD ENGR	
SUPERVISOR	
COGNIZANT ENGINEER	BWHC
APPD	

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC

HVAC AIRFLOW & CONTROL COMPOSITE DIAGRAM

PROJECT W460 Pu STORAGE & HANDLING
BLDG NO 2736-ZB | PROJ NO 5900 | DWG NO ES-W460-H5 | REV 0
SCALE NONE | SHEET 2 OF

2 PLOT SCALE: 1=1



USE	PRELIMINARY
REVIEW NO.	6 DATE 1/27/97
DRAWN BY	T ARNDT
	SEE DR/AT FORM
	SEE DR/AT FORM
	SEE DR/AT FORM
COMPANY	BWHC

U.S. DEPARTMENT OF ENERGY
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FLUOR DANIEL NORTHWEST, INC

HVAC AIRFLOW & CONTROL COMPOSITE DIAGRAM

W460 Pu STORAGE & HANDLING

F	2736-2B	8900	ES-W460-H5	0
SCALE NONE			SHEET 3 of	

M-18

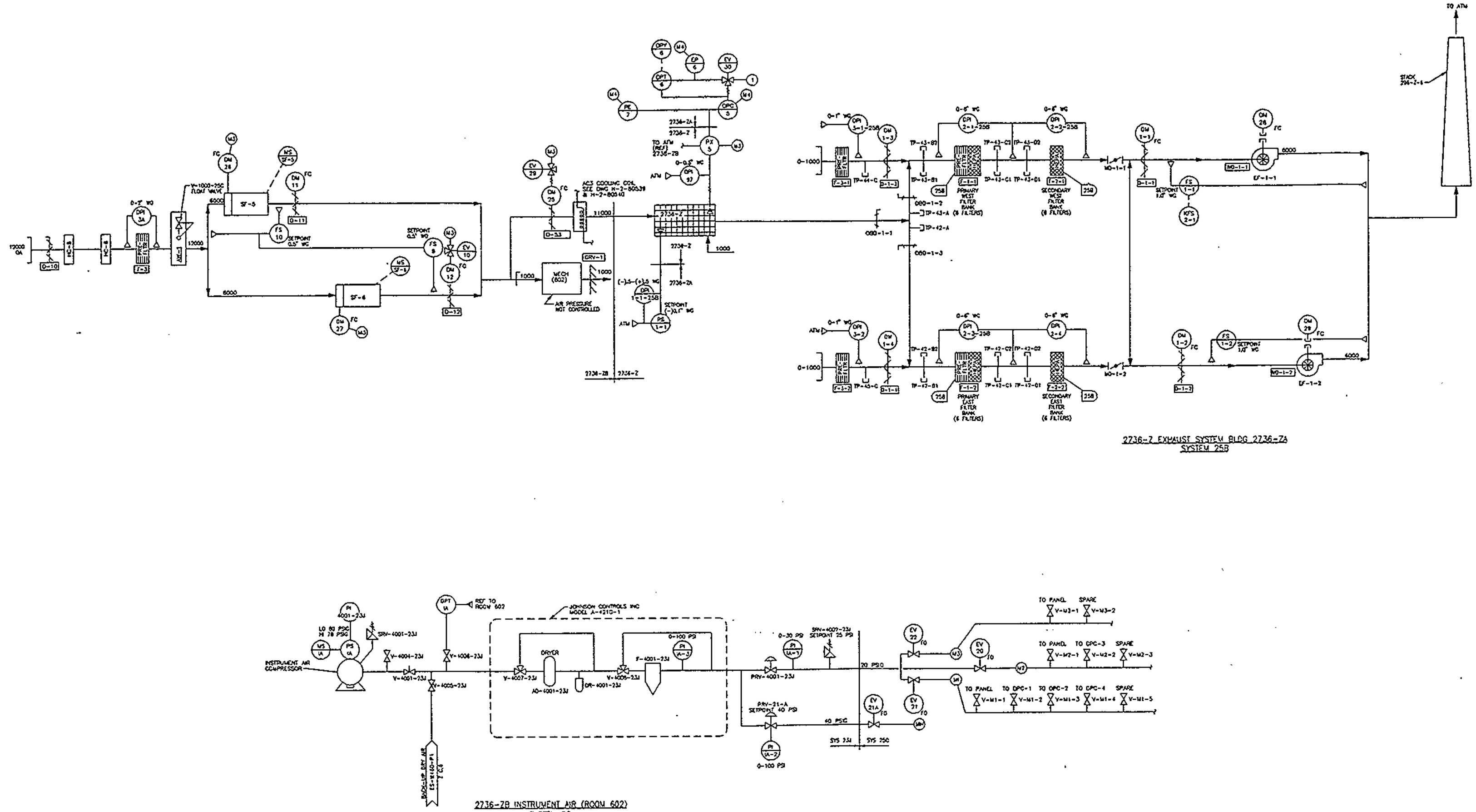
DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		NEXT USED ON	REFERENCES

REVISIONS

CADFILE IW460H5C CADCODE DOS:6.22:ACD2:12.0:SS

PLOT SCALE: 1=1

ES-W460-H5 SH 3 OF REV 0



DRAWN BY	T ARNDT
ENGR	SEE DR/AT FORM
	SEE DR/AT FORM
	SEE DR/AT FORM
COMPANY	BWHC

PRELIMINARY
REVIEW NO. 5 DATE 1/27/97

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC

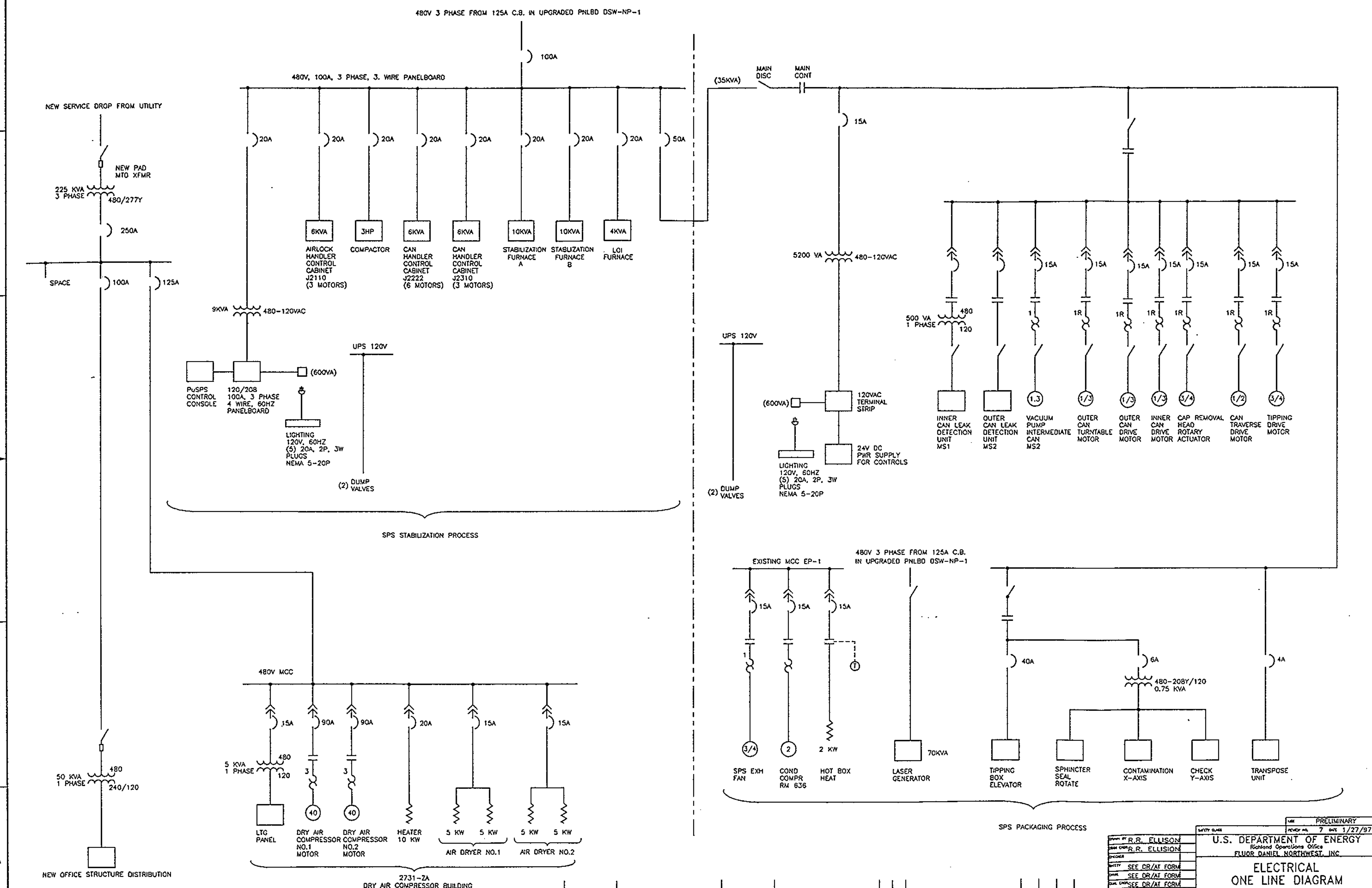
HVAC
AIRFLOW & CONTROL
COMPOSITE DIAGRAM

PROJECT W460 Pu STORAGE & HANDLING
F 2736-ZB 8900 ES-W460-H5 0
SCALE SHOWN SHEET 4 OF

DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		NEXT USED ON	REFERENCES

REVISIONS
CADFILE IW460H5D CADCODE DOS:6.22:ACD2:12.0:SS

PLOT SCALE: 1=1.5



DWG NO	TITLE	
DRAWING TRACEABILITY LIST		
REF NUMBER	TITLE	
NEXT USED ON	REFERENCES	

REVISIONS

CADFILE W46CE3A CADCODE DOS:6.22:ACD2:12.0:SS

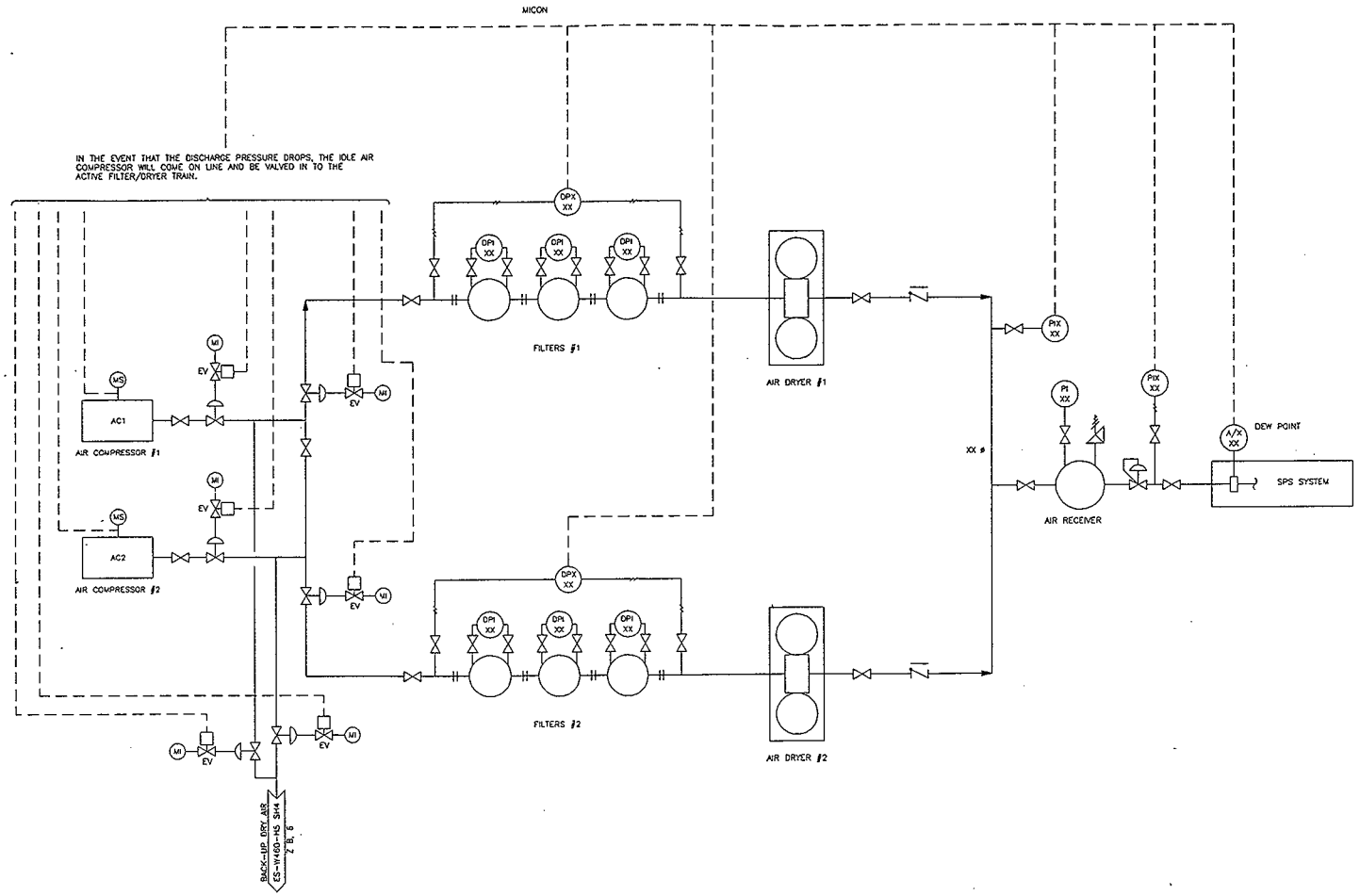
PRELIMINARY
7 1/27/97
R.R. ELLISON
R.R. ELLISON
SEE DR/AT FORM
SEE DR/AT FORM
SEE DR/AT FORM
BWCH

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC

ELECTRICAL
ONE LINE DIAGRAM

W460 Pu STORAGE & HANDLING
2736-ZB 7201 ES-W460-E3 0
NONE SHEET 1 OF 1

2 PLOT SCALE: 1=1



DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		NEXT USED ON	REFERENCES

REVISIONS

NO	DESCRIPTION	REV DATE	ENGR

CADFILE IW460P1A CADCODE DOS:6.22:ACD2:12.0:SS

PRELIMINARY

SAFETY CLASS — APPROVAL NO. 9 DATE 1/27/97

DRAWN BY	DJ KOLAR
DESIGNED	
CHECKED	
SAFETY	SEE DR/AT FORM
CONST	SEE DR/AT FORM
QUAL ENGR	SEE DR/AT FORM
LDD DATE	
SYSTEM	
DRAWING	BWHC
APVD	
APVD	

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC

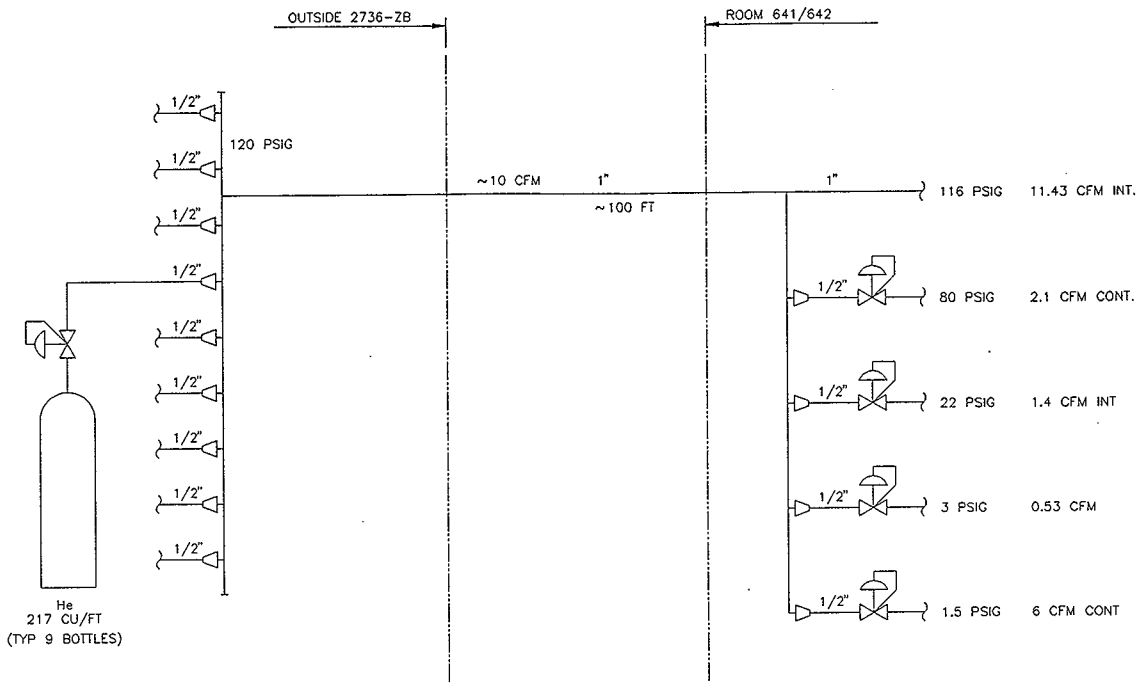
PIPING
P & ID
DRY AIR SYSTEM

PROJECT W460 Pu STORAGE & HANDLING

REV	BLDG NO	ACCT NO	DWG NO	REV
F	2731-ZB	7604	ES-W460-P1	0

SCALE SHOWN SHEET 1 OF 1

2 PLOT SCALE: 1=1



PRELIMINARY

DJ KOLAR

SEE DR/AT FORM

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
FLUOR DANIEL NORTHWEST, INC

PIPING
P & ID
HELIUM DISTRIBUTION

W460 Pu STORAGE & HANDLING

2736-ZB | 7004 | ES-W460-P2 | 0

SCALE: NONE

DRAWING TRACEABILITY LIST

DWG NO | TITLE | REF NUMBER | TITLE | NEXT USED ON | REFERENCES

REVISIONS

CADFILE: W460P2A | CADCODE: DOS:6.22:ACD2:12.0:SS

BWHC

2 PLOT SCALE: 1=1

1 M-22

DISTRIBUTION SHEET

To	From	Page 1 of 1
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W-460, Plutonium Stabilization & Handling		ECN No. NA

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