Report
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Rev. 0

B PLANT COMPLIANCE TO DOE ORDER 6430.1A AND OTHER CODES, STANDARDS, AND REGULATIONS

TASK 3

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Prepared by

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
1845 Terminal Drive, Suite 202
Richland, WA 99352

Sub-Contract MNP-SVV-536053
Task 89-3

Prepared for

WESTINGHOUSE HANFORD COMPANY
P. O. Box 1970
Richland, WA 99352

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1. INTRODUCTION

This report documents the evaluation of B Plant compliance to DOE Order 6430.1A and Codes, Standards, and Regulations (CS&Rs) pertaining to radioactive waste management. This work was performed under Task 3 of Sub-Contract MNP-SVV-536053, Task 89-3. Task 1 and Task 2 of Task 89-3 were performed in parallel with Task 3 and served to identify and summarize the major requirements for radioactive liquid waste facilities. A detailed compliance assessment of seven B Plant systems was performed including:

Structural
Process and Building Ventilation
Fire Protection
Electrical
Utilities and Services
Process Piping/Process Vessels/Confinement
Instrumentation and Control

Draft versions of the compliance assessments have been submitted to WHC for review and comment. This report addresses these comments and consolidates the results from these draft assessments. WHC is initiating action to respond to the comments and recommendations of this report.

Section 2 of this report explains the assessment method. Section 3 provides a summary of general areas of major concern while Section 4 presents more detailed discussion of noncompliance items identified in the assessments. The assessments are provided in tabular form in Appendix A.

2. METHOD

The goal of Task 3 was to identify B Plant areas of noncompliance to DOE Orders and CS&Rs to permit reactivation of B Plant for a 20-year mission. Applicable CS&Rs were identified in Task 1 of this project. At the onset of the task, it was determined that a detailed assessment of B Plant systems to DOE 6430.1A, General Design Criteria, would provide a sound basis for initial B Plant decisions, so Task 3 initially concentrated on DOE 6430.1A comparisons.

The applicable CS&Rs other than DOE 6430.1A were identified in the Task 1 deliverable of February 1, 1989. The compliance assessment for many of these CS&Rs were contained in DOE 6430.1A comparison tables and required no further comment. Additionally, many of the other CS&R provisions identified were covered by DOE 6430.1A criteria and were not repeated. However, there were several CS&R items which required elaboration. These CS&Rs are shown in Table 1. The columns and rows of the Table 1 matrix match those of the Task 1 deliverable. Rows are structured according to the major plant system and subsystems. The columns show the other CS&R contained in the assessment tables in Appendix A.

For each system or design area, comparison tables were prepared listing the requirement or design criteria on the left and B Plant implementation of the criteria on the right. An assessment of B Plant implementation compliance or noncompliance was also included. Technical information to complete the implementation portion of the table was taken from documents listed in Appendix B. . These include Conceptual Design Reports, Functional Design Criteria, and drawings for the specific system. These resources were supplemented by the 1985 B Plant SAR, various technical reports, and Hanford Plant Standards. A final resource was communication and comments from B Plant staff. The compliance/noncompliance assessment was based on the engineering judgment of the task participants.

The compliance assessment was based on a B Plant classification as a Radioactive Liquid Waste Facility as defined by DOE 6430.1A, Section 1323. Furthermore, it is assumed that B Plant will not be a plutonium handling facility. An additional assumption initially used in the assessment was the canyon ventilation and the canyon building are the only safety class items required for B Plant operation. Final accident analysis and the resulting safety system selection was still being prepared by WHC, and during the course of this work, other candidate safety systems have been identified. Although no final decision on safety class items was available, the comparison tables attempted to address safety class item issues on a case by case basis. Selection of safety class items has major impact on B Plant compliance to applicable CS&Rs.

Task 1 Key Provision Identifier	DOE 5480.4 Environmental Protection RL 5480.10A Industrial Hygiene	DOE 5480.5 Nuclear Facility Safety	DOE 5480.7 Fire Protection	DOE 5820.2A Radioactive Waste Management	40 CFR 264 EPA Regs for Hazardous Wastes	29 CFR 1910 29 CFR 1926 OSHA	WAC 296-24 General Health and Safety Standards (WISHA)	WAC 173-303 Dangerous Waste Regulations	Other
2.0 STRUCTURES									
2.1 Structural Design Requirements					264.35	1910.24	73513, 76507		
2.2 Natural Forces Requirements					264.18				
2.3 NonReactor Nuclear Facilities Requirements									
2.4 Radioactive Liquid Facility Requirements									
3.0 HVAC									
3.1 General							33017 WAC 296-62-07517		ANSI/ASME N509 NFPA 91
3.2 Non-Reactor Nuclear Facilities									
3.3 Air Pollution Control			9a(3) 9c(4)	I 3b(2)(f)		1910.96(c) 1910.134 1910.1001			

Table 1. Codes, Standards, and Regulations other than DOE 6430.1A Used in this Assessment

Task 1 Key Provision Identifier	DOE 5480.4 Environmental Protection RL 5480.10A Industrial Hygiene	DOE 5480.5 Nuclear Facility Safety	DOE 5480.7 Fire Protection	DOE 5820.2A Radioactive Waste Management	40 CFR 264 EPA Regs for Hazardous Wastes	29 CFR 1910 29 CFR 1926 OSHA	WAC 296-24 General Health and Safety Standards (WISHA)	WAC 173-303 Dangerous Waste Regulations	Other
4.0 FIRE PROTECTION									
4.1 General			9.0 10.0 RL 5480.7A 5.g			1910.160 1910.162 1910.159 1926.151 1926.152			
4.2 Non-Reactor Nuclear Facilities									
5.0 ELECTRICAL									
5.1 General						1926.402 1910.302 thru .308			
5.2 Wiring									
5.3 Utility Service									
5.4 Lightning									
5.5 Grounding									
5.6 Inside Services									
5.7 Special Systems				I 3b(2)(k)					
5.8 Communications					264.32 264.34				

Table 1. Codes, Standards, and Regulations other than DOE 6430.1A Used in this Assessment (Continued)

Task 1 Key Provision Identifier	DOE 5480.4 Environmental Protection RL 5480.10A Industrial Hygiene	DOE 5480.5 Nuclear Facility Safety	DOE 5480.7 Fire Protection	DOE 5820.2A Radioactive Waste Management	40 CFR 264 EPA Regs for Hazardous Wastes	29 CFR 1910 29 CFR 1926 OSHA	WAC 296-24 General Health and Safety Standards (WISHA)	WAC 173-303 Dangerous Waste Regulations	Other
5.9 NonReactor Nuclear Facilities									
6.0 UTILITIES AND SERVICES									
6.1 General									
6.2 Process Sampling System				I 3b(2)(j)					
6.3 Air Supply									
6.4 Mechanical Equipment									
6.5 Cranes and Hoists						1910.179(g)(3) 1910.179(e)(4) 1910.134 1926.550(d)(2)	23503 23509(4) 23517 24503 23505		
6.6 Cooling Water									
6.7 Steam									

Table 1. Codes, Standards, and Regulations other than DOE 6430.1A Used in this Assessment (Continued)

Task 1 Key Provision Identifier	DOE 5480.4 Environmental Protection RL 5480.10A Industrial Hygiene	DOE 5480.5 Nuclear Facility Safety	DOE 5480.7 Fire Protection	DOE 5820.2A Radioactive Waste Management	40 CFR 264 EPA Regs for Hazardous Wastes	29 CFR 1910 29 CFR 1926 OSHA	WAC 296-24 General Health and Safety Standards (WISHA)	WAC 173-303 Dangerous Waste Regulations	Other
6.8 Misc. (Potable Water Collection Systems, etc.)	RL 5480-10A Att. D-1,3,b D-1,3,f D-1,3,l				40 CFR 280.21				
7.0 PROCESS PIPING/ PROCESS VESSELS									
7.1 General					264.190 264.193(d) 264.193(e)				
7.2 Nonreactor Nuclear Facilities									
7.3 Radioactive Liquid Waste Facilities				I 3b(2)(a) I 3b(2)(b) I 3b(2)(c) I 3b(2)(d) I 3b(2)(g) I 3b(4)(d)	264.170 264.171 264.172 264.174 264.175 264.220 264.222			173-303-640	
8.0 INSTRUMENTATION									
8.1 General									
8.2 Wiring & Trays									
8.3 NIMS	5480.4 Att.2(f)								

Table 1. Codes, Standards, and Regulations other than DOE 6430.1A Used in this Assessment (Continued)

Task 1 Key Provision Identifier	DOE 5480.4 Environmental Protection RL 5480.10A Industrial Hygiene	DOE 5480.5 Nuclear Facility Safety	DOE 5480.7 Fire Protection	DOE 5820.2A Radioactive Waste Management	40 CFR 264 EPA Regs for Hazardous Wastes	29 CFR 1910 29 CFR 1926 OSHA	WAC 296-24 General Health and Safety Standards (WISHA)	WAC 173-303 Dangerous Waste Regulations	Other
8.4 Personnel Protection		5480.5,11c		I 3b(2)(h)	264.193				
8.5 Process				I 3b(3)(a) I 3b(3)(b) I 3b(3)(c) I 3b(3)(d) I 3b(3)(e)					

Table 1. Codes, Standards, and Regulations other than DOE 6430.1A Used in this Assessment (Continued)

In general, effort concentrated on assessments of the 221-B Canyon building. Often the assessment was expanded to surrounding B Plant facilities. For example, the HVAC had to include an assessment of the 291-B stack and associated facilities. Once noncompliance issues were identified from the tables, an assessment of the circumstances causing the noncompliance and alternatives to achieve compliance was performed. These alternatives were described in qualitative terms; cost and schedule estimates were beyond the scope of this task.

3. RESULTS

Detailed compliance assessment tables are organized by plant system and are presented in Appendix A. Noncompliance items from the tables are discussed in Section 4. The major noncompliance issues are:

- It is not clear that existing safety class structures including the canyon (secondary confinement) and ventilation components retain confinement capability during and after a DBE. Initial results from analysis is encouraging (see Section 4.2).

- The safety class stack ventilation and effluent monitoring systems do not have adequately qualified emergency power (see Section 4.3).

- Modification to the exhaust stack, filter cells and exhaust air tunnels may be needed to preclude unacceptable consequences during a DBE (see Section 4.3).

- Fire Protection Analysis and subsequent facility modifications, if any, must be performed to ensure that B Plant is an "improved risk" facility (see Section 4.4).

- ALARA objectives can be enhanced in the areas of canyon sampling, steam system pressure relief and operating gallery instrument tube confinement (see Sections 4.6 and 4.7).

- The existing once-through process cooling system should be replaced to meet the requirements of closed loop cooling systems specified by 6430.1A for use in high-level radioactive liquid waste facilities (see Section 4.6).

- Many of the candidate safety class instrumentation and control systems do not meet the requirements of I&C safety class items including DBA resistance, redundancy, environmental qualification and UPS power.

4. B PLANT IMPLEMENTATION OF DESIGN CRITERIA: NONCOMPLIANCE ITEMS

This section provides a summary of noncompliance items identified in the assessments contained in Appendix A. The specific code citation is presented with a discussion of B Plant variance to the code requirements. A brief recommendation is also provided. Noncompliance items are presented by system. This system breakdown was established by the Task I work to identify applicable codes, standard, and regulations for radioactive liquid waste facilities. Numbers on the left hand column of each section are the applicable paragraph number from the criteria document.

4.1 ADMINISTRATIVE REQUIREMENTS

The Task 1 matrix included codes, standards, and regulations for administrative requirements for the operation of nuclear facilities. Task 3 concentrated on design issues in order to identify the necessary engineering projects and possible facility modifications to bring B Plant into compliance with the codes. So no detailed assessment table for administrative codes was prepared. However, there are administrative requirements which may directly affect the scope of engineering projects. These include:

- The final safety analysis report (FSAR) must be completed and approved prior to initial operation. Safety class items identified by the FSAR have major impact on system design.

- Seismic design shall be reviewed by a qualified independent organization. Considerable seismic analysis is required to establish B Plant structural confinement adequacy.

- Decommissioning issues must be addressed as specified in Section 1300-11 of 6430.1A. These include design details consistent with program requirements of DOE 5820.2.

- A comprehensive documentation system is required to properly facilitate QA and future safety audits. A document control and updating system approaching the requirement of NQA-1 is necessary to ensure compliance to design criteria and safety requirements.

4.2 B PLANT IMPLEMENTATION OF STRUCTURAL DESIGN CRITERIA

The assessment of B Plant compliance to structural design criteria (Appendix A, Table 2 and 2A) concentrated on the canyon building 221-B since this was an area of potential major impact. The structure was built in the early 1940s, so assessment of compliance to modern standards was carried out by comparison of modern standards to the Uniform Building Code of 1940, the assumed code of record for original construction. Several items could not be accurately assessed such as proper concrete pouring and forming procedures since adequate records do not exist to support this "after the fact" analysis.

4.2.1 Noncompliance Items From 6430.1A

0111-2.8.5 Concrete and masonry structures shall be investigated for stresses and deformations induced by creep and shrinkage. For concrete and masonry structures, the minimum linear coefficient of shrinkage shall be assumed to be 0.0002 inch/inch unless a detailed analysis is undertaken. The theoretical shrinkage displacement shall be computed as the product of the linear coefficient and the length of the member.

Discussion: The existing shrinkage cracks in the structure may adversely impact the integrity of the west and east walls.

Recommendation: Cracks should be evaluated for their impact on structural integrity. WHC structural analysis is currently addressing the redistribution of dead weight stresses due to creep. Fill cracks to improve wall integrity if necessary.

0111-3.3 Control joints shall be designed and placed in such a manner as to avoid structural distress and uncontrolled cracking from thermal expansion and contraction, concrete shrinkage, and movements due to wind and earthquake forces.

Discussion: The control joints do not appear to be properly designed to relieve structural distress due to earthquake forces.

Recommendation: Continue studies of earthquake effects and impacts of failure due to structure distress. Perhaps initiate a study to assess a construction fix to mitigate control joint mislocations.

0111-99.0.1 Safety class items required to function during or following severe natural phenomena shall not be prevented from performing their required safety functions by the failure of components, systems, or structures that are not designed to the severe natural phenomena criteria.

Safety class structures shall be protected against dynamic effects, including effects of missiles and discharging fluids, that may result from natural phenomena, accidents at nearby facilities, including military installations and

transportation facilities, equipment failure, and similar events and conditions inside and outside the facility. The design bases for such events shall take into account their historic frequency and severity in the region of the site and the potential risk to the environment or the health and safety of the public. Earthquakes, tornados, straight winds, and floods shall be addressed.

The design of structures, including their supports, that are confinement system barriers shall ensure satisfaction of the functional requirements for the specific confinement system they are part of. In addition, safety class confinement barriers (barriers whose continued integrity is shown by a safety analysis to be required following severe natural phenomena, including the DBE, and man-made events) shall be designed to withstand secondary events as well as primary events....

Discussion: Structures which have questionable integrity during natural events include the ventilation stack (in particular the acid brick lining), the canyon building, and the cell drain header below the plant. Failure of these systems during a DBE may have unacceptable release consequences because of the possible loss of confinement and confinement ventilation.

Recommendation: Continue to resolve via analysis questions of stack resistance and canyon resistance and cell drain header resistance to DBE. Also see Sections 4.3.1 and 4.7.1 for further discussion on the ventilation system and cell drain header.

4.2.2 Noncompliance Items From Other Codes, Standards, and Regulations

WAC 296-24-73513 All buildings, docks, tramways, walkways, log dumps, and other structures shall be so designed, constructed, and maintained as to provide a safety factor of 4. This means that all members shall be capable of supporting four times the maximum strain to be imposed.

WAC 296-24-76507 Fixed stairways shall be designed and constructed to carry load of five times the normal live load anticipated but never of less strength than to carry safely a moving concentrated load of 1,000 pounds.

29 CFR 1910.24 — Fixed industrial stairs include interior and exterior stairs around machinery, tanks and other equipment, and stairs leading to or from floors, platforms, or pits. Fixed stairways shall be designated and constructed to carry a load of five times the normal live load anticipated.

Discussion: Design building loads are based on UBC requirements for combinations of dead loads, live loads, impact loads, and loads during DBAs. A factor of safety of 4 for buildings and 5 for fixed stairs cannot be assured.

Recommendation: UBC requirements are generally acceptable for DOE facilities and structures and should be acceptable for B Plant. Ongoing structural analysis may demonstrate compliance. If not, variance from these requirements may be needed.

4.3 B PLANT IMPLEMENTATION OF PROCESS AND BUILDING VENTILATION CRITERIA

The assessment of B Plant compliance to process and building ventilation criteria (Appendix A, Table 3 and 3A) included Building 271-B as well as Building 221-B. Building 271-B functions as a personnel support and office building for the operations conducted in the galleries and canyon contained in Building 221-B, and in some measure the ventilation systems are interrelated. When the buildings were constructed in the early 1940s, few guidelines existed for confinement-type ventilation design. This assessment was accomplished by comparison of the drawings and documents representing the existing plant to the modern standards developed decades after some of the plant and ventilation systems were originally constructed. Although at first glance this seems unrealistic, the rationale is that confinement ventilation in a nuclear materials-handling facility is such a potentially contentious and volatile subject that the plant must effectively function as if its ventilation equipment had originally been built to the standards of today.

4.3.1 Noncompliance Items From 6430.1A

1550-2.5.6 Ductwork to be designed to comply with NFPA 90A, including specification and installation of smoke and fire dampers at fire wall penetrations and smoke pressurization/ containment dampers as required for smoke pressurization/ evacuation systems. Exhaust ductwork to comply with NFPA 91.

Discussion: Ductwork framing in 271-B is wood which will not meet NFPA requirements. These supply ducts contain asbestos. Furthermore, fire protection piping and instrument cabling is supported by the ductwork.

Recommendation: Replace ductwork and provide proper pipe supports and cable raceways as appropriate.

1550-99.0.1 Ventilation systems to be designed to provide continuous air flow pattern from the environment into the building and then from noncontaminated areas of the building to potentially contaminated areas. Thus, the air flow is toward areas of higher radioactive or hazardous material contamination. Dampers to be located so that significant cross-contamination will not occur in case of a localized release of material.

Discussion: This general requirement is to be applied to non-reactor nuclear facilities, and is presented under the heading of general ventilation and offgas criteria.

The air flow pattern appears to be in compliance. Supply air is provided to the operating gallery from ten supply fans drawing outside air. Air is supplied to the electrical gallery from two supply fans, also drawing outside air. Air flows from the operating gallery through floor penetrations into the pipe gallery, which is consistent with the criteria since the pipe gallery is more likely to become contaminated than the operating gallery. There is also some small amount of air flow from the electrical gallery into the pipe gallery due to floor penetrations between the two galleries. Air to the three floors of the office building and the electrical shop at the basement level is provided by supply fans drawing outside air. The craneway and canyon areas are supplied by ten fans drawing outside air. The hot cells are supplied by leakage from the canyon around the crevices in the cover blocks. Under normal circumstances, the difference in negative pressures provided by the exhaust fans for these areas keeps the airflow moving smoothly in the correct directions.

The portion of the requirement on the use and location of dampers needs to be discussed. Dampers are available that seal tightly enough to prevent a significant amount of radioactive contamination from passing them. However, the correct application of such a damper is in ductwork as a contamination control device for isolation of equipment to be repaired or replaced. The actuation of these dampers is not rapid enough to prevent contaminated air from reversing direction in the event of a ventilation upset or in the case of localized radioactive releases. In addition, if a damper were to be used for the control of a localized release in the general airflow between zones discussed in the preceding paragraph, that would result in a ventilation upset that could allow greater spread of the contaminant, perhaps in the "wrong" direction. Therefore, although no dampers are provided between zones, the airflow pattern is sufficient to prevent cross-contamination under normal conditions.

Even under abnormal operating conditions, as long as the exhaust fans are able to provide the negative pressures on the various zones according to design, no cross-contamination occurs between zones. Regardless of this fact, it is considered good practice to ensure integrity and separation of zones by airlocks, or by a single stage of HEPA filtration where one zone's air is supplied by another. Airlocks have been constructed between the piping gallery and the first floor of the office building

to separate the two zones (upgrade project B-557). However, no airlocks were provided between the operating gallery and the second floor of the office building although the two areas represent the same two disparate zones as on the first floor.

There is also no HEPA filtration on the floor penetrations between the piping gallery (considered more likely to be contaminated) and both the operating gallery and the electrical gallery. It is particularly a problem between the piping gallery and the electrical gallery, as these are two different zones.

Recommendations: Install airlocks between the operating gallery and office building, and install any attendant ducts and HEPA filtration that may be necessary to allow air supply transfer between these zones. Alternatively, perform a safety assessment to show there is negligible risk from contamination between these zones.

Install HEPA filtration on floor penetrations between the piping gallery and both the operating gallery and the electrical gallery.

1550-99.0.1 Portions of ventilation and offgas systems that provide required functions following a seismic event to be designed to be functional following a DBE.

Equipment in ventilation and offgas systems to be appropriately qualified to ensure reliable operation during normal operating conditions, anticipated operational occurrences, and during and after a DBE.

If the maintenance of a controlled, continuous confinement air flow is required, electrical equipment or components required to provide the air flow shall be supplied with safety class electric power and provided with an emergency power source.

If an elevated stack is used for confinement exhaust discharge, provisions shall be made to ensure adequate ventilation in the event of stack failure.

Air filtration units must remain functional throughout DBAs and retain collected materials after the accident.

Discussion: Preliminary safety analysis indicates that the exhaust ventilation system is safety class and must function following a DBE. The exhaust ventilation system has the following major structural components:

- o Exhaust ventilation stack,
- o Filter cells,
- o Exhaust air tunnel, and
- o Exhaust ducts.

An evaluation is being performed to determine the survivability of these components following a design basis earthquake.

Recommendation: In order for the B Plant to meet DOE 6430.1A 1550.99.0.1, the following modifications to the ventilation system may be indicated by the ongoing analysis:

- o Alternatives to the exhaust stack if the stack fails and blocks proper stack flow.
- o Filter cells 1 through 3 may need to be removed to prevent the release of radionuclides on the filter media. Radiation measurements indicate that cells 1 through 3 might have as much as 68,000 Ci of Sr 90 and 10,000 Ci of Cs 137. This contamination may become airborne following a DBE.
- o Exhaust fans and stack monitoring instrumentation will need to be qualified.
- o Emergency power will be needed for the electrically powered exhaust fans.
- o A means for ensuring ventilation filtering after a DBE must be devised.

1550-99.0.1 Gas storage areas and process areas that use nonradioactive hazardous materials shall have ventilation systems designed to ensure that the hazardous material concentrations do not exceed the limits referenced in DOE 5480.10 and are ALARA in the workplace environment. Effective loss-of-ventilation alarms shall be provided in all of these areas.

Discussion: Ventilation system for chemical storage area (AMU) on third floor of Building 271-B may not have the capacity to adequately exhaust the area in case of an AMU spill. Order 5480.10 refers to Title 29 CFR 1910, Subpart Z, for exposure limits for toxic and hazardous materials.

Recommendation: Examine feasibility of providing adequate ventilation exhaust if present system is not large enough. Provision should also be made for instrumentation or alarms as necessary upon loss of ventilation or upon chemical spill.

4.3.2 Noncompliance Items From Other Codes, Standards, and Regulations

ANSI/ASME N509

5.5 Heaters shall be electric and capable of meeting the structural requirements of this standard. Heaters shall be designed for replacement without metal cutting or welding.

Discussion: This criteria applies to exhaust stream heating and is required by DOE 6430.1A, 1550-2.5.5, Air Cleaning Devices, which states that HEPA filter assemblies shall comply with ASME N509. According to SD-WM-SAR-013, Paragraph 5.4.3.1, the vessel vent systems have steam heaters upstream of their HEPAs.

It also appears that the vessel vent is educted by means of a steam jet into the ventilation air tunnel. Although no criteria have been found discussing this practice, an evaluation of the amount of moisture contributed to the exhaust air stream is needed. This may be especially important if for any reason the condensers downstream of the eductors fail.

Recommendation: Evaluation is needed to determine whether or not compliance with this criteria will be met by replacing the existing steam heaters with electric ones.

Evaluation is also needed to determine the impact of using steam eduction for transfer of vessel vent gases, especially considering the possibility of failure of the downstream condensers.

4.4 B PLANT IMPLEMENTATION OF FIRE PROTECTION DESIGN CRITERIA

Complete assessment of fire protection compliance (Appendix A, Tables 4 and 4A) is dependent on the performance of a fire protection design analysis (Ref. DOE 6430.1A [0110-6.2] and DOE 5480.7). This analysis should establish a base line design flowsheet and appropriate accident analysis to establish the DBF and associated risks. This analysis will also establish fire barrier requirements, the fire protection required to establish "improved risk," the need for special protection systems, and the heat loads and risk factors. Until this fire protection design analysis is performed, many fire protection features cannot be fully evaluated for compliance. These are generally identified as "To Be Determined (TBD) - noncompliance items" with discussion.

4.4.1 Noncompliance Items From 6430.1A

0110-6.2

Performance of a "special" fire protection design analysis, using time parameters established in accordance with DOE 5480.7, which identifies special fire preventive and protection features and controls which achieve a level of fire protection that meets or exceeds the "improved risk" level.

Performance of a "general" fire-protection design analysis to ascertain and limit the cost of future damage repair and replacement of facilities and their contents from fire. Determination of special fire prevention and protection features and controls to achieve a level of improved risk fire protection that limits damage to an acceptable level.

Division of facilities into areas in which the total potential fire loss to each area and its equipment does not exceed $75 million. Separation of these areas by fire walls and barriers with not less than 4-hr fire resistance ratings.

Discussion: Until fire protection design analysis is performed, many fire protection features cannot be evaluated for compliance.

Recommendation: Perform fire protection design analysis in the project preliminary design phase.

1530-4.2.5

Self-restoring sprinkler systems to be used where the water from sprinklers will be contaminated by contact with room contents.

Discussion: The manually operated cell sprinkler systems do not provide a self-restoring capability. The intent here is to limit the amount of waste effluent during a fire. The cell drain header and the Cell 10 tank provide confinement of effluent from sprinkler actuation therefore, lack of automatic shutoff capability is of less concern.

Recommendation: Evaluate the effectiveness of automatic shutoff versus manual shutoff in improving facility safety.

1530-99.0 Automatic water sprinkler coverage shall be provided throughout the facility except in areas where nuclear criticality or other hazards specifically preclude its use, or in control rooms where Halon systems shall be used to reduce equipment damage.

Discussion: Many areas of the 221-B facility are not provided with automatic water sprinkler coverage. Automatic coverage is not provided in the cells except for the AFFF system.

Recommendation: Automatic detection and suppression should be used unless fire protection design analysis shows acceptable risk using the existing manual system.

1530-99.0 Fire suppression systems used in areas that contain safety class equipment shall not result in flooding of the safety class equipment or otherwise reduce the ability to achieve required safety functions.

Failure of a fire suppression system shall not prevent safety class equipment from performing its necessary functions.

Discussion: It may be possible to damage HEPA filter systems by inadvertent operation of the tunnel water fog nozzles (~5 gpm and ~50 gpm). Also, if the fire detection systems fail, the suppression systems will not operate in addition to failure to divert air-flow from the HEPA filters to the sandfilter.

Recommendation: Continue to perform ongoing fire protection design analysis. The above items should be considered during final evaluation/identification of Safety Class I fire protection systems, if any.

4.4.2 Noncompliance Items From Other Codes, Standards, and Regulations

DOE Order 5480.7-9.a

Threats to the Public Health or Welfare and Hazards to Life: The objectives of having no threats to the public health and welfare and no undue hazards to life from fire can be considered to have been attained when:

- The facility containment systems are designed to preclude an offsite release of hazardous amounts of toxic materials under maximum credible fire conditions.
- Exhaust and ventilation systems, including filters, are protected or isolated from the effects of a credible fire to the extent that hazardous amounts of toxic materials or combustion products will not escape.

Discussion: Ongoing fire safety analysis is evaluating scenarios for both organic fire and hydrogen explosion. Although protective systems for the HEPA filters are installed, it is not clear they are adequate to prevent a radioactive release from these scenarios.

Recommendations: Evaluate existing mitigating systems to identify design improvements to enhance effectiveness. Evaluate need for additional mitigating systems. Reduce or delete organic source term.

DOE Order 5480.7-9.c

Property Damage Limitation. The objective of limiting property loss can be considered to have been attained when fire protection systems are provided as follows:

- When the maximum possible property loss is in the range of $1-25 million, an automatic fire protection system is provided that will limit the probable loss to the lower figure.
- When the maximum possible property loss is in the range of $25-50 million, a redundant protection system is provided, that even in the failure of the primary system, should limit the loss to the lower figure.
- When the maximum possible property loss exceeds $50 million, redundant systems are provided as in subparagraphs above, and a failure-proof type of fire protection system, such as blank walls or physical

separation, is provided to limit the maximum property loss to $75 million.

DOE Order 5480.7-10.a

An improved risk facility is characterized by a sufficiently high level of fire protection to fulfill requirements for insurability by the Factory Mutual System, Industrial Risk Insurers, or other private industrial fire insurance companies that limit their underwriting to the best protected class of industrial risks. A basic requirement is the provision of automatic fire extinguishing systems in all areas subject to serious property damage or business interruption losses as a result of fire. Above all other requirements, to qualify for an improved risk rating, it is necessary that strong, tangible evidence be available attesting to existence of continuing sincere interest by management and employees in minimizing losses from fire and related perils.

DOE Order 5480.7-10.b

DOE facilities qualifying as improved risks will incorporate the following physical improvements and internal programs, and maintain records for appraisal of the programs:

- Review of plans prior to contemplated construction to assure adequacy of fire risk appraisal and protection, and follow up review to ensure that fire protection features are provided where necessary to comply with paragraph 9 above.
- Limitation by physical means (e.g., geographic isolation, firewalls, firedoors, draft barriers) of areas that can be directly damaged in the event of a single fire.
- Protection of special hazards by isolation, segregation, or use of special fire controls systems (e.g., automatic sprinklers, inert gas flooding, explosion suppression) together with devices (e.g., relief valves, filters, roof hatches, scuppers, blast walls) for limiting or controlling damage potentials of fire, hazardous smoke, gases, water runoff, or other occurrences that may reasonably be anticipated during a fire emergency.

Discussion: As identified in Section 4.4.1 evaluation against these criteria is currently being performed and may identify additional fire protection requirements (i.e., additional fire barriers, additional fire sprinklers).

Recommendation: Proceed with ongoing evaluation to identify required upgrades. Initiate upgrades as required.

4.5 B PLANT IMPLEMENTATION OF ELECTRICAL SYSTEMS DESIGN CRITERIA

The assessment for electrical systems is contained in Appendix A, Tables 5 and 5A. Recent electrical upgrades to B Plant are in compliance with 6430.1A criteria and provide a well designed, reliable power system. The diversity provided by the two normal primary sources and the 2300V "emergency" source greatly enhance power availability. Additionally, the redundancy and diversity provided at the substation and the secondary branch circuits to the MCCs greatly reduces single point failures.

4.5.1 Noncompliance Items From 6430.1A

1605-1 All systems shall comply with NFPA 70 and ANSI C2.

Discussion: NFPA70 is the National Electrical Code and ANSI C2 is the National Electrical Safety Code. Recent upgrades specify both for use. However, wiring from the MCCs to the cells has not been completely upgraded. It is likely some of these wire runs are out of compliance with the modern consensus standards.

Recommendation: Wiring is replaced to the cells on an as-needed basis, and as replacement is carried out, new wiring conforming to modern insulation and fire resistance, standards is used. For such a unique application, a variance on wiring type, fire resistance and even fill volume would likely be approved as a minor variance except for wiring the safety class items. Wiring for safety class items which require power to perform their safety functions should be installed per NEC and other requirements of 6430.1A, 1660-1.

1605-2.1.1 The complete raceway installation shall be suitably sealed to maintain established fire ratings as defined in UL Building Materials Directory and UL1749.

Discussion: Fire ratings are not fully defined and established at this time. However, the older cell raceway installations will likely be deficient as a fire seal. Some older penetrations in other plant locations which lack proper sealing may also exist.

Recommendation: Proper sealing of cell raceways may hamper needed wire maintenance but should be done. Nonconforming raceway penetrations at other locations should be repaired as they are discovered during routine operation and maintenance.

1605-2.1.3

1605-2.2.1 Equipment served via flexible steel conduit shall have a separate equipment ground conductor installed in the raceway.

Bonding and grounding conductors shall be ASTM B1 solid, bare copper for sizes No. 8 AWG and smaller and shall be ASTM B 8-81 Class B stranded copper for wire sizes No. 6 AWG and larger.

Discussion: There are several design detail criteria where DOE 6430.1A criteria exceed the requirements of NFPA 70 and ANSI C2 and, furthermore, do not delineate exceptions. These include more restrictive limitations on wire size and type and installation details for raceways. The above referenced criteria are two examples.

Recommendations: Variances should be granted for cases where the implementation meets NFPA 70 and ANSI C2.

1630-5 Lightning protection systems shall comply with NFPA 78.

Lightning protection systems should be considered for buildings containing facilities for the use, processing, and storage of radioactive, explosive, and similarly hazardous materials; for buildings over 50 feet in height; and for buildings containing valuable equipment. A risk assessment using the guide in Appendix I of NFPA 78 shall be made of these buildings to determine the risk of loss due to lightning.

Discussion: Protection details per NFPA 78 are dependent on a proper assessment of lightning risks. Although arrestors are provided in recent substation upgrades, full compliance with NFPA 78 is not clear.

Recommendation: Perform lightning risk assessment per NFPA 78, Appendix 1. Perform a compliance study of NFPA 78 to existing structure.

1640-1.3 Power system reliability consideration shall comply with IEEE 493 to ensure continual power supply to systems and

equipment designated as critical by the cognizant DOE authority.

Discussion: Compliance to IEEE 493 requires substantial analysis for reliability verification. However, the redundant and diverse design features of the primary and secondary system should meet the intent of IEEE 493. Notice, also, that DOE requires this for "critical" facilities.

Recommendation: Define status of B Plant as "noncritical" or perform analysis per IEEE 493.

1660-1 Additional emergency systems shall be provided to support systems or equipment components whose operating continuity is determined to be vital by the cognizant DOE authority for protection of health, life, property, safeguards, and security systems.

Emergency power systems shall comply with NFPA 37, NFPA 70, NFPA 101, NFPA 110, and IEEE 446.

Redundant safety class electric systems shall be physically protected or separated to prevent a common external event from causing a failure of the redundant systems. IEEE 379 and IEEE 384 shall be used as redundancy and separation criteria.

Discussion: Emergency power is required for the ventilation system and safety class items requiring electrical power to perform their safety function.

Recommendation: Install emergency power system for the ventilation and stack monitor. Uninterruptable power and other emergency power may be required based on safety class item selection.

Design of emergency power systems to the referenced codes in these 6430.1A criteria will provide a system which approaches the Class 1E systems used in commercial reactors. Class 1E power systems have not been broadly applied to nonreactor DOE facilities because, especially for existing facilities, such applications are not practical. Instead, emergency power systems must be designed with adequate reliability to provide acceptable risk as determined from the consequences of power system failure. To achieve the required reliability, the designer should use the guidelines contained in IEEE 446, "Recommended Practice for Design of Reliable Industrial

and Commercial Power Systems," IEEE 379, "Standard Application of the Single Failure Criterion to Nuclear Power Generating Stations," and IEEE 384, "Standard Criteria for Independence of Class 1E Equipment and Circuits." It is likely that adequate reliability, as determined by quantitative analysis, can be achieved without application of all criteria in these guidelines.

4.5.2 Noncompliance Item from Other Codes, Standards, and Regulations

No additional major noncompliance issues were identified from other Codes, Standards, and Regulations.

4.6 B PLANT IMPLEMENTATION OF UTILITIES AND SERVICES DESIGN CRITERIA

The utilities and services assessment is provided in Tables 6 and 6A of Appendix A. For this study, utilities and services include wastewater treatment systems, cooling water systems, steam systems, sampling services, and other components or services to support plant operations.

4.6.1 Noncompliance Items From 6430.1A

1300-6.1 Confinement — Specific facilities shall be designed to minimize personnel exposures to external and internal radiological hazards. Primary radiation protection shall be provided by the use of engineered controls (e.g., remote handling, equipment layout, and shielding; secondary radiation protection shall be provided by administrative control).

Discussion: Canyon sampling is included in this assessment as a service. All B Plant process samples planned for the NCAW mission will be obtained at the canyon sampling stations and will require the actions of a sample team. A "Gilmont Shield," also referred to as the "Goldberg," is available and has to be positioned by the crane. It is routinely used when obtaining "bulk samples" which are judged necessary for certain high radiation samples. Use of decontaminating techniques and positioning of lead sheeting and bricks reduce the radiation exposure to personnel; however, the sampling procedure is difficult and not all personnel can successfully get a useful sample. Any delays mean added radiation exposure to those involved.

A recent study reportedly proposed a sampling cubicle in the pipe gallery and is still being considered.

Some entries to the canyon will always be required, but perhaps they can be reduced by technology improvements with the goal of reducing personnel radiation exposure ALARA.

Recommendation: Perform a ALARA analysis of the current system versus several improvements such as:

- Improve Gilmont Shield design,
- Install sample recirculation capability on the cold side (some capability already exists),
- Install remotely operated samplers,
- Provide sample schedules that minimize the trips into the canyon for sampling,
- Design samplers for ease of maintenance repairs and replacement,

- o Consider expanding the use of the crane for sampling functions.

1323-4.4 Treatment Systems

Recirculating closed-loop cooling systems shall be required for facilities and equipment associated with the storage or treatment of high-heat, high-level radioactive liquid waste. As a minimum, these systems shall comply with 1540-99, Special Facilities.

Discussion: The existing system is a once-through system which discharges through the cooling water effluent system (CBC).

Recommendation: A closed-loop cooling system should be designed and installed. Applicable 6430.1A criteria for piping, etc., should be used.

1540-99.0.1 Cooling System

The water system shall be designed to a national piping code (i.e., ASME Boiler and Pressure Vessel Code, Section III, or ASME B31.3).

Discussion: Existing piping through the canyon walls to the cell was designed and installed before the use of these codes. No reference can be located to provide comparison of the codes of that day to the current aforementioned ASME codes. There is no way to assure compliance of these old installations. Forty plus years of reliable piping experience suggests the "old codes" were equivalent to the intent of the current codes. When a cell service line fails, there are spare routings available.

Recommendation: Even though an upgrade to the cooling system to provide a closed-loop system is needed, existing embedded piping will be almost impossible to replace. An equivalency analysis is needed. Prepare an equivalency analysis based on:

- o Satisfactory experience with the existing systems for 40 plus years,

- o Provision of spare cooling water service routes,
- o Use of one of the referenced ASME codes for the design of the proposed closed loop cooling water systems.

4.6.2 Noncompliance Items From Other Codes, Standards, and Regulations

WAC 196-24-23517 (1)(c) Except for floor operated cranes, a gong or other effective warning signal shall be provided for each crane equipped with a powered traveling mechanism.

Discussion: A warning device to annunciate crane movement is not currently installed. Although access to the crane area is strictly controlled, this WAC requirement should be met.

Recommendation: Ensure that a warning device is installed in the crane replacement project.

4.7 B PLANT IMPLEMENTATION OF PROCESS PIPING/PROCESS VESSELS/CONFINEMENT DESIGN CRITERIA

The assessment for piping, process vessels and confinement is provided in Appendix A, Tables 7 and 7A. In order to perform a compliance assessment for the B-Plant confinement systems, the specific arrangement and function of the confinement barriers must be clearly defined. Sections 1300-7 and 1325-3 of 6430.1A are the sections directly applicable to define confinement barriers. As stated in 1323-5.1, confinement system requirements for a specific radioactive liquid waste facility (RCWF) shall be determined on a case by case basis. For B Plant, the primary confinement system consists of the process vessels and interconnecting piping within the cells and hot pipe trench. The piping for the process ventilation (process offgas) system is also primary confinement up to the HEPA filters.

As defined in 6430.1A, the secondary confinement is used to collect and contain spills, overflow and leakage from primary confinement structures. The secondary confinement consists of the cell walls, canyon roof and walls, cell drain header, cell drain down-comers, hot pipe trench, trench down-comers and the building air tunnel (canyon ventilation exhaust) up to the HEPA filters. Note that by using Cell 10 as a secondary confinement sump via the cell drain header, the secondary confinement is capable of retaining the maximum radioactive liquid waste inventory within the primary confinement as required by 6430.1A, 1323-5.1.

Current B Plant philosophy is to designate the secondary confinement as DBA resistant to meet the 6430.1A, 1300-7.2 requirement that at least one of the confinement systems shall be designed to ensure it can withstand postulated DBA's. The secondary system then becomes a safety class item as defined in 6430.1A, 1300-3.2. Under this definition of the secondary confinement as a safety class item, ongoing safety analysis shows that there are no failures of primary vessels or pipes which present an unacceptable risk. Thus, there are no primary confinement system safety class items.

According to 6430.1A, 1323-5.1, an RLWF requires tertiary confinement. However, 6430.1A, 1300-7.2 permits secondary and tertiary barriers to exist in common as a single structural envelope provided the barrier can withstand the effects of man-made events and DBA's including the DBE and does not contain access ways that permit the routine transfer of personnel, equipment or materials directly from the exterior. Since appropriate air locks and controls are provided, and the secondary confinement can survive postulated DBA's as discussed above, this is the case. So for B-Plant, secondary and tertiary barriers are considered common.

A schematic of the primary and secondary confinement barrier is shown in Figure 1.

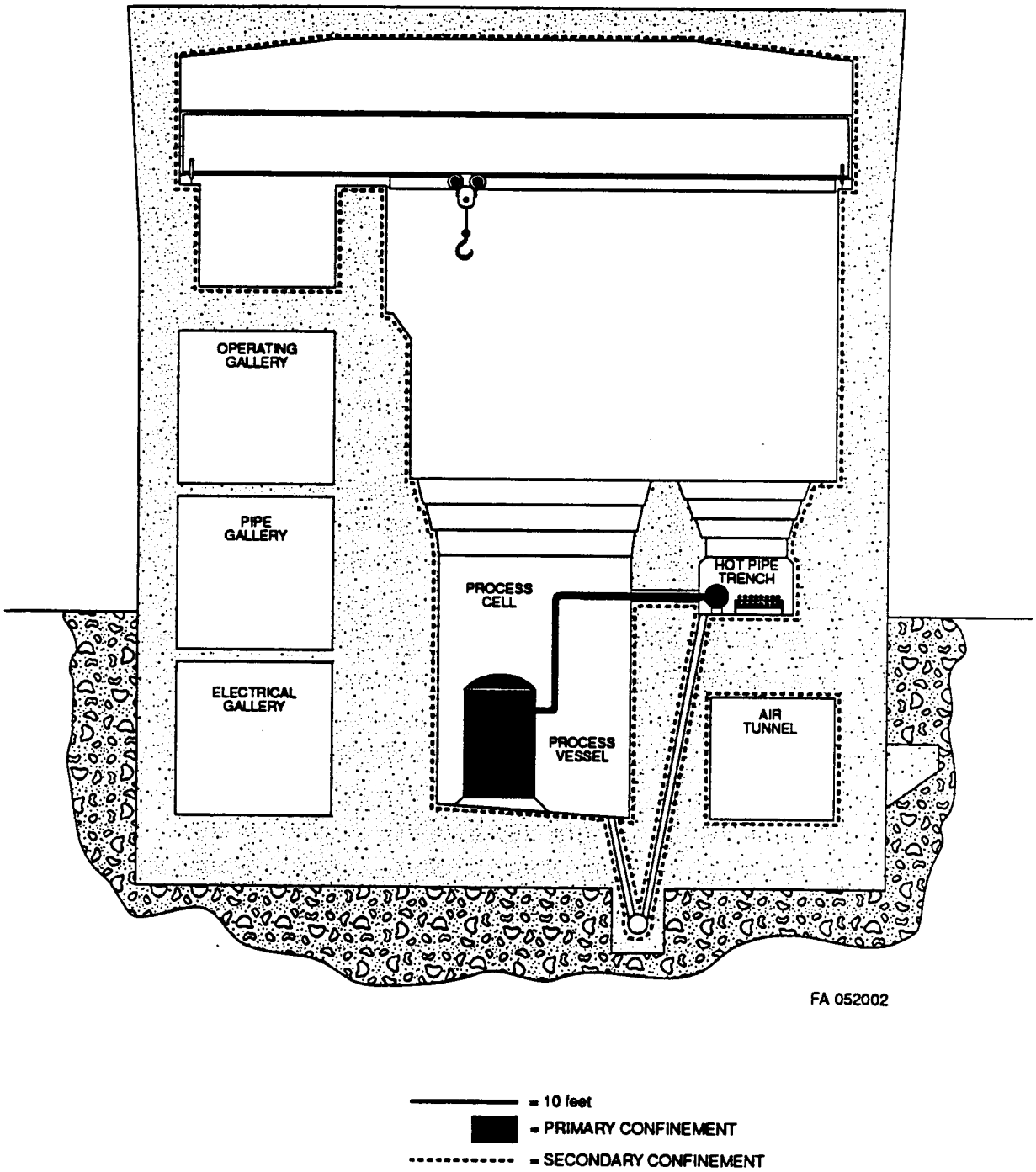

Figure 1. Typical Cross-Section of 221-B Structure

4.7.1 Noncompliance Items From 6430.1A

0275-99.0.2 Process Wastes

Waste storage tanks and transfer lines shall be designed and constructed so that any leakage shall be detected and contained before it reaches the environment.

Transfer lines shall have inspection and collection pits at practical intervals into which leakage can drain by gravity.

Discussion: Transfer lines for waste effluent streams are not equipped to detect leakage at the primary barrier or at the environment interface. Additionally, waste transfer lines do not have collection pits. Leaks will simply flow into the concrete encasements.

Recommendation: Leak monitoring should be considered for the BCE and the CBC. The CBC may not be necessary if closed loop cooling is installed. It is not clear existing ground water monitors provide timely discovery of leaks.

1300-6.1 Radiation Protection

Specific facilities shall be designed to minimize personnel exposures to external and internal radiological hazards. Primary radiation protection shall be provided by the use of engineered controls (e.g., confinement, ventilation, remote handling, equipment layout, and shielding; secondary radiation protection shall be provided by administrative control).

Discussion: Radiation protection via confinement is a key B Plant objective. However, the intent of ALARA in the operating gallery could be enhanced by additional confinement measures at the instrument dip tubes and at other piping with direct interface to the primary confinement (process system).

Another issue is the pressure-relief system on the steam supply lines to the in-cell concentrators. All four relief lines vent upward outside the north side of the 221-B building. This could lead to unnecessary releases. For example, the Cell 5 system became contaminated about 10 years ago and periodically relieves and recontaminates the building exterior and adjacent ground at the NE end. At least two events are recalled; only the Cell 5 concentrator was involved. A study was made about 10 years ago to vent the Cell 5 system into a canyon cell. It was not acceptable for engineering reasons at that time.

Recommendation: To achieve ALARA, consider the use of gloveboxes or other secondary confinement for instrumentation and dip tubes.

Re-evaluate the steam supply and control system with the goal of reducing the frequency of pressure relief events. Reactivate a study to vent all concentrator steam pressure relief systems to a canyon cell(s); or to a surge tank(s).

1300-7.2 General Confinement: At least one of the confinement systems (primary or secondary) shall be designed to withstand the effects of severe natural phenomenon and man-made events for criteria of DOE 6430.1A Section 0111-99.0.

1323-5.2 HLW Confinement: At least one confinement system shall be designed to withstand the effects of man-made events and DBAs. The process cell and/or secondary storage tank confinement shall be designed to remain functional during normal operations, anticipated operational occurrences, and for the DBAs they are required to withstand.

Discussion: Confinement during a DBE is a requirement. Current philosophy is to designate the secondary confinement as DBE resistant.

Recommendation: Continue structural analysis to demonstrate integrity of the secondary confinement system as discussed in Section 4.2.1.

4.7.2 Noncompliance Items From Other Codes, Standards, and Regulations

40 CFR 264.193 (e): Secondary containment liners must be free of cracks and gaps.

Discussion: A liner is being installed in the cell drain header to prevent leaks at the 221-B building section joints. However, as currently designed, there may be a gap at the junction of the cell drain header and the cell downcomers.

Recommendation: Develop a means to seal the liner at this junction as needed. If this cannot be done, a variance needs to be requested as outlined below.

40 CFR 264.193 (e) Secondary confinement vaults must be provided with an impermeable interior coat or liner that is compatible with the stored waste and will prevent migration of the waste into the concrete.

Discussion: The cells are used as a secondary confinement for the process tanks and qualify as a vault per 40 CFR 264. Lining cells provides additional confinement but, moreover, allows easier decontamination for plant decommissioning. The cells are not currently lined to prevent migration of waste into the cell walls.

Recommendation: Based on the fact that any possible migration has already occurred, liners for decontamination are not effective. The cell walls are unusually thick for a "vault," and provide more than adequate confinement, so a variance would likely be granted. To obtain a variance, as detailed in 40 CFR 264.193(g), the Regional Administration needs to be assured that there will be no migration of hazardous waste or its hazardous constituents into the ground water or surface water to pose a hazard to health or the environment.

Alternatively, cells requiring liners should be assessed and appropriate liners should be installed if needed.

40 CFR 264.173
40 CFR 264.174 This subpart applies to storage of hazardous waste in containers. Containers must be managed so as to preclude leakage; areas to be inspected weekly.

Discussion: Some containers containing WESF wastes are difficult to inspect because of high container activity. These wastes are administratively controlled to contain no free liquids. These containers are stored in the cells and, therefore, have secondary confinement.

Recommendation: A variance is being established for some container storage areas. Based on the existence of secondary confinement and the difficulty involved with operation disruption needed to permit weekly inspections, a variance would likely be granted.

Additionally, once the crane is operational, routine inspections are possible.

4.8 B PLANT IMPLEMENTATION OF INSTRUMENTATION AND CONTROLS DESIGN CRITERIA

The compliance assessment tables for instrumentation and controls are given in Appendix A, Tables 8 and 8A.

4.8.1 Noncompliance Item From 6430.1A

1300-6.5.1 Monitoring System	All radiation monitoring, alarm, and warning systems that are required to function during a loss of normal power shall be provided with an emergency UPS.
1300-9 Effluent Monitoring and Control	All effluent streams shall be sampled or monitored as appropriate to ensure accurate measurements under normal operations, anticipated operational occurrences, and DBA conditions.
Discussion:	Effluent and stack monitoring systems are not currently powered by safety class power. Effluent monitors are safety class by 6430.1A definition.
Recommendation:	Continue assessment of monitoring systems which must function during DBAs including loss of power. Provide UPS, emergency power, or equivalent to ensure monitoring system function.
1300-6.5.2 Air Monitoring and Warning Systems	Air monitoring and warning systems shall be installed in work areas where radioactive material is handled. Air monitoring systems shall comply with ANSI N13.1.
Discussion:	Location of air monitors were determined by "engineering judgement" rather than by ANSI N13.1 requirements.
Recommendation:	Perform an evaluation of sampling locations in light of ANSI N13.1 requirements. Move and add sampling points as necessary.
1550-99.0.1 General	Process areas that use nonradioactive hazardous materials shall have ventilation systems designed to ensure that the hazardous material concentrations do not exceed the limits referenced in DOE 5480.10 and are ALARA in the workplace environment. Effective loss-of-ventilation alarms shall be provided in all of these areas.

Discussion: The ventilation for the AMU tanks in 271-B is currently being upgraded (Project W-008). However, this upgrade does not include a detector and alarm for ventilation malfunction. The tanks are vented to the outside through dedicated lines, and under normal conditions, loss of ventilation to the tank area would not likely produce excessive hazardous material concentrations.

Recommendation: Perform an assessment to determine the safety necessity of the ventilation system in light of an operational occurrence which may cause a hazardous material release. If ventilation is necessary to limit concentration levels, install a loss of ventilation detection system. See Section 4.3.1.

1660-99.0.2 Instrumentation and Controls

Safety class instrumentation shall sense abnormal conditions affecting safety and subsequently provide an alarm, e.g., low dp between HVAC zones, criticality monitoring. Criteria for DBA operation, redundancy, qualification, separation, and UPS power for safety class instrument systems is covered in 6430.1A 1660-99.0.2 through 1660-99.0.6.

Discussion: It is not clear that safety class instruments identified in the ongoing safety analysis for B Plant conform to these requirements with respect to DBA operation, redundancy, qualification, separation, and UPS power.

Recommendation: Safety class instrument criteria consistent with 6430.1A requirements should be applied to the design and installation of safety class instrument systems as identified by safety analysis.

In general, for instruments servicing safety class systems or providing safety class action, the I&C design can usually be made to "fail safe" in the event of I&C system component failures or in the event of loss of power. For I&C systems which must remain active in order to perform their safety functions, redundant control loops are generally required. Additionally, these systems must be serviced by safety class power and instrument air if required. Often, provisions for safety class services for the I&C safety class can be provided locally by UPS and bottled air. Entire upgrades of the electrical power or air service systems are generally not required.

4.8.2 Noncompliance Items From Other Codes, Standards, and Regulations

DOE Order 5820.2A I 3b(3) (b) Leak detection systems (e.g., conductivity probes) shall be designed and operated so that they will detect the failure of the primary containment boundary, the occurrence of water release, or accumulated liquid in the secondary containment system.

Discussion: Currently, leaks can be detected by a measured drop in process tank level. Also, if the leak is large enough, a rise in level in Tank 10-1 indicates a leak within a cell. It is not clear that either of these techniques provide the necessary leak detection (conductivity) to meet requirements of this code. Leak detection probes at all cell drain header downcomers are installed but not all are in service.

Recommendation: Demonstrate the adequacy of discovering leaks using level measurement. The cell leak detection probes should be reactivated. Using the conductivity probe at each of the cells and a conductivity probe at the inlet to the cell 10 tank, it should be easy to detect any spill from the process vessels and the subsequent arrival of the spill at the 10-1 tank. The signal from the 10-1 tank probe would provide assurance that the spill is not held up and accumulating.

DOE Order 5820.2A I 3b(3) (d) Electrical monitoring and leak detection devices essential to safe operations shall be provided with backup power, as appropriate, to ensure operability under emergency conditions.

Discussion: The requirement of emergency power for effluent monitors is discussed in 4.8.1 above. This requirement implies leak detection devices should also have backup power.

Recommendation: Continue assessment of monitoring systems which must function during emergency conditions or DBAs. Provide UPS or backup power as appropriate.

40 CFR 264.193(c) Secondary containment systems must be provided with a leak detection system to detect the failure of either the primary or secondary containment structure within 24 hours.

Discussion: Requirements for primary confinement leak detection is in 6430.1A paragraphs 0275-99.0.2 and 1323-5.2 as discussed

in Section 4.7.1. Further discussion on primary leakage is given above from DOE 5820.2A I 3b(3)(b). This requirement is similar.

Recommendation: Repairs to existing conductivity probes to provide 5820.2A compliance should also ensure compliance to this requirement.

APPENDIX A

B PLANT CONFORMANCE TABLES

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements

Applicable Section	Design Criteria Summary	B Plant Implementation
0111	Structural Design Requirements	
0111-1	1) Materials, framing systems, and details shall be compatible with the following: o Clear space and span requirements o Serviceability requirements o Applicable fire protection classification o Security requirements o Foundation conditions o Future expansion requirements o Architectural treatment o Climatic conditions o Structural design loads for the specific facility and location	Compliance. Refer to: (1) SD-WM-TA-015, "Process and Facility Options or Pretreatment of Hanford Tank Waste," (2) SD-WM-ES-023, "Evaluation of Process and Facility Options for Treatment of Double-Shell Tank Wastes," and (3) SD-WM-TA-013, "B Plant Productivity Retention Study," regarding the use of B Plant as the preferred facility option for treatment of Hanford Site tank waste.
	2) Structural design drawings shall indicate design criteria, structural materials and their strengths with applicable materials standards, design loads including loads that can occur during construction, and allowable foundation loads that were used in the design.	Partial compliance. W69334 Lists concrete compressive strength requirement to be 2500 lb/sq-in. and allowable soil bearing pressure to be 8000 lb/sq-in. Design Loads and rebar information not indicated. This criteria is not, however, important to B-Plant safety.
	3) Where earthquake resistance is required, the cognizant DOE authority should consult LBL-9143 for practical guidelines for engineering earthquake safety and management planning and technical procedures for design of new facilities or evaluation of existing ones. . . .	Noncompliance. However, should only denotes a recommendation.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0111-2	Loads	
0111-2.1	General Requirements	
	4) Structures and their elements shall be designed for the loads prescribed in the following criteria.	No response necessary; this is only a lead-in sentence to the other criteria.
0111-2.2	Dead Loads	
0111-2.2.1	General	
	5) Dead loads shall include the weights of all permanent materials and equipment, including the structure's own weight, supported in, or on, a structure. Load calculations shall include an allowance for any loadings anticipated to be added at a later date. Initially assumed loads shall be revised so that the final design reflects the configuration shown on the drawings.	Compliance. Although historical data (i.e. original structural design calculations) are not available for review, Chapter 23, Section 2301, "Dead Load" of the 1940 Uniform Building Code does contain equivalent requirements which 221-B Canyon was designed in accordance with. The nondestructive evaluation of the 221-B Canyon by Muenow and Associates resulted in their assessment that the concrete structure was primarily still in good to excellent condition (except for the east wall) which attests to the structural integrity of 221-B Canyon to withstand the loadings imposed on it over the past 45 years. Actual static load capacity will be determined as part of the seismic analyses currently being conducted.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0111-2.2.2	Unit Weights	
	6) Unit weights of materials and construction assemblies for buildings and other structures shall be per ANSI A58.1. If not established in this standard, unit weights shall be determined from manufacturers' drawings or catalogs.	Compliance. The building material/component unit weights listed in the Appendix of the UBC 1940 are equal to, although not as extensive as, the ANSI A58.1-1982 dead load design tables (both documents list concrete [stone or gravel] as 144 lbs/ft^3).
0111-2.2.3	Service Equipment	
	7) Design dead loads shall include the weight of all permanent service equipment....	Compliance. Drawing W69333 details the overhead crane wheel loads.
0111-2.2.4	Allowance for Partition Loads	
	8) Minimum allowance for weights of partitions, where partitions are to be rearranged or relocated shall be: o For partition weights of 150 plf or less, an equivalent uniform dead load of 20 psf shall be used. o For partition weights above 150 plf, the actual linear loads shall be used. o Partitions that are likely to be rearranged or relocated should be calculated as live loads for load factor design.	Not applicable to 221-B Canyon structure.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0111-2.3	Live Loads	
0111-2.3.1	General	
	9) Live loads shall include all loads resulting from the occupancy and use of the structure, whether acting vertically down, vertically up, or laterally. Live loads shall include neither dead loads nor loads from the environment such as wind, tornado, earthquake, thermal forces, earth pressure, and fluid pressure.	Compliance. Although historical data (i.e. original structural design calculations) are not available for review, Chapter 23, Sections 2301 through 2312 of the UBC 1940, does contain equivalent requirements which 221-B Canyon was designed in accordance with. The nondestructive evaluation of 221-B Canyon by Muenow and Associates resulted in their assessment that the concrete structure was primarily still in good to excellent condition (except for the east wall) which attests to the structural integrity of 221-B Canyon to withstand the loadings imposed on it over the past 45 years. Seismic loadings are expected to dominate.
0111-2.3.2	Buildings and Other Structures	
	10) Live loads for buildings and other structures shall be those produced by the intended use or occupancy. Live loads shall not be less than minimum uniform load or concentrated load stipulated in ANSI A58.1.	Compliance. The live loads listed in Section 2304 of the UBC 1940 are equivalent to the live loads listed in Table 2 of ANSI A58.1-1982.
	11) Live loads on roofs shall be as stipulated in ANSI A58.1 and shall include the minimum roof live loads or snow loads and snow drifts or possible rain loads stipulated therein, whichever has the more severe effect.	Compliance. Chapter 23, Section 2305 of UBC 1940 contains equivalent verbiage/requirements to that contained in Chapter 4, Section 4.10 of ANSI A58.1-1982 except that UBC 1940 generally calls for a vertical live loading of 20 psf and ANSI A58.1 allows for reduction factors to be included into the stipulated roof loading equation.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0111-2.3.3	Highway and Railway Structures	Not applicable to 221-B Canyon.
0111-2.4	Wind Loads	
0111-2.4.1	General	
	12) The structural frame and exterior components of all buildings, signs, tanks, towers, and other exposed structures shall be designed to resist pressures due to wind assumed to act from any direction.	Compliance. ERDA-1538 "Waste Management Operations," Canyon was designed for straight wind loads per UBC. Chapter 23, Section 2307 of UBC 1940 required for design purposes a wind pressure of not less than 15 psf for portions of buildings less than 60 ft above ground and a wind pressure of not less than 20 psf for those portions more than 60 ft above ground.
0111-2.4.2	Buildings and Other Structures	
	13) Wind loads for buildings and other structures shall be determined in accordance with ANSI A58.1 and UCRL 15910.	Compliance. Contingent upon the completion of planned structural qualification analyses for 221-B Canyon with respect to wind loadings. Present design criteria delineated in SDC-41 is in accordance with ANSI A58.1-1982. Seismic loadings, however, are overriding concern with respect to 221-B Canyon safety.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	14) The basic wind speed shall be derived from DOE site-specific hazard model studies summarized in UCRL 53526, Rev. 1. If site-specific hazard model studies are not available, a hazard model shall be developed consistent with the approach used in UCRL 53526, Rev. 1.	Compliance. SDC 4.1 dictates the use of a basic wind speed for Hanford of 70 mph. This is consistent with the wind speed tables contained in UCRL 15910 which in turn are based upon UCRL 53526, Rev. 1.
0111-2.4.3	Highway and Railway Structures	Not applicable to 221-B Canyon.
0111-2.5	Tornado Loads	
	15) The basic wind speed and missile parameters shall be derived from DOE site-specific hazard models studies summarized in UCRL 53526, Rev. 1. If site-specific hazards model studies are not available, a hazard model shall be developed consistent with the approach used in UCRL 53526, Rev. 1.	Compliance. SDC 4.1 DBT criteria values were based on UCRL 53526, Rev. 1, Table 7, "Design Basis Tornado Parameters." See Item 44.
	16) Facilities for radioactive material handling, processing, or storage, and other facilities having high value or vital importance to DOE programs that are classified as critical facilities shall require special tornado loading criteria as stipulated in Section 0111-99.0 Non-reactor Nuclear Facilities General. Structures other than critical facilities need not be designed for tornado loading.	Compliance. Contingent upon the completion of planned structural qualification analyses for 221-B Canyon with respect to tornado loadings, using SDC-4.1 design load criteria. ERDA-1538 "Waste Management Operations," 12/75, Table III. 2-27 Lists that 221-B Canyon was designed for straight wind loads only, per UBC 1940. Refer to item 13.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0111-2.6	Internal Shock and Blast Loads	
	17) Building structures (excluding explosive facilities) that house operations that may release energy from rupture of equipment or explosions either inadvertently or purposely (such as testing) shall be designed to control the resulting internal shock pressure loads per applicable criteria.	Compliance. Contingent upon the current safety/risk evaluations defining DBAs. Hot cell structures should be able to withstand internally generated shock and blast loads. This will need to be proven and documented if any DBAs are defined which involve these effects.
0111-2.7	Earthquake Loads	
0111-2.7.1	Buildings and Other Structures	
	18) The basic seismic parameters shall be derived from DOE site-specific hazard model studies summarized in UCRL 53582. If site-specific hazard model studies are not available, a hazard model shall be developed that is consistent with the approach used in UCRL 53582. In applying UCRL 53582, specific guidance on relating frequency of occurrence to facility hazard levels shall be obtained from UCRL 15910.	Compliance. SDC 4.1 SSE criteria is consistent with UCRL 53582, Rev. 1.
	19) Earthquake load design for buildings and other structures shall be determined in accordance with the procedures contained in UBC and UCRL 15910. The provisions and design procedures of TM 5-809-10 for the application of seismic loadings to conventional buildings shall also apply. For critical facilities, the provisions and design procedures of TM 5-809-10.1 shall be used.	Compliance. Contingent upon completion of 221-B Canyon seismic structural evaluation which is in progress. This seismic evaluation is being conducted in accordance with SDC-4.1 which calls out UCRL 15910. The Appendix of UBC 1940 included the Hanford area in Zone 1-Locations not subject to frequent seismic disturbances.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	19) Continued.	Earthquake design requirements were based on resisting the horizontal force calculated according to F=CxW where F equals the horizontal force in pounds, W equals the total dead load plus one-half the total vertical designed live load, and C equals a numerical constant per the "Horizontal Force Factor" table contained in the Appendix.
	20) Facilities for radioactive material handling, processing, or storage, and other facilities having high value or vital importance to DOE programs that are classified as critical facilities shall require application of dynamic analysis in determining structural requirements for earthquake loading as stipulated in Section 0111-99.0, Non-reactor Nuclear Facilities - General.	Compliance. Non-linear dynamic analyses are currently being conducted.
	21) An independent review of the seismic design shall be made for facilities and buildings where a seismic event can have a potential risk to operator lives, to public safety, or large economic loss. The review shall be made in two stages, the first at the end of preliminary design and the second before final design is complete. For additional guidance on independent reviews, see LBL-9143 and UCRL 15910.	Noncompliance. Contingent upon a third party review of current seismic analyses. Need to identify WHCs design review procedures, especially in light of the recent change to this criteria (i.e., as of 1/3/89) that now mandates an independent review.
0111-2.7.2	Highway and Railway Structures	Not applicable to 221-B Canyon.
0111-2.8	Other Loads for Buildings and Other Structures	

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0111-2.8.1	Vibratory Loadings	
	22) Equipment supports shall be designed to avoid resonance resulting from the harmony between the natural frequency of the structure and the operating frequency of reciprocating or rotating equipment supported on the structure. Induced dynamic loads and amplitudes of vibration shall be determined by dynamic analysis. The operating frequency of supported equipment shall be determined from manufacturer's data prior to completion of structural design. Resonance shall be prevented by designing equipment isolation supports to reduce the dynamic transmission of the applied load to as low a level as can be economically achieved in the design.	Unable to access at this time. However, there does not appear to be any large rotating/vibrating equipment (e.g., turbines, large fans) that would transmit such dynamic loads to the structures.
0111-2.8.2	Earth and Groundwater Pressures	
	23) Every foundation wall or other wall serving as a retaining structure shall be designed to resist, in addition to the vertical loads acting on it, the incident lateral earth pressures and surcharges, plus hydrostatic pressures corresponding to the maximum probable groundwater level.	Compliance. Soil structure interaction analyses being performed as part of the 221-B Canyon seismic analyses should prove the design adequacy of the structure below grade. Canyon structure is 22 ft-6 in. below ground. The south wall thickness below ground is 5 ft-0 in. The north wall thickness below ground is 3 ft-0 in. No major structural problems have been identified from the previous 45 years of operation.
	24) Retaining walls shall be designed for earth pressures and potential groundwater levels producing the highest stresses and overturning moments. When a water-pressure-relief system is incorporated into the design, only earth pressures need be considered. In cohesive soils, the long-term consolidation effects on the stability of the walls shall be considered.	Not applicable to 221-B Canyon structure.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	24) Continued. Lateral earth pressures shall be determined in accordance with accepted structural and geotechnical engineering practice.	
0111-2.8.3	Fluid and Gas Pressure	
	25) The design of components of buildings and other structures shall include the effects of fluid and gas pressures, both internal and external.	Compliance. Although no historical data is available, the cell walls vary between 7 and 9 ft in thickness. This wall thickness should be able to withstand any fluid and gas pressure effects. Gas pressure events are being included in the current WHC safety analysis. This will probably require structural qualification documentation.
0111-2.8.4	Thermal Forces	
	26) The design of structures shall include the effects of stresses and movements resulting from variations in temperature. The rise and fall in the temperature shall be determined for the localities in which the structures are to be built. Structures shall be designed for movements resulting from the maximum seasonal temperature changes. The design shall provide for the lags between air temperatures and the interior temperatures of massive concrete members or structures.	Compliance. Although it does not appear that shrinkage and temperature reinforcement is in compliance with Section 2615 of the UBC 1940, expansion joints running the entire perimeter of the building are provided approximately 40 ft on-center.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0111-2.8.5	Creep and Shrinkage Forces	
	27) Concrete and masonry structures shall be investigated for stresses and deformations induced by creep and shrinkage. For concrete and masonry structures, the minimum linear coefficient of shrinkage shall be assumed to be 0.0002 inch/inch, unless a detailed analysis is undertaken. The theoretical shrinkage displacement shall be computed as the product of the linear coefficient and the length of the member.	Noncompliance. Field tests/evaluations conducted by Muenow & Associates indicated shrinkage cracks which penetrate into the concrete approximately 6 in. Project technical opinion is that this condition does not affect the structural integrity of the north and south walls. WHC structural analysis is currently planning to address redistribution of the dead weight stresses due to creep.
0111-2.9	Other Loads for Highway and Railway Structures	
0111-2.10	Combination of Loads and Design Requirements for Buildings and Other Structures	
	28) Combination of loads, allowable stresses, and strength requirements for buildings and other structures shall be as stipulated in the UBC, except as otherwise indicated in 0111-99, Special Facilities.	Compliance. It appears that the 221-B Canyon design is in general conformance with the UBC 1940 requirements (e.g. strength requirements for concrete of 2500 psi). The canyon structure also has not had any major structural failures over the past 45 years, attesting to its ability to withstand the loads which have been imposed on it. However, seismic loadings based on current standards and the canyon structure's ability to withstand these loadings are the key safety concern at this time.
0111-2.11	Combination of Loads and Design Requirements for Highway and Railway Structures	Not Applicable to 221-B Canyon.
0111-3	Structural Systems for Buildings and Other Structures	

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0111-3.1	Framing	
	29) Buildings shall be framed to allow simple formwork, fabrication, and construction procedures. Structural systems shall be designed for ductile modes of failure to the extent feasible. In the selection of a particular framing system, consideration shall be given to the structure's functional requirements, including: o Column-free areas o Floor-to-ceiling heights o Number of stories o Elevator, crane, or hoist installations o Heavy loads o Other particular requirements pertaining to the specific facility.	Compliance. The 221-B Canyon structure, comprised of 40 individual hot cells was designed for the operation of the Bismuth Phosphate Process. This is not important to safety.
0111-3.2	Floors	
	30) Where the first floor uses concrete-slab-on-grade construction, the slab shall be placed on a free-draining aggregate base overlying a compacted subgrade. A plastic vapor barrier shall be used under the slab where moisture conditions warrant. Excessive loads or equipment subject to vibration shall be supported by separate pads isolated from the rest of the floor slab with flexible joints.	Not Applicable. 221-B Canyon is not a slab-on-grade concrete structure.
	31) For framed floors, the economy of prefabricated systems shall be considered.... Where concrete floors are used, the economy of flat plate slabs shall be considered, with the objective of using their undersurface for ceilings.	Compliance. Crane, operating, and pipe gallery floor undersurfaces are used as ceilings.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0111-3.3	Control Joints	
	32) Control joints shall be designed and placed in such a manner as to avoid structural distress and uncontrolled cracking from thermal expansion and contraction, concrete shrinkage, and movements due to wind and earthquake forces.	Noncompliance. Construction and expansion joints are located both horizontally and vertically throughout the structure (refer to structural drawings W69333, W69334, W69565, W69566, W69978, W69994). However, the ability of the unbonded construction joints in the walls to avoid movements due to earthquake forces is currently under study.
0111-3.4	Foundations	
0111-3.4.1	General Requirements	
	33) The provisions of the UBC shall be the minimum requirements for foundations design. The potential adverse effects of frost heave and movements due to expansive soils shall also be considered in the design.	Compliance. It appears that the requirements of Section 2802 "Footings and Foundations" of UBC 1940 have been implemented. The most significant proof of this is that the canyon structure has not experienced any major foundation and/or settlement problems/failures over the past 45 years.
	34) For all structures, Section 0201, Subsurface Investigations, shall be complied with to determine subsurface conditions, recommended foundation type, allowable design soil bearing pressure, seismic potential, and differential settlement.	Partial compliance. Drawing W69334 lists the allowable soil bearing pressure as 8,000 psf. Soil-structure-interaction analyses are part of the current 221-B Canyon seismic analyses.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0111-3.42	Foundation Vibrations	
	35) Analysis of foundation vibrations, design to avoid resonance and vibration and shock isolation, where required, shall be in accordance with Chapter 1 of DM-7.03.	Compliance. The 221-B Canyon 6 ft thick concrete foundation mat should be able to withstand any vibratory loadings.
0111-4	Structural Systems for Highway and Railway Structures	Not applicable to 221-B Canyon.
0111-99	Special Facilities	
0111-99.1	Nonreactor Nuclear Facilities - General	
0111-99.0.1	General	
	36) Special facility structures that need not be designed to withstand severe natural phenomena or man-made events shall be designed to the requirements in Section 0111-2, Loads.	Compliance. The SAR will require that B Plant structures withstand severe natural phenomena.
	37) Safety class items required to function during or following severe natural phenomena shall not be prevented from performing their required safety functions by the failure of components, systems, or structures that are not designed to the severe natural phenomena criteria.	Noncompliance. Based upon prior seismic analyses, the canyon structure will not withstand the SSE, resulting in the structural collapse of the upper walls and roof, which in turn would prevent the function of safety class items. However, this scenario is being revaluated based upon new seismic analyses which are currently being performed.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	38) Safety class structures shall be protected against dynamic effects, including effects of missiles and discharging fluids, that may result from natural phenomena, accidents at nearby facilities, including military installations and transportation facilities, equipment failure, and similar events and conditions inside and outside the facility. The design bases for such events shall take into account their historic frequency and severity in the region of the site and the potential risk to the environment or the health and safety of the public. Earthquakes, tornados, straight winds, and floods shall be addressed.	Noncompliance. Based upon prior seismic analyses. New seismic and safety analyses are being performed, the results of which may address this criteria.
	39) Facilities containing plutonium, other radioactive material, or other material that would be likely to produce significant health or safety hazards shall be evaluated as to the degree of risk, and more stringent criteria applied to the structural design, as necessary.	Compliance. Safety/Risk Evaluations are currently underway.
	40) For buildings subject to future additional ceiling-roof equipment loadings, consideration shall be given to providing for a future 10 to 20 psf additional structural loading.	Not applicable to 221-B Canyon, no additional roof equipment loadings are planned.
	41) Where floor-mounted special facilities equipment will have a commonality of use, it shall be centrally located with respect to special facilities operations. Current and future floor loadings and equipment locations shall be provided for in structural planning and design.	Compliance. Pipe, electrical, and hot pipe trench/gallery(s) locations with respect to the hotcells are able to accommodate future process equipment layouts.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	42) The design of structures, including their supports, that are confinement system barriers shall ensure satisfaction of the functional requirements for the specific confinement system they are part of. In addition, safety class confinement barriers (barriers whose continued integrity is shown by a safety analysis to be required following severe natural phenomena, including the DBE, and man-made events) shall be designed to withstand secondary events as well as primary events....	Noncompliance. Pending the results of new seismic analyses which are currently being performed.
	43) In no case shall the total combustible loading located in a fire area exceed the fire resistance rating of the area enclosure. This shall be documented in a fire risk analysis.	Compliance. Fire resistance ratings of the 7 to 9 ft thick concrete hot cells should far exceed the process total combustible loadings. This will need to be documented as part of the fire risk analysis.
0111-99.0.2	Tornado and Extreme Wind	
	44) DOE site-specific hazard model studies summarized in UCRL 53526, Rev. 1, shall be used to select the DBT and extreme wind characteristics for the design of structures. If site-specific hazard model studies are not available, a hazard model shall be developed consistent with the approach used in UCRL 53526, Rev. 1.	Compliance. SDC-4.1, "Standard Arch-Civil Design Criteria, Design Loads for Facilities," requires the use of the values from UCRL 53526, Rev. 1
	45) In designing for tornado or extreme wind resistance: o The tornado rotational speed shall be appropriately combined with the translational speed. o Resulting loads from the rate of pressure drop, taking into consideration any pressure equalization due to permissible venting, shall be combined with velocity-induced pressure loads as stipulated in UCRL 53526, Rev. 1.	Compliance. Contingent upon the completion of planned structural qualification analyses for 221-B Canyon with respect to tornado loadings. SDC-4.1, is based on UCRL 53526, Rev. 1 and UCRL 15910. Tornado analyses are planned for the 221-B Canyon to structurally qualify it with respect to tornado-induced loadings.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	45) Continued o UCRL 53526, Rev. 1, provide the characteristics of typical tornado-generated missiles. Additional missiles may be identified from review of on-site sources and possible missiles that could be borne to the site by a tornado. Both small high-velocity missiles and massive low velocity missiles shall be considered separately in terms of penetration, perforation, or crushing effects. The horizontal and vertical velocities of the missiles shall be combined in the design.	UBC 1940 does not contain any tornado design requirements.
	o The minimum wind speed used shall be 70 mph.	
0111-99.0.3	Floods	
	46) The design loads from flooding shall comply with UCRL 15910. In calculating design loads from flooding, the following shall be used:	Not applicable, 221-B Canyon located outside/beyond the flood-affected zone.
	o Greater than maximum historic levels recorded for the site.	
	o No less than the probable maximum flood.	
0111-990.4	Earthquakes	
	47) The systems, components, and structures that shall be designed to meet these special facility criteria shall be identified through a written evaluation (see Section 0111-99.0.1, General). Such systems, components, and structures shall be designed to withstand a DBE and to continue to operate after the occurrence of an OBE. Site-specific seismic parameters shall be determined for a DBE and an OBE.	Compliance. Written evaluation will be forth coming from WHC safety personnel (i.e., R. Marusich).

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	48) The DBE and OBE shall be assumed capable of occurring at any time, except that the simultaneous occurrence with any other limiting site-related event such as a tornado, fire, or flood need not be considered for design purposes, except where the joint occurrence is casually related (e.g. fire or flood).	Compliance.
	49) To determine the DBE, site-specific earthquake hazard models and response spectra given in UCRL 53582, Rev. 1, shall be used to select the appropriate seismic ground acceleration. Design guidance in UCRL 15910 shall be used in applying UCRL 53582, Rev. 1. The DBE shall be defined by design response spectra appropriate for the site, or by acceleration time histories representative of the anticipated ground motions.	Compliance. UCRL 15910 and 53582, Rev. 1 are required per SDC-4.1, by which current seismic studies are being conducted.
	50) The adequacy of systems, components, and structures to withstand a seismic event shall be verified by a dynamic analysis, except where it can be demonstrated that the use of a simplified approach such as static load method, component testing, or a combination of testing and analysis provides assurance of adequate seismic design. The ratio of vertical-to-horizontal acceleration shall be two-thirds unless specific data justify use of a different ratio.	Compliance. Dynamic analysis currently being conducted.
0111-99.0.5	Aircraft	
	51) Unless the safety analysis can demonstrate that the risk from an aircraft crashing into the facility is acceptable, potential aircraft crashes shall be considered among the spectrum of man-made missiles that confinement structures shall be designed to withstand or against which they shall be protected.	TBD. Current safety analysis will determine the credibility of an aircraft incident.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0111-99.0.6	Nearby Explosions and Externally Generated Missiles	
	52) The potential effects of a major explosion at a nearby facility or transportation route shall be considered among the spectrum of external blast effects and missiles that confinement structures shall be designed to withstand or against which they shall be protected.	Not applicable, 221-B Canyon is not located near a facility which could explode.
0111-99.0.7	Explosion, Internal Pressurization, Criticality, and Other DBA Causes	
	53) The probable consequence of DBAs involving internally generated missiles or blast effects shall be considered. Structures required to function following such accidents shall be designed to withstand these DBAs.	Compliance. Contingent upon the results of the current safety/risk evaluations defining DBAs. Hot cell structures should be able to withstand DBAs involving internally generated missiles or blast effects. This will need to be proven and documented if any DBAs are defined which involve internally generated missiles or blast effects.
0111-99.0.8	Load Combinations	
	54) Safety class structures and structural members shall be designed to resist the appropriate load combinations provided in UCRL 15910.	Compliance. SDC-4.1 requires the use of UCRL 15910. Currently structural qualification efforts are taking this into account.
	55) Concrete structures and structural members for safety class concrete structures shall meet the design and construction requirements of ACI 349.	Still under evaluation; however, this may not be applicable at this "after-the-fact" time. The Muenow and Associates evaluation that the concrete was generally in good to excellent condition, with its compressive strength being approximately 6000 psi (well over its design value of 2500 psi), is more important to current safety considerations.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	56) Safety class steel structures shall meet the design, fabrication, and erection requirements of AISC N690.	Not applicable to 221-B Canyon since it is a concrete structure.
0111-99.4	Explosives Facilities	Not applicable to 221-B Canyon.
0220	Earthwork	
0220-3	Design	
	57) The earthwork design and specification shall comply with the recommendations in the subsurface investigation.	Compliance. No settlement problems have occurred which resulted in structural failure of the 221-B Canyon.
0235	Building Foundations	
0235-1	58) Building foundations shall be designed in accordance with the requirements of the UBC and ACI 318.	Compliance. See Item 33. There are no known structural deficiencies in the canyon Mat Foundation (e.g. settlement cracks).
0235-2	Foundation Design Criteria	
0235-2.1	General	
	59) Alternative types of foundations shall be considered based on preliminary information concerning the purpose of the structure, foundation loads, and subsurface soil conditions.	Compliance. Selection of Mat Foundation to support hot cell structures can be justified. Not important to safety.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0235-2.2	Adverse Subsurface Conditions	
	60) One of the following procedures shall be used where poor soil conditions are encountered: o Bypass the poor soil by means of deep foundations extending to or into a suitable bearing material, o Design structure foundations to accommodate anticipated differential settlements, o Remove the poor material, and either treat and replace it or substitute good compacted fill material, o Treat the soil in place before construction to improve its properties.	Not applicable, poor soil conditions not encountered.
	61) Where reasonable alternative design foundation types are possible, preliminary designs shall be prepared for the purpose of detailed cost comparisons.	Not applicable at this "after-the-fact" time. This is not important to safety.
0235-2.3	Cost Estimates and Final Selection	
	62) Final foundation design shall not be initiated until the evaluation and cost comparison of the proposed alternatives have been completed.	Not applicable at this "after-the-fact" time. This is not important to safety.
0235-3	Concrete	
	63) Concrete for building foundations shall be designed in accordance with Section 0330, Cast-In-Place-Concrete.	See to Items 73 through 80.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0235-4	Pier-And-Beam Foundation	
	64) Grade beams shall comply with ACI 318 and piers shall comply with ACI 336.3R.	Not applicable to 221-B Canyon structure.
0235-5	Pile Foundations	
	65) Pile foundations shall comply with UBC and ACI 543R.	Not applicable to 221-B Canyon structure.
0235-6	Ribbed-Mat Slab Foundations	
	66) Ribbed-mat slabs shall comply with ACI 336.2R.	Not applicable to 221-B Canyon Structure.
0235-7	Expansive Soils	
	67) Where expansive soils are encountered, the magnitude of swell or settlement shall be determined in accordance with ASTM D4546 or AASHTO T 258. Based on the results of these tests, the foundation design shall consider one of the following options: o Mechanically or chemically altering the soil characteristics, o Controlling moisture conditions, o Designing the foundation to tolerate the estimated volume change.	Not applicable, expansive soils not encountered.
0235-8	Equipment Foundations	
	68) Heavy vibration-producing equipment shall have separate foundations.	Not required due to overall building 6 ft thick concrete Mat Foundation.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
Division 3	Concrete	
0300	Coverage	
	69) The requirements of this division shall be used in conjunction with those of Section 0111, Structural Design Requirements.	No response necessary; this is only an introductory statement.
0301	General Requirements	
0301-1	Buildings and Other Structures	
	70) Concrete materials, design, and construction for buildings and other structures shall comply with the UBC and ACI 318.	Compliance. The favorable assessment of the condition of the concrete by Muenow and Associates after 45 years can attest to the general compliance with the requirements of Chapter 26, "Reinforced Concrete" of UBC 1940.
0301-2	Highway and Railway Structures	Not applicable to 221-B Canyon.
0301-3	Sanitary Engineering Structures	
	71) Concrete materials, design, and construction for sanitary engineering structures shall comply with ACI 350R.	Not applicable to 221-B Canyon.
0310	Concrete Formwork	
	72) Formwork for concrete construction shall comply with ACI 347 and ACI SP-4.	Not applicable at this "after-the-fact" time.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0320	Concrete Reinforcement	
0320-1	Materials for Reinforcement	
	73) Reinforcement materials for buildings and other structures shall comply with UBC and ACI 318; for highway structures, with the AASHTO HB-13; for railway structures, with the AREA Manual for Railway Engineering (Fixed Properties); for special facilities, with ACI 349 (see Section 011-99.0, Non-reactor Nuclear Facilities - General).	Compliance. WHC personnel currently trying to assess reinforcement material. NDT testing by Muenrow indicated "the absence of serious reinforcement steel corrosion" and that it was in good to excellent condition.
0320-2	Detailing of Reinforcement	
	74) Reinforcement details shall comply with ACI 352R and ACI SP-66 in addition to UBC and ACI 318 for buildings and other structures.	Not applicable at this "after-the-fact" time.
0330	Cast-In-Place Concrete	
0330-1	Coverage	
	75) This section covers the selection of materials, proportioning of mixes, mixing, placing, testing, and quality of cast-in-place concrete.	No response necessary; this is only an introductory statement.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0330-2	Materials, Testing, and Quality Control	
	76) Materials, testing, and quality control for cast-in-place concrete shall comply with UBC and ACI 318 for buildings and other structures, with the AASHTO HB-13 for highway structures, with the AREA Manual for Railway Engineering (Fixed Properties) for railway structures, and with the ACI 349 (see Section 0111-99, Special Facilities) for special facilities.	Compliance. Drawing W69334 requires concrete compressive strength to be 2500 psi after 28 days. Field tests conducted by Muenow indicates actual concrete compressive strengths to vary between 5,340 psi and 6,000 psi. Muenow report concluded that the 221-B Canyon concrete to be in good to excellent condition except for the east wall, which has total depth cracks. This wall, however, will undergo major re-construction as part of the W-002 B Plant crane replacement project.
	77) Tolerances for formed concrete shall be as suggested in ACI 347.	Not applicable at this "after-the-fact" time.
0330-3	Selecting Proportions for Concrete Mixer	
0330-3.1	Normal, Heavyweight, and Mass Concrete	
	78) The selection of proportions for concrete mixes for normal, heavyweight, and mass concrete shall comply with ACI 211.1.	Compliance. Actual concrete compressive strengths exceed the required strength of 2500 psi. See to Item 76.
0330-3.2	Structural Lightweight Concrete	
	79) The selection of proportions for structural lightweight concrete shall comply with ACI 211.2.	Not applicable to 221-B Canyon.
0330-4	Mixing, Transporting, and Placing	
	80) The mixing, transporting, and placing of cast-in-place concrete shall comply with ACI 304.	Not applicable at this "after-the-fact" time. NDT tests conducted by Muenow concluded that the 221-B Canyon concrete and reinforcement steel is in good to excellent

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0330-5	Climatic Considerations	
0330-5.1	Hot Weather Concreting	
	81) Hot weather concreting shall comply with ACI 305R.	Not applicable at this "after-the-fact" time.
0330-5.2	Cold Weather Concreting	
	82) Cold weather concreting shall comply with ACI 306R.	Not applicable at this "after-the-fact" time.
0330-6	Post-Tensioned Construction	Not applicable to 221-B Canyon.
0340	Precast Concrete	Not applicable to 221-B Canyon.
0350	Cementitious Decks for Buildings	Not applicable to 221-B Canyon.
0370	Repair and Restoration of Concrete Structures	
0370-1	Coverage	
	83) This section covers evaluation of damage or deterioration, selection of repair methods, surface preparation, and repair and restoration of concrete structures. The materials covered are portland cement mortars and concretes, latex-modified portland cement mortar, epoxy mortars, epoxy concrete, or methyl methacrylate concrete.	No response necessary; this is only an introductory statement.
0370-2	General	
	84) Methods, procedures, and materials for the repair and restoration of concrete structures shall comply with guidelines ACI 503.4 ACI 546.1R, the AREA Manual for Railway Engineering (Fixed Properties) and the AASHTO Manual for Bridge Maintenance.	Compliance. Muenow structural repair procedure (SD-RE-TI-213, Rev.0) would comply.

TABLE 2. B Plant Implementation of DOE 6430.1A General Design Criteria for Structural Design Requirements (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
0380	Mass Concrete	
0380-1	Coverage	
	85) This section covers the selection of materials, proportioning of mixes, mixing, placings, and curing of mass concrete.	No response necessary; this is only an introductory statement.
0380-2	General	
	86) The selection of materials, mix proportioning, and construction methods and procedures for mass concrete shall comply with ACI 207.1R and ACI 207.4R.	Not applicable at this "after-the-fact" time.

TABLE 2A. B Plant Comparison to CS&Rs: Structural

Applicable Section	Design Criteria Summary	B Plant Implementation
40 CFR 264.35	Aisle space must allow movement of personnel protection equipment, spill control equipment, and decontamination equipment.	Compliance. Aisle spacings are per UBC and meet the intent of this requirement. Also, recent upgrades for the Life Safety Code NFPA 101 requirements provide assurance of adequate aisle space.
40 CFR 264.18	New facilities for treatment, storage, or disposal of hazardous wastes shall not be within 200 ft. of a fault.	Compliance with comment. Any new facilities constructed to support B Plant must consider this issue.
WAC 296-24-73513 Buildings-Floors	All buildings, docks, tramways, log dumps, and other structures shall be so designed, constructed, and maintained as to provided a safety factor of 4. This means that all members shall be capable of supporting four times the maximum strain to be imposed. This provision refers to buildings, docks, etc. designed and constructed subsequent to the effective date of these standards and also refers in all cases where either complete or major changes or repairs are made to such buildings, docks, tramways, walkways, log dumps, and other structures.	Noncompliance. The building design for B Plant is based on allowable stresses for loadings as specified by the Uniform Building Code (UBC). This does not necessarily provide a safety factor of 4. Ongoing structual analysis may demonstrate compliance.
WAC 296-24-76507 Stair Strength	Fixed stairways shall be designed and constructed to carry a load of five times the normal live load anticipated, but never of less strength than to carry safely a moving concentrated load of 1,000 pounds.	Noncompliance. UBC was used as a basis for stair load design and does not provide assurance of construction to 5X normal load or 1,000 pound concentrated loads.
29 CFR 1910.24 Fixed Industrial Stairs	Fixed industrial stairs include interior and exterior stairs around machinery, tanks, and other equipment, and stairs leading to or from floors, platforms, or pits. Fixed stairways shall be designed and constructed to carry a load of five times the normal live load anticipated.	Noncompliance. See WAC 296-24-76507 above.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation

Applicable Section	Design Criteria Summary	B Plant Implementation
1323	Radioactive Liquid Waste Facilities	
1323-4	Special Design Features	
1323-4.4	1) Provisions shall be made so that effluents from a treatment system can be analyzed.	Compliance. Airborne effluents from B Plant are analyzed by extracting a representative sample from the stack.
1323-5.2	2) Process and waste storage vessels shall be vented through appropriate treatment systems that control the release of radioactive material in gaseous effluents to the extent that the guidelines referenced in Section 1300-1.4.3, Routine Releases, are not exceeded and these releases are ALARA. The design shall ensure the following:	
	o Offgas will be suitably pretreated upstream of offgas treatment equipment to remove or reduce the concentration of chemicals that may adversely affect system operation.	Compliance. Vessel vent system provided with dedicated HEPA filters.
	o The venting system will prevent overpressure or vacuum conditions from occurring within vessels.	Compliance. Project W-024 will replace the vessel vent system. The new system is expected to prevent over-pressurization of the vessels.
	o The venting system will prevent the buildup of hydrogen from radiolysis.	Compliance. Vessel ventilation and building ventilation systems will prevent hydrogen buildup.
1323-6.3.1	3) Effluent system designs shall preclude the holdup or collection of fissile material or other material capable of sustaining a chain reaction in portions of the system that are not geometrically favorable. Nuclear criticality safety shall be considered in the design of airborne effluent systems.	Compliance. Buildup of fissile material in airborne effluent system in quantities sufficient to cause criticality is not credible.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1550-1.1	4) Selection of major HVAC equipment components based on a consideration of health and safety requirements, initial costs, operating costs, and maintenance costs according to Section 0110-12.7, Building Design Analysis.	Costs were probably not explicitly considered in the design. However, failure to consider costs will not impact safety. Health and safety requirements were considered.
	5) HVAC equipment sized to satisfy building heating and cooling load requirements and to meet all general equipment design and selection criteria contained in the ASHRAE handbooks.	All design after 1979 are according to ERDA Appendix 6301, Part I, D., Tables 1, 2, and 3, and Tables I and II, Paragraph D, SDC-5.1 and ASHRAE handbooks.
1550-1.2.1	6) Use of building envelope thermal transmittance values ("U" values), as determined from ASHRAE Standard 90, as the basic building envelope criteria.	U values taken from SDC-5.1.
1550-1.2.2	7) Recommended design values for inside design temperatures and relative humidities to be within the criteria bounds of ASHRAE Standard 55. Values also to be within the energy conservation criteria guidelines stated in Section 0110-12, Energy Conservation.	Energy conservation was probably not explicitly considered in design. Failure to consider energy conservation will not impact safety.
1550-1.2.3	8) HVAC system equipment to be designed using outside design temperatures as indicated in Table 1550-1.2.3 for the particular application. Where data for a particular location are not listed, design conditions to be estimated from data available at nearby weather stations.	Compliance per SDC-5.1.
1550-1.2.4	9) Infiltration for heating and cooling design loads to be calculated according to methods provided by ASHRAE Publication Grp 158 and the ASHRAE Fundamentals handbook.	Compliance per SDC-5.1.
1550-1.2.5	10) Weather data for use in sizing HVAC equipment to be obtained from local weather station, AFM 88-29, "Climate Conditions for the United States," ASHRAE Fundamentals handbook, National Climatic Data Center, NOAA, Federal Building, Asheville, North Carolina 28801.	Outdoor air design temperatures taken from SDC-5.1.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1550-1.3	11) The capacity of central heating, refrigeration, and ventilation equipment to be sized for the peak block building or the maximum simultaneous zone heating and cooling design loads and in accordance with the ASHRAE Fundamentals handbook.	Compliance with ASHRAE.
1550-1.4	12) In locations where a wide variation exists between the dry and wet bulb temperatures for extended periods of time, evaporative/adiabatic cooling to be considered for the applications listed below. Applications to be considered include warehouses, shops not requiring close ($\pm$ 5°F) temperature control, nonresidential-size kitchens, makeup air ventilation units, and mechanical equipment spaces.	Compliance. Evaporative cooling used.
1550-1.5.1	13) Ventilation exhaust systems to be selected for the effective removal of noxious odors, hazardous gases, vapors, fumes, dusts, mists, and excessive heat and for the provision of fresh air to occupants.	Compliance. The ventilation systems for Buildings 221-B and 271-B are oncethrough systems. Filtered outdoor air is supplied to Building 271-B. The operating gallery of Building 221-B is also supplied with filtered outdoor air. The pipe gallery of 221-B receives air from the operating gallery. Air exhausted from Buildings 221-B and 271-B is filtered by HEPA filters prior to discharge.
1550-1.5.2	14) Outdoor air to be used to provide makeup air, dilute nontoxic contaminants, and provide acceptable indoor air quality in spaces served by ventilation systems. Outside air to meet the quality required by ASHRAE Standard 62.	Compliance. Outdoor air is normally expected to meet the quality requirements of ASHRAE Standard 62. Outdoor air is filtered before it enters occupied areas.
1550-1.5.3	15) Outdoor air to be provided in the quantities indicated for conditioned offices and other occupied spaces in ASHRAE Standard 62.	Compliance. Outdoor air quantities are sufficient to meet ASHRAE 62.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1550-1.5.4	16) When air is supplied to a space, the portion of the total supply air that exceeds required outdoor air quantity is to be recirculated through the ventilation system except from areas in which recirculation is specifically prohibited.	Compliance. Supply air is not recirculated.
	17) Areas from which air is not recirculated include areas that produce or emit dust particles, heat, odors, fumes, spray, gases, smoke, or other contaminants that cannot be sufficiently treated and are injurious to health and safety of personnel or are potentially damaging to equipment. These areas to be 100% exhausted.	Compliance. Ventilation system for such areas is designed as a once-through system and is 100% exhausted.
	18) Restrooms, janitor's closets, garbage rooms, and other malodorous spaces to be exhausted at a rate of not less than 2 cfm/ft^2, or as specified in ASHRAE Standard 62.	Compliance. Air is exhausted from the men's change room at a rate of 8,000 cfm.
1550-1.5.5	19) Ventilation air to be provided in the quantities required to maintain all the PELs established by 29 CFR 910 and all ACGIH TLVs. Design air quantities to be calculated according to the methods prescribed by ASHRAE, ACGIH Industrial Ventilation Manual, 29 CFR 10, and NFPA 45.	Compliance. Based on an initial review, air flow rates are sufficiently high in occupied areas to prevent airborne concentrations of hazardous materials from reaching PELs and TLVs.
1550-1.5.6	20) Local exhaust systems to be designed to maintain the required capture air velocities for source contaminant control. Air quantities to be calculated by the methods prescribed by ASHRAE and the ACGIH Industrial Ventilation Manual.	Not applicable. Not applicable for canyon as air flow is used as contamination control--not designed to handle capture velocities.
1550-1.5.7	21) Mechanical and electrical equipment rooms to be exhausted so that room temperature does not exceed NEMA equipment ratings. Space temperature limit criterion to be provided in the project criteria.	Compliance. Evaporative cooling is provided to the operating gallery to maintain a satisfactory environment. Mechanical and electrical equipment spaces do not exceed NEMA temperature requirements, which are quite conservative.
	22) Equipment rooms containing refrigeration equipment to be ventilated in accordance with ASHRAE Standard 15.	Not applicable. No refrigeration equipment in current configuration.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1550-1.6	23) Specific energy-efficient features and waste heat recovery systems for all types of HVAC equipment to be considered according to the methods prescribed in Section 0110-12.7, Building Analysis Procedures, and Section 1550-1.1, General Selection Procedures for HVAC Systems.	Energy efficient features and heat recovery systems were not considered in the design. This will not impact safety.
1550-2.1.1	24) Selection of central station cooling systems to be based on the life cycle cost (LCC) analysis procedures outlined in Section 0110-12.7, Building Analysis Procedures. Size, selection, and design to be based on ASHRAE. Central chilled-water plants to be considered where two or more adjacent buildings are to be air-conditioned.	Not applicable; no chilled water systems are used for HVAC (space cooling or air conditioning).
	25) The design professional to consider the use of multiple chillers for all chilled-water loads greater than 400 tons.	Not applicable. No chillers in current configuration for HVAC.
	26) Temperature-critical areas, as determined by project criteria, such as laboratories and computer centers to be provided with independent refrigeration systems with backup systems if involved with vital programs.	Not applicable. No temperature-critical areas were identified.
1550-2.1.2	27) Selection of either centrifugal, reciprocating, helical, rotary-screw, absorption, or steam-powered chillers to be based on coefficients of performance at full- and part-load conditions using the LCC methods described in Section 0110-12.7, Building Analysis Procedures.	Not applicable. No chillers in current configuration for HVAC.
1550-2.1.3	28) Water-cooled condensers shall comply with ASHRAE Standard 15 and ASME Boiler and Pressure Vessel Code, Section VIII.	Compliance. Project W-024 will replace the condensers with ones designed according to ASHRAE and ASME.
1550-2.1.4	29) Cooling towers to be located and placed to avoid problems with water drift and deposition of water treatment chemicals. Towers are not located on roofs and are to have ample clearance from any obstructions that would restrict airflow, cause recirculation of discharge air, or inhibit maintenance.	Not applicable. No cooling towers in current configuration.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B-Plant Implementation
	30) Cooling tower water treatment program to be selected by a specialist.	Not applicable. No cooling towers in current configuration.
	31) Cooling tower components to be selected to prolong cooling tower life by use of neoprene fiberglass fill and one of the following: o Chemical treatment of tower members constructed of wood to form a coating insoluble in water. o Pressure treatment of the tower members constructed of wood with chemicals to prevent wood decay. o Use of noncorroding ceramic, plastic, and metal components instead of wood.	Not applicable. No cooling towers in current configuration.
1550-2.2.1	32) Building heat generation system not to be provided unless one of the following conditions exists: o Connection to central plant distribution system is not cost-effective. o Central plant has insufficient capacity to accept building loads. o Building use precludes connection to potentially interruptible central system.	Not applicable. No heat generation equipment in current configuration.
	33) If maintenance of building temperature is critical, a stand-alone heating system to be designed with backup capability and independent of other facility systems.	Not applicable. Maintenance of building temperature is not critical.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1550-2.2.2	34) For buildings connected to the central plant heat generation/ distribution system, one of the following are to be provided: o Steam-to-building hot water heat exchanger. o HTW-to-building hot water heat exchanger. o Steam pressure-reducing station.	Compliance. Steam pressure reducing stations are provided.
	35) Steam-to-hot water or HTW-to-building heating water converters to be selected based on design criteria contained in ASHRAE.	Not applicable since steam is used directly and a pressure reducing station is provided. See Item 34.
1550-2.2.3	36) Design professional to consider the use of direct and indirect gas-fired units, electric heating, heat pumps (air- and water-cooled), low-temperature gas infrared heating, hot water radiant, heating and hot water distribution to terminal units, depending on the building type, DOE facility preference, and LCC.	Compliance. Gas-fired units may have been considered in the design, along with the other heating methods. In view of the availability of onsite steam, steam undoubtedly was considered the optimum choice. This will not impact safety.
	37) For hot water or steam distribution systems, with the heating medium generated within the building, the following requirements are to be met: o Hydronic or steam boilers to be selected on LCC analysis. o Two or more boilers to be provided, with the proportion of load each handles determined by energy, redundancy, and maintenance requirements and with staging of boilers, internal heating steps, and boiler sequencing as discussed in Section 1595-74.	Not applicable. No heating medium generated within the building.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
Continued	37) o For fuel oil systems, underground storage tanks to be installed in accordance with national, state, and local EPA regulations and to provide 30 days of full heating capacity. Tanks to comply with NFPA 30 requirements.	
1550-2.3.1	38) Design professional to select chilled water, hot water, condenser water, boiler feed, and condensate return systems designed for economical pipe sizes based on allowable pressure drop, flow rate, and pump selection criteria, as prescribed by ASHRAE.	Compliance. Project W-024 will provide condenser and condensate return systems according to ASHRAE.
1550-2.4	39) All steam piping to comply with ASME B31.1 and be a minimum of Schedule 40 black steel. Fittings, valves, and accessories to be selected by pipe size and temperature and pressure conditions.	Compliance. Steam piping is schedule 40 black steel.
1550-2.5.1	40) Air-handling equipment and air-distribution systems to be designed and sized to optimize both initial-cost and air-handling system operating and maintenance costs according to procedures outlined here and in Section 0110-12.7.	Compliance. Designs were optimized from a safety and health viewpoint. Costs were not explicitly considered in the design. This is not expected to impact safety.
	41) All air-handling system equipment to be provided with vibration isolators and flexible ductwork connectors to minimize transmission of vibration and noise. Systems to satisfy the NC levels recommended for various types of spaces and vibration criteria listed in the ASHRAE handbooks. Where air-handling equipment and air-distribution systems cannot meet these requirements, sound attenuation devices to be installed in the air-handling systems.	Compliance with SDC-5.1 which requires compliance with the NC-45 Noise Criteria Curve, ASHRAE fundamentals.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	42) Air flow diagram to be developed and provided in the preliminary design phase unless waived by the DOE project criteria. These diagrams to be provided for each air-handling and air-distribution system and to include capacities and locations of fans, coils, filters, terminal devices, and other major air-distribution system equipment, as well as airflows and system air pressures and space pressure differentials.	Compliance with intent. Needed air flow diagrams are under development. Flow diagrams need to indicate both system air pressures and space differential pressures.
	43) Supply and outdoor air intakes to be located a minimum of 10 ft from any exhaust opening.	B Plant appears to be in compliance.
1550-2.5.2	44) Selection of packaged air-handling units complete with filters, coils, mixing boxes, fan section, and other accessories or built-up air handling units to be based on LCC analysis and requirements of NFPA 90A, AMCA Publication 99, AMCA Publication 261, and ARI 430.	Out of compliance. However, failure to perform a life cycle cost analysis will not impact safety. Based on initial review, it is expected that NFPA, NMCA, and ARI requirements have been met.
1550-2.5.3	45) Fans to be designed and specified to assure stable, non-pulsing, aerodynamic operation in the range of operation over varying speeds. Air-handling units and fans in sizes over 1 hp to use belt drives. Fans with motors of 10 hp or less to be designed with adjustable motor pulley sheaves to assist in air balancing of systems. Fans with motors greater than 10 hp to use fixed (nonadjustable) drives that can be adjusted by substituting fixed motor pulley sheaves of different diameters. Supply air-handling units and return air fans in variable-air-volume systems to control capacity through the use of variable-speed drives, inlet vanes, or scroll bypass dampers. All fans to comply with AMCA Standard 210, ASHRAE Standard 51, and ASHRAE Equipment handbook.	Compliance with AMCA Standard, ASHRAE Standard 51, and ASHRAE equipment handbook.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	46) Spark-resistant construction to be used where required by NFPA. All fans and accessories to be designed and specified to meet all smoke and flame spread requirements of NFPA 255.	Compliance for B Plant based on initial review. (Note that NFPA 255 is a testing standard, probably quoted in error, and that NFPA 90A actually covers smoke and flame spread requirements with which B Plant appears to comply.)
	47) Selection of fan construction materials to consider corrosion resistance and cost.	Compliance with intent. Corrosion resistance considered in design. Costs were not considered in design but will not impact safety.
1550-2.5.4	48) Heating and cooling coils to comply with ARI410. Heating or cooling coil selection not to conflict with ASHRAE Fundamentals handbook or ASHRAE Equipment handbook.	Compliance with SDC-5.1.
	49) Cooling coils to be designed with a maximum face velocity of 600 fpm. Coils designed with face velocities exceeding 500 fpm to be specified with provisions to prevent condensate carryover, or use moisture eliminators. Coils to be specified with drain feature.	Compliance with SDC-5.1.
	50) Recirculating air systems with outside winter air design temperatures below freezing to be designed with a preheat coil located either in the outside air intake or in the mixed air stream upstream of the cooling coil unless the theoretical mixed air temperature is calculated to be above 35°F.	Not applicable. No recirculating air systems; however, fresh air intakes appear to have preheaters.
1550-2.5.5	51) Air-cleaning equipment for ductwork installation to be easily removable, serviceable, and maintainable. Air-cleaning equipment to have face velocities as recommended by the filter manufacturer to achieve maximum efficiency and minimum pressure drop. Filters to be constructed of noncombustible materials meeting the requirements for UL 900, Class I.	Compliance with SDC-5.1.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	52) Air filters to be located on the suction side of fans and coils and in other special locations as required for air treatment.	Compliance. Air filters located on suction side of fan.
	53) HEPA filtration system to be used for areas handling carcinogenic, bacteriological, radioactive, or highly toxic materials to minimize exposure to personnel or the environment. HEPA filters to be designed for a maximum pressure drop of 1.0 in. water at rated flow when clean.	Compliance. HEPA filters are provided.
	54) Filters used in building environmental air-handling systems for removing particulate matter from atmospheric air to be specified to meet minimum efficiencies required by the ASHRAE Dust Spot method using atmospheric dust for medium-efficiency applications. Prefilters to have a minimum efficiency of 35% when tested with atmospheric dust.	Compliance. Prefilters are 85% NBS.
1550-2.5.6	55) Ductwork systems to be designed for efficient distribution of air from the conditioned spaces with consideration of noise, available space, maintenance, air quality and quantity, and optimum balance between expenditure of fan energy (annual operating cost) and duct size (initial investment).	Compliance with all factors except costs. Costs were not explicitly factored into the design, but this will not impact safety.
	56) Ductwork systems to be designed to meet the leakage rate requirements of SMACNA HVAC Air Duct Leakage Test Manual.	Compliance with intent. Ductwork completed after 1979 comply with SMACNA.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	57) Ductwork to be designed to comply with NFPA 90A, including specification and installation of smoke and fire dampers at fire wall penetrations and smoke pressurization/containment dampers as required for smoke pressurization/evacuation systems. Exhaust ductwork to comply with NFPA 91.	Out of compliance. Ductwork framing in Building 271-B is wood. Fire dampers have been installed in all ducts which penetrate the walls of Building 221-B as part of upgrade project B-472.
	58) Ductwork systems to have testing and balancing dampers and accessories specified and installed as discussed in Section 1550-3.2, Testing and Balancing Devices.	B Plant appears to be in compliance.
	59) Penetrations of ductwork through security barriers to be minimized. Penetrations more than 96 $in.^2$ in area and more than 6 in. in minimum dimension to provide a penetration delay equal to that required for the security barrier. The physical attributes and intended service of the ductwork and the axial configuration of the barrier penetration to be considered when considering that penetration delay.	Security impacts are out of scope of this study.
1550-3.1	60) System performance tests to be specified for mechanical air distribution and HVAC water distribution systems to verify compliance with DOE project criteria. These tests shall be performed by an independent AABC testing organization.	B Plant appears to be in compliance with intent. Although it is not clear that HVAC testing procedures are in effect except for HEPA filtration for regular periodic checks, all ventilation systems were performance tested after installation by independent qualified onsite personnel. HEPA filtration is performance tested at least yearly.
1550-3.2	61) HVAC air and water distribution systems to be provided with permanently installed calibrated testing and balancing devices with access as needed to accurately measure and adjust water flows or air flows, pressures, or temperatures as required.	See Item 60.
1550-3.3	62) Test and measuring locations to be noted on construction drawings. The use of duct mounted air flow monitoring stations to be considered where limited duct space or configuration restrict the use of pitot tube traverse procedures or where especially sensitive measuring requirements are dictated by DOE project criteria.	See Item 60.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation (Continued)

Applicable Section		Design Criteria Summary	B Plant Implementation
1550-99.0		Non-reactor Nuclear Facilities - General	
1550-99.0.1	63)	Ventilation systems to be designed to provide continuous air flow pattern from the environment into the building and then from noncontaminated areas of the building of potentially contaminated areas. Thus, the air flow is toward areas of higher radioactive or hazardous material contamination. Dampers to be located so that significant cross-contamination will not occur in case of a localized release of material.	Compliance. Air flow pattern is progressively toward areas of higher contamination. Out of compliance. Although no dampers are provided to prevent cross-contamination, the air flow pattern is sufficient to prevent cross-contamination. Airlocks should be strongly considered for installation between the operating gallery and the office building. See discussion in Section 4.3.1
	64)	Ventilation system balancing to be specified to ensure that the building air pressure is always negative with respect to the outside atmosphere.	Compliance. Building 221-B is always negative with respect to atmosphere. Building 271-B is slightly positive with respect to atmosphere. However, it is considered "cold" or never contaminated, so that positive pressure is appropriate.
	65)	Portions of ventilation and offgas systems that provide required functions following a seismic event to be designed to be functional following a DBE.	Out of compliance. Portions of the system are not seismically resistant. See discussion in Section 4.3.1.
	66)	The failure of ventilation and offgas systems not designed as safety class systems shall not prevent other facility safety class systems from performing their required safety functions.	Out of compliance. Nonsafety class items (such as the water seals) may fail and impact safety class ventilation.
	67)	Hydrogen gas storage areas and process areas that use hydrogen to have provisions for sufficient ventilation to ensure that under all conditions (normal operations, anticipated operational occurrences, and DBA conditions) the hydrogen concentration in the air and/or offgas will never exceed 4% by volume.	Out of compliance. Exhaust ventilation in its current configuration is not expected to survive a DBE. Failure of exhaust ventilation may result in hydrogen concentrations above 4% by volume.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	68) Equipment in ventilation and offgas systems to be appropriately qualified to ensure reliable operation during normal operating conditions, anticipated operational occurrences, and during and after a DBE.	Out of compliance. Exhaust ventilation system is not seismically qualified. See discussion in Section 4.3.1.
	69) The design of a confinement ventilation system shall ensure the ability to maintain desired air flow characteristics when access doors or hatches are open.	Based on initial review, B Plant expected to be in compliance.
	70) The ventilation system design shall provide the necessary confinement capability under all credible circumstances with the addition of a single failure in the system.	Compliance for office building and galleries, as no single failure is identified, causing unacceptable consequences per SD-WM-ES-072, Rev. 0. Canyon appears to be in compliance except for DBE, which is under evaluation. See Item 65.
	71) If the maintenance of a controlled, continuous confinement air flow is required, electrical equipment or components required to provide the air flow shall be supplied with safety class electric power and provided with an emergency power source.	Out of compliance. Safety class electric power is not supplied to any ventilation equipment.
	72) Air cleanup systems shall be provided in confinement exhaust systems to limit the release of radioactive or other hazardous material to the environment and to minimize the spread of contamination within the facility.	Compliance with respect to exhaust to environment. However, see Item 63 and discussion in Section 4.3.1.
	73) The following general cleanup system requirements shall be met for confinement ventilation design:	
	(a) The level of radioactive material in confinement exhaust systems shall be monitored.	Compliance. Monitoring of confinement exhaust is provided by a probe in the stack.
	(b) Alarms shall be provided to annunciate activity levels above specified limits.	Compliance.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation (Continued)

Applicable Section		Design Criteria Summary	B Plant Implementation
Continued	73) (c)	Appropriate manual or automatic protective features are required to prevent an uncontrolled release of radioactive material.	Compliance.
	(d)	Elevated confinement exhaust discharges are required.	Compliance. Stack provides elevated discharge.
	(e)	If an elevated stack is used for confinement exhaust discharge, provisions shall be made to ensure adequate ventilation in the event of stack failure.	Out of compliance. See Item 65.
	(f)	Air filtration units must remain functional throughout DBAs and retain collected materials after the accident.	Out of compliance. See Item 65.
	(g)	The number of air filtration stages required for any area of a facility shall be determined by safety analysis based on the quantity and type of radioactive materials to be confined.	Compliance.
	(h)	Air filtration units shall be installed as close as practical to the source of contaminants to minimize the contamination of ventilation system ductwork.	Compliance.
	(i)	The cleanup system shall have installed test and measuring devices and shall facilitate monitoring operations, maintenance, and periodic inspection and testing during equipment operation or shutdown, as appropriate.	Compliance.
	(j)	Ventilation exhaust and air cleanup systems associated with the process confinement (primary confinement) shall not be shared with process area and building confinement (secondary and tertiary) systems.	Out of compliance. Vessel vent systems discharge to the building exhaust system air tunnel. However, these are apparently HEPA filters installed on the process confinement air (vessel vent system) just upstream of the discharge point into the ventilation tunnel. Therefore, this configuration is not expected to impact safety.

TABLE 3. B Plant Implementation of DOE 6430.1A General Design Criteria for Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
Continued	73) (k) Consideration shall be given to providing HEPA filtration or fail safe backflow prevention for process area intake ventilation systems.	Compliance. Project W-024 will provide dampers for backflow prevention.
1550-99.0.1	74) Gas storage areas and process areas that use nonradioactive hazardous materials shall have ventilation systems designed to ensure that the hazardous material concentrations do not exceed the limits referenced in DOE 5480.10 and are ALARA in the workplace environment. Effective loss-of-ventilation alarms shall be provided in all of these areas.	Noncompliance. Ventilation system for chemical storage area (AMU) on third floor of Building 271-B may not have the capacity to adequately exhaust the area in case of an AMU spill. Order 5480.10 refers to Title 29 CFR 1910, Subpart Z, for exposure limits for toxic and hazardous materials.

TABLE 3A. B Plant Comparison to CS&Rs: Process and Building Ventilation

Applicable Section	Design Criteria Summary	B Plant Implementation
5480.7 Fire Protection	9a(3) The facility containment systems are designed to preclude an offsite release of hazardous amounts of toxic materials under maximum credible fire conditions.	TBD - Noncompliance. Ongoing fire safety analysis is evaluating scenarios for both organic fire and hydrogen explosion. Although protective systems for the HEPA filters are installed, it is not clear they are adequate to prevent a radioactive release from these scenarios.
	9a(4) Exhaust and ventilation systems, including filters, are protected or isolated from the effects of a credible fire to the extent that hazardous amounts of toxic materials or combustion products will not escape.	
5820.2A I 3b (2)(f) High Level Waste Storage And Transfer Operations	Where required, ventilation and filtration systems shall be provided to maintain radionuclide releases within the guidelines specified in DOE 5481.1B and applicable EH Orders.	Compliance. This particular requirement is listed for new facilities. Even though B Plant is not a new facility, its management operates in accordance with federal regulations for employee exposure limits and in accordance with ALARA principles.

TABLE 3A. B Plant Comparison to CS&Rs: Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
5820.2A (Continued)	Ventilation systems shall be provided where the possibility exists for generating flammable and explosive mixtures of gases (e.g., hydrogen/air or organics/air).	Compliance. 5.8.2 of the SAR (SD-WM-SAR-013) describes the means of exhaust for any gases generated during processing. Monitoring provides information on the approach to flammability limits, with mitigation by air admixture in a safely contained space to dilute below flammability limits.
29 CFR 1910.96 (c) Exposure to Airborne Radioactive Material	This section states that no employer shall possess, use, or transport any radioactive material in such a manner as to cause any employee to be exposed to airborne radioactive material in concentrations in excess of the limits specified in 10 CFR 20, Table 1.	Compliance. B Plant is operated in accordance with federal guidelines for employee exposure and within principles of ALARA, with exposure from routine operations not exceeding 125 mr/yr. This is within Table 1 limits. In addition, respiratory protective equipment is readily available. Employees are trained in the use of these protective devices. Personnel trained in health physics are available to monitor the need for respiratory protection and to provide guidance and assistance in the use of the devices.
29 CFR 1910.134 Respiratory Protection	This section outlines employer and employee responsibilities regarding respiratory protection for breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors.	Compliance. Respiratory protection equipment is readily available. Employees are required to be trained in the use of these protective devices. Personnel trained in health physics are available to monitor the need for respiratory protection and to provide guidance and assistance in the use of the devices.

TABLE 3A. B Plant Comparison to CS&Rs: Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
WAC 296-24-33017 (c) Ventilation	(i) Enclosed processing buildings shall be ventilated at a rate of not less than 1 cubic foot per minute per square foot of solid floor area. This shall be accomplished by natural or mechanical ventilation with discharge or exhaust to a safe location outside of the building. Provision shall be made for introduction of makeup air in such a manner as not to short circuit the ventilation. Ventilation shall be arranged to include all floor areas or pits where flammable vapors may collect.	Compliance. Preliminary investigation shows that although the crane gallery and canyon areas are not considered normally occupied areas, ventilation of slightly more than one cubic foot/minute per square foot of building is provided. In Building 271-B, ventilation rate appears to be approximately 2-1/2 times the minimum. The electrical gallery, pipe gallery, and operating gallery appear to be supplied with slightly less than twice the minimum.
	(ii) Equipment used in a building and the ventilation of the building shall be designed so as to limit flammable vapor-air mixtures under normal operating conditions to the interior of equipment, and to not more than 5 feet from equipment which exposes Class I liquids to the air. Examples of such equipment are dispensing stations, open centrifuges, plate and frame filters, open vacuum filters, and surfaces of open equipment.	Compliance. Process flammables are limited to containment within vessels in cells, and are served by separate ventilation exhaust systems than those which serves rest of the building.
WAC 296-62-07517 Asbestos	(2) Permissible exposure to airborne concentrations of asbestos fibers.	
	(a) The 8-hr time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed two fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in (5) of this section.	Compliance. Normally occupied areas of building have been treated so that asbestos is contained and kept separate from normal breathable atmosphere. Asbestos control program has been implemented, and treatment continues as appropriate for newly discovered problem areas. When asbestos removal or other disturbance of asbestos is necessary, the area is physically separated from other occupied areas by installation of temporary partitions, signs are posted, and steps are taken to mitigate exposure to all workers in accordance with applicable regulations.

TABLE 3A. B Plant Comparison to CS&Rs: Process and Building Ventilation (Continued)

Applicable Section		Design Criteria Summary	B Plant Implementation
	(b)	Ceiling concentration. No employee shall be exposed at any time to airborne concentrations of asbestos fibers in excess of 10 fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in (5) of this section.	Compliance. See Item WAC 296-62-07517, (2)(a).
29 CFR 1910.1001 Asbestos, Tremolite, Anthophyllite, and Actinolite	(a)	This section applies to all occupational exposures to asbestos, tremolite, anthophyllite, and actinolite, in all industries and covered by the Occupational Safety and Health Act.	Compliance. See Item WAC 296-62-07517, (2)(a).
(2)(c)		The employer shall ensure that no employee is exposed to an airborne concentration of these materials in excess of 0.2 fiber per cubic centimeter of air as an eight hour time weighted average.	Compliance. See Item WAC 296-62-07517, (2)(a).
NFPA 91		Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying.	
		1-2 Purpose. The object of this standard is to eliminate or reduce the known fire and explosion hazards inherent in the operation of these systems and to prevent them from becoming the means of spreading fire.	Compliance. Process flammables are limited to containment within vessels in cells, served by vessel vent exhaust systems. Mitigation of fire spreading is accomplished via physical barriers of vessels and cell walls, length of ductwork to nearest downstream combustibles (HEPA), and firescreens and deluge systems for HEPAs.

TABLE 3A. B Plant Comparison to CS&Rs: Process and Building Ventilation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	2-1 General. These general requirements apply to systems for removal of flammable vapors (including paint spraying residue); corrosive fumes; dust, stock, and refuse conveying except as modified or amplified by the specific rules which follow (Chapters 3 and 4) or by the standards applying to specific industries or operations. This standard discusses duct and connection integrity, minimum duct thicknesses, etc. (Note that the formal title of the is standard is NFPA 91-1983.)	Compliance for any replacements to old ventilation system. Existing system includes ventilation tunnel of steel reinforced concrete, for example, which is not covered specifically by this standard. However, existing system meets intention of criteria for integrity of ductwork and for the ability to withstand fire.
ANSI/ASME N509-1980		
5. Components		
5.1 HEPA Filters	HEPA filters shall meet the construction, material, test, and qualification requirements of military specification MIL-F-51068 and shall have fiberglass media conforming to the requirements of military specification MIL-F-51079.	Compliance for any replacements for HEPAs. Existing system includes some old filter banks containing HEPAs that may not comply, but that have been abandoned in place and are no longer used. Replacements for filter banks now used comply with these military specifications.
5.1.1 Construction	Filters for use in containment shall have steel cell sides and shall be compatible with the chemical composition of the air stream. Filter systems exposed to temperatures greater than 200°F or used in ESF systems shall have steel cell sides.	Compliance for any replacements for HEPAs. See comments for Item 5.1.
5.5 Air Heaters	Heaters shall be electric and capable of meeting the requirements of Par. 4.5 of this standard (discusses structural load requirements). Heaters shall be designed for replacement without metal cutting or welding. This criteria applies to exhaust stream heating and is required by DOE 6430.1A, 1550-2.5.5, Air Cleaning Devices, which states that HEPA filter assemblies shall comply with ASME N509.	Out of Compliance. According to SD-WM-SAR-013, Par. 5.4.3.1, the vessel vent systems have steam heaters.

TABLE 4. B Plant Conformance with DOE 6430.1A General Design Criteria for Fire Protection

Applicable Section	Design Criteria Summary	B Plant Conformance
0110-6	FIRE PROTECTION	
0110-6.1	1) Fire Protection facility compliance with: o DOE 5480.4 Attachment 2, Section 2.C o DOE 5480.7 o 29 CFR 1926 o 29 CFR 1910 o NFPA 101 - Life Safety Code	See specific items discussed in this section.
	2) Any materials with unusual fire characteristics such as urethane foams, and any materials that develop significant quantities of toxic or other harmful products of combustion shall not be used as interior finishes or other interior applications without the approval of the cognizant DOE fire protection authority. The use of foamed plastics in construction shall be prohibited unless they fully comply with FM 1-57.	Compliance with intent. Although some urethane foam plastics may be in place, no large quantities of materials with unusual fire characteristics were used in construction.
0110-6.2	3) A special fire protection design analysis shall be made of each facility vital to DOE mission accomplishment. The analysis shall use time parameters established in accordance with DOE 5480.7. The analysis shall identify the special fire prevention and protection features and controls deemed by the cognizant DOE fire protection authority to achieve a level of fire protection for vital facilities and programs that meets or exceeds the "improved risk" level.	Noncompliance. Complete assessment of fire protection compliance is dependent on the performance of a fire protection design analysis (Ref. DOE 6430.1A [0110-6.2] and DOE 5480.7). This analysis requires an established base line design flowsheet and appropriate accident analysis to establish the DBF and associated risks. This analysis will also establish fire barrier requirements, the fire protection required to establish "improved risk," the need for special protection systems, and the heat loads and risk factors.

TABLE 4. B Plant Conformance of DOE 6430.1A General Design Criteria for Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Conformance
	4) A general fire-protection design analysis shall be made of each facility to ascertain and limit the cost of future damage repair and replacement of facilities and their contents from fire. The analysis shall be made using those parameters established in DOE 5480.7. The analysis shall determine the special fire prevention and protection features and controls deemed by the cognizant DOE fire protection authority to achieve a level of improved risk fire protection that limits damage to an acceptable level.	Noncompliance. See Item 3.
	5) Inclusion of fire protection design analysis as part of the Title I Design Summary document required by DOE 4700.1.	Noncompliance. See Item 3. In the upgrade projects, the intent of this requirement was met. For future upgrades, fire protection design analysis will be part of the project documentation.
0110-6.3	6) All facilities shall be divided into areas in which the total potential fire loss to each area and its equipment does not exceed $75 million as described in DOE 5480.7. Areas shall be separated by fire walls and barriers with not less than 4-hr fire-resistance ratings. Where exceptions are necessary for reasons of operations or equipment, exemption procedures shall comply with DOE 5480.7.	Noncompliance. The canyon probably conforms to this requirement as walls and cell hatch covers provide the fire protection. Ongoing analysis will confirm proper locations for barriers. New fire barriers may be required.
	7) Wall, floor and ceiling, and roof and ceiling assemblies shall be tested and rated for their fire resistance by UL or FM.	Compliance. Evaluation performed by WHC Fire Safety.
0110-6.4	8) Hazardous areas such as radioactive spaces or spaces with inert atmosphere shall have sufficient alarms and interlocks to assure that access by emergency personnel will not endanger such personnel or result in a public hazard.	Compliance with intent. Administrative controls are utilized to provide adequate protection (protective equipment requirements). Project B-392 included an alarm annunciator panel at the main entry door to Building 271-B that indicates the zone in which the fire is located. This will enhance administrative control of emergency personnel response.

TABLE 4. B Plant Conformance of DOE 6430.1A General Design Criteria for Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Conformance
	9) The design of hazardous areas shall facilitate access by emergency personnel from the exterior, and at the same time, shall maintain any required confinement or containment using air locks or other features.	Compliance. Airlocks are provided for personnel access. Primary confinement areas are not normally accessed by emergency personnel.
	10) Facility exterior design per NFPA 80A.	Compliance. If other structures near Building 221-B were to burn, the building exterior (shell) will not be affected to any significant extent by these exposures.
0110-99	SPECIAL FACILITIES	
0110-99.0.6	11) Development of the DBF to include considerations that may exist during normal operations and special situations (e.g., during periods of decontamination, renovation, modification, repair, and maintenance).	Compliance. DBF analysis is being performed.
0110-99.0.6 (Continued)	12) The structural shell surrounding the critical areas and their supporting members to remain standing and continue to act as a confinement structure during the DBF under conditions of failure of any fire suppression system not designed as a safety class item. Fire resistance of this shell to be attained by an integral part of the structure (concrete, walls, beams, and columns) and not by a composite assembly (membrane fire proofing).	Compliance. It is unlikely the canyon structure will be compromised in the event of DBF. The structure of Building 221-B will remain intact and continue to act as a confinement structure.
	13) In no event shall the fire resistance rating be less than 2-hr under conditions of failure of any fire suppression system not designed as a safety class item.	Compliance. The structure of Building 221-H will remain intact whether or not the fire suppression systems function.
	13a) Penetrations in this shell shall incorporate, as a minimum, protection against DBF exposures unless greater protection is required by other sections of these criteria.	Compliance.

TABLE 4. B Plant Conformance of DOE 6430.1A General Design Criteria for Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Conformance
1530	FIRE PROTECTION	
1530-1	14) Fire protection systems to comply with DOE 5480.7.	Noncompliance. See Item 3. (Section 4.7 of the B Plant SAR indicates that 5480.7 shall be used for design.)
1530-2	15) Fire protection design to incorporate an improved risk level of fire protection as directed in DOE 5480.7.	Noncompliance. See Item 3.
B1530-3.1	16) All sprinkler or other fire suppression system components to be all UL or FM approved.	Compliance. This has been required for all upgrade projects.
1530-3.2	17) Determination of Occupancy Hazard Classification for facilities per NFPA 13.	Compliance. This requirement was met in Building 271-B, but does not apply to Building 221-B. Organics are pumped through the occupied pipe gallery, but this is not a regular operation and thus no provisions for permanent sprinkler systems have been made.
1530-3.3.1	18) NFPA 13 to be used for calculating water demand for systems designed using pipe schedule methods.	Compliance. Project HCP-675 which installed the 271-B fire sprinklers utilized this methodology.
1530-3.3.2	19) NFPA 13 to be used for hydraulically designed sprinkler systems to determine water supply requirements for hose streams (gpm) and duration (min).	Not applicable. See Item 18.
	20) For ordinary hazard occupancies and above, hose stream requirements shall be a minimum of 500 gpm.	Compliance.
	21) Determination of water supply adequacy shall be made on the basis of actual flow test data gathered using methods in NFPA 13, Appendix B.	Compliance. Flow test was performed by Factory Mutual representatives.
1530-3.3.3	22) Where reliance is placed on fire department response, water supply to be adequate to supply (at least 0.03 gpm/ft^3 of fuel in the largest fire area).	TBD. See Item 3.

TABLE 4. B Plant Conformance of DOE 6430.1A General Design Criteria for Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Conformance
1530-3.3.3	23) Water supply at the hydrants to be available at 20 psig residual pressure.	Compliance. The raw water system operates at about 70-100 psi. The sanitary water system operates at about 100 psi. See Item 61.
1530-4.1	24) Sprinkler systems to comply with NFPA 13.	Compliance. NFPA 13 used per FDC for project B-472. SDC 7.8 for fire alarms also calls out NFPA 13.
1530-4.2.1	25) Sprinkler systems to normally be wet pipe for ordinary installation, using pipe schedule sizes listed in NFPA 13.	Compliance. Sprinklers in Building 271-B are wet. Fire sprays in cells are dry until valve at riser base (fire header) is manually opened.
	26) Hydraulic designs to be considered for all systems.	Compliance. No hydraulic design methods were used in B Plant.
1530-4.2.2	27) Dry pipe systems to be provided in unheated areas or other areas subject to freezing temperatures.	Compliance with intent. Anti-freeze loops are used in laundry storage area and elevator penthouse in compliance with NFPA 13.
	28) Water demands for dry pipe systems to be computed over areas 30% greater than for comparable wet pipe systems.	Not applicable. There are no dry pipe systems at B Plant.
1530-4.2.3	29) Pre-action system to be used where it is important to prevent the accidental discharge of water.	Compliance. Pre-action systems are used in cells that require foam fire suppression. Other cells have manual activation of sprinklers and do not need pre-action systems.
	30) Detection system for activation of the pre-action valve to have a separate alarm/supervisory signal to indicate status.	Compliance. Pre-action systems conform to this. Status of valves given in Room 205 (of Building 271-B) and central fire station.
	31) For extra hazard areas, a deluge system with open sprinkler heads may be used which complies with NFPA 13.	Compliance with intent. The cell foam system is a deluge system which complies with NFPA 16.
1530-4.2.5	32) Self-restoring sprinkler systems to be used where the water from sprinklers will be contaminated by contact with room contents.	Compliance with intent. Sprinklers to the cells are manually controlled, but not self-restoring. The fire foam system for the cells shuts off automatically after the heat detectors cool below the set point.

TABLE 4. B Plant Conformance of DOE 6430.1A General Design Criteria for Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Conformance
1530-4.2.6	33) Quick-response sprinklers to be considered in lieu of conventional sprinklers in areas where there are high-value concentrations (values per square foot).	Not applicable to B Plant facilities.
1530-5.1	34) Special protection systems to be considered for use in extinguishing or controlling fire in easily-ignited, fast-burning substances such as flammable liquids, some gases, and chemicals.	Compliance. Special protection systems are used in organic cells. The system is an aqueous film forming foam with nozzles in the top portion of cells above the tanks.
	35) Special protection systems to supplement, but not substitute for, automatic sprinklers.	Not applicable to B Plant facilities.
1530-5.2.1	36) Water spray systems to comply with NFPA 13.	Compliance. Sprinklers in 271-B and 221-B comply.
1530-5.2.2	37) Carbon dioxide agent quantity requirements and installations procedures to comply with NFPA 12.	Not applicable to B Plant facilities.
1530-5.2.3	38) Dry chemical systems to comply with NFPA 17.	Not applicable. Dry chemical systems are not installed in B Plant.
1530-5.2.4	39) Foam systems to comply with NFPA 11, 11A, 16, 16A, and NFPA 409.	Compliance with intent.
1530-5.2.5	40) Halon 1301 systems and Halon 1211 systems to comply with NFPA 12A and NFPA 12B respectively.	Not applicable. Halon systems are not installed in B Plant.
1530-6	41) Standpipe system installations to comply with NFPA 14.	Compliance. Standpipe installation in 271-B complies with NFPA 14.
1530-7	42) Portable fire extinguishers to comply with NFPA 10.	Compliance.

TABLE 4. B Plant Conformance of DOE 6430.1A General Design Criteria for Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Conformance
1530-8.1	43) Fire detection and alarm devices to have UL-listed components or be FM-approved.	Compliance. Hanford generally complies with this for all installations. (Project B-392 specifies this; SDC7.8 for fire alarm systems also specifies this.)
	44) Devices and systems to comply with NFPA 71 and 72A through 72H as applicable.	Compliance with intent. Although NFPA 72 A-H are utilized where applicable, NFPA 71 was not imposed except via reference.
1530-8.2.1	45) Fire alarm systems to have the following basic features: o Transmission of signals to facility fire department alarm center per NFPA. o Building local alarms or zone in alarm. o Trouble signals as required. o Emergency battery backup for system operation. o Electric supervision of all circuits per NFPA. o Supervisory devices for all critical functions. o Capability to annunciate at least three separate conditions: - Fire alarm. - Supervisory alarm. - Trouble signal indicating a fault in either of the first two.	Compliance. Gamewell panel is in place to transfer signal using RF. B Plant complies with all elements of this section.
1530-8.2.2	46) Alarms that respond to flow of water shall be provided wherever a sprinkler system is installed and shall comply with NFPA requirements.	Compliance. Flow alarm switches are included in accordance with NFPA 72 A.
1530-8.2.2	47) Manual fire notification method such as manual fire alarm boxes to be provided and located in accordance with appropriate NFPA standards.	Compliance. In accordance with NFPA 72 A.
1530-8.3.1	48) Automatic detection systems may be used to supplement or to actuate extinguishing systems.	Compliance. Heat detectors used to actuate 221-B cell foam system.

TABLE 4. B Plant Conformance of DOE 6430.1A General Design Criteria for Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Conformance
	49) Automatic fire detectors and their spacing to comply with NFPA 72E and Appendices A, B, and C.	Compliance. B Plant upgrade project B-392, Fire Alarms, complies with this requirement.
1530-8.3.2	50) Heat-actuated detectors appropriate when: o Speed of detection is not a prime consideration. o Space is small or confined, and rapid heat build-up is expected. o Ambient conditions do not permit use of other detection devices.	Compliance. Heat detectors are used in the canyon cells and air tunnel before and after the HEPA filters.
1530-8.3.3	51) Flame-actuated detectors appropriate when rapid detection is of prime importance in high hazard areas.	Not applicable to B Plant facilities.
1530-8.3.4	52) Smoke detector location and spacing to be determined by the methods of NFPA 72E and its Appendix C.	Compliance. Located on fire doors and dampers only. Upgrade Project B-472 is in compliance providing coverage in 225-B.
	53) Smoke detectors to be of the type operating on one of the principles described in NFPA 72E.	Compliance. See Item 52.
1530-9	54) Wherever practical, dedicated fire water storage and distribution systems to be used. If dedicated fire water supply cannot be provided, fire protection water supply to assure availability regardless of simultaneous process and domestic water usage.	Compliance with intent. Raw water provided from the adjacent steam plant supplies the fire water and process header. This is sufficient water for both used simultaneously. Thus, the fire water supply is assured. Secondary sources of water for fire protection are pumphouses 282-BH and 282-B for a total flow of 1000 gpm. *Safety class water supply may be required for specific Safety Class I fire protection system - TBD.
	55) Automatic sprinkler systems or stand pipes fed from a potable water system to have check valves installed in the sprinkler lead-ins.	Compliance with intent. Sanitary water can be used to feed sprinklers. A check valve is installed.
	56) Underground fire water mains, valves, hydrants, and fittings to be installed and tested per NFPA 24 and Section 0260.	Compliance with intent.

TABLE 4. B Plant Conformance of DOE 6430.1A General Design Criteria for Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Conformance
1530-9 (continued)	57) Water storage tanks to comply with NFPA 22.	Not applicable. B Plant does not used stored water for fire suppression.
	58) Fire pumps to comply with NFPA 20.	Not applicable to B Plant facilities, although diesel raw water pumps are identified in the SAR for backup to fire protection.
	59) Water storage to be sufficient to meet the requirements of NFPA 13.	Not Applicable. B Plant does not use stored water for fire suppression.
	60) Where feasible, all water distribution systems to be of the looped grid type providing two-way flow with sectional valving arranged to provide alternate water flow paths to any point in the system.	Compliance. B Plant complies with this requirement. Loop consists of process water header and fire protection header. Valving is only at either end of each header so that flow path options are limited.
	61) Fire mains (except those supplying a single hydrant or extensions of existing smaller mains) shall be at least 8 inches. Mains shall be sized to supply the largest fire demand plus the largest domestic and process demand with consideration for residual sprinkler system pressure requirements.	Compliance. Raw water mains are 8 in. and 10 in. TBD. See Item 3. Maximum demand and residual pressure requirement of 20 psi must be evaluated.
	62) Sprinkler supply lead-ins to be at least 6 in., except for very small sprinkler systems.	Compliance. Sprinkler lead-in to each cell is 4 in. Cell system considered a small system 271-B lead-in is 8 in.
	63) For combined fire and domestic process water systems, supplies to be arranged and valved so that the domestic and process systems can be shut down without shutting off the fire system supply.	Noncompliance. Shutdown of raw water systems may affect specific fire suppression system. See Item 3.
	64) Sprinkler risers to be located at an exterior wall.	Compliance. Building 271-B sprinkler system riser is located on the loading dock at Column line 4.

TABLE 4. B Plant Conformance of DOE 6430.1A General Design Criteria for Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Conformance
	65) Outside control valves that can be locked open to be provided on each supply lead-in and located, if possible, a minimum distance of 40 ft from the building. Post Indicator Valves (PIVs) to be used where possible. If PIVs not possible, OS&Y valves in pits may be used.	Compliance. PIV with tamper alarm is located near 291-B sand filter.
	66) Key-operated buried valves not to be used for sprinkler control valves.	Compliance. PIV and OS&Y valves are used.
1530-9 (Continued)	67) No more than one valve controlling a sprinkler supply lead-in.	Compliance. Installed in accordance with NFPA 13.
	68) All lead-ins to be connected with the sprinkler system at the base of the riser.	Compliance. 271-B riser lead-in connected at base of riser in basement.
	69) Alarm valves to be located as close as practical to the building entry point.	Compliance. Installed in accordance with NFPA 13.
	70) Hydrants to be located such that hose lays from hydrants to all exterior portions of a protected building are no more than 300 ft.	Compliance. (Except 221-BB ~ 325 ft.)
	71) Hydrants not to be closer than 50 ft from building.	Compliance. Hydrants are about 100 ft from Building 271-B.
1530-99.0	72) An assessment shall be made early in the design or modification to determine the facility structures, systems, and components that shall be protected against the effects of a DBF and explosion. A fire protection engineer or person knowledgeable in applying the principles of fire protection shall develop the fire protection system. To maximize the protection against fire, the system shall contain an appropriate integration of fire prevention, detection, and suppression features.	Compliance. The design procedures for B Plant comply with the intent of the requirement. See Item 3.

TABLE 4. B Plant Conformance of DOE 6430.1A General Design Criteria for Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Conformance
1530-99.0 (Continued)	73) Fire protection systems shall not 1) prevent a facility from achieving and maintaining a safe shutdown condition, 2) prevent the mitigation of DBA consequences, or 3) cause an inadvertent nuclear criticality.	Compliance. Effectiveness of fire protection systems is dependent upon design based on analysis discussed in Item 72.
	74) Fire suppression systems used within areas containing fissile material and other material capable of sustaining a chain reaction shall not result in flooding or in other conditions that could produce an inadvertent nuclear criticality.	Not applicable to B Plant as it currently exists. This should be assessed if the future mission involves fissile material.
	75) Fire suppression systems used in areas that contain safety class equipment shall not result in flooding of the safety class equipment or otherwise reduce the ability to achieve required safety functions.	TBD. See Item 3. Analysis/evaluation required to determine potential damage to HEPA filters if tunnel spray system is inadvertently activated.
	76) Total reliance shall not be placed on a single fire suppression system. Appropriate backup capability shall be provided.	Noncompliance. No back-up capability is provided for the cell foam system.
	77) Failure of a fire suppression system shall not prevent safety class equipment from performing its necessary functions.	TBD - Noncompliance. See Item 3. Failure of the cell foam or tunnel spray systems may result in failure of HEPA filter integrity.
	78) To ensure that redundant safety class components shall be capable of performing the necessary safety functions, the facility design shall provide appropriate separation against fire, explosion, and failure of fire suppression systems.	Noncompliance. Fire barriers have not been established (Ref. WHC letter #1350-88-225).

TABLE 4. B Plant Conformance of DOE 6430.1A General Design Criteria for Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Conformance
1530-99.0 (Continued)	79) Fire protection systems, or portions of them that must function following a seismic event, shall be designed to remain operable following the DBE. The fire protection system shall also be designed to withstand the effects of tornadoes and other severe natural phenomena and to remain functional to the extent that sufficient protective and suppressive capabilities are maintained to prevent the uncontrolled release of radioactive materials as a result of fire.	Not applicable. Currently there are no SC-1 fire protection systems. The fire protection system is not designed to be operable following the DBE.
	80) Mechanical- and fluid-system portions of the fire protection systems shall meet the appropriate NFPA requirements.	Compliance. As indicated separately in this document.
	81) The operation or failure of a fire protection system that interfaces with a safety class system such as a safety class water system shall not prevent the safety class system from completing its safety functions when required.	TBD. See Item 3.
	82) Confinement systems, particularly the building structural shell and its associated ventilation system, shall be designed with the capability of retaining the confinement function during the DBF.	TBD - Noncompliance. See Item 3.
	83) When the use of water sprinkler coverage is precluded because of nuclear criticality or other hazards, non-aqueous extinguishing systems (i.e., inert gas, carbon dioxide, high-expansion foam, or halogenated organics) shall be used.	Not Applicable. See Item 74.

TABLE 4. B Plant Conformance of DOE 6430.1A General Design Criteria for Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Conformance
1530-99.0 (Continued)	84) Fire protection systems shall be designed so that the failure of any component (equipment or control device) shall not disable the entire fire protection system. Fire protection systems and components shall have fail safe features and audible and visual alarms for operability and trouble indications.	TBD. See Item 3. This will require a Failure Mode Effects Analysis (FMEA) of the fire protection systems.
	85) An emergency source of electric power shall be provided to operate fire protection systems. Fire protection systems shall be capable of operating during a normal power outage. The emergency power sources and the electrical distribution circuits shall have independence and testability to ensure performance of their safety functions assuming any single failure.	Compliance. Storage battery secondary power supply is provided in compliance with NFPA standards.
	86) When the process uses or produces combustible gases or vapors, the design shall include features such as inert gas purging, premixing hydrogen to a nonflammable percent with inert gas, and increasing the air flow within process confinement barriers to provide the dilution required to maintain the concentration of gases or vapors below to lower limit for flammability.	Compliance. Process vessel ventilation is provided.
	87) Automatic water sprinkler coverage shall be provided throughout the facility except in areas where nuclear criticality or other hazards specifically preclude its use or in control rooms where Halon systems shall be used to reduce equipment damage.	Noncompliance. See Item 3. Portions of the facility are not provided sprinkler coverage. Process cells depend on manual valve operation. No Halon systems are used in the control room--only overhead water sprinklers. (Note: This Halon requirement is expected to change when 6430.1A is re-issued.)

TABLE 4. B Plant Conformance of DOE 6430.1A General Design Criteria for Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Conformance
1530-99.0 (Continued)	88) The water supply for permanent fire protection installation shall have a minimum of two reliable, independent sources, and sufficient capacity (based on maximum demand) for fire-fighting until other sources become available.	Compliance. See Item 54 for discussion of raw water sources.
	89) To protect the integrity of process confinement systems, fire protection systems shall include the following features: 1) Automatic and redundant fire detection devices. 2) A fire-extinguishing system to rapidly remove heat produced by fire to prevent or minimize the pressurization of a process confinement and to rapidly extinguish a fire to minimize the loading of ventilation system filters with combustion products. 3) The introduction of the extinguishing agent in a way that does not result in overpressurization of the confinement barriers.	Compliance. Considering the exhaust filters as the primary confinement systems, automatic and redundant detection is provided via heat detectors in tunnel and cells. The cell foam system provides adequate extinguishing capability.
1540-99.0.2	90) Where fire barriers are penetrated by the confinement system's ventilation ducting, fire dampers shall be appropriately used to maintain the barrier integrity. However, the closure of such dampers shall not compromise the functions of the confinement system where the loss of confinement might pose a greater threat than the spread of fire. In such cases, alternative fire protection means (e.g., duct wrapping) shall be used as a substitute for fire barrier closure. In no case shall a sprinkler system (including safety class sprinklers) be considered a fire barrier substitution.	TBD. See Item 3. Although additional smoke detector actuated fire dampers were installed by Project B-472 for life safety considerations, additional dampers may be required after the fire safety design analysis is completed.

TABLE 4. B Plant Conformance of DOE 6430.1A General Design Criteria for Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Conformance
1540-99.0.2 (continued)	90a) Collection systems shall be provided for water runoff such as from firefighting activities from areas within special facilities containing radioactive material. Nuclear criticality prevention (if necessary), confinement, sampling, volume determination, and retrievability of liquids and solids shall be provided for in the design of collection systems. The size of the collection system for firefighting water shall be based on the maximum amount of water that would be collected in fighting the DBF. The configuration of the system components shall be based on conservative assumptions as to the concentration of fissile or other materials capable of sustaining a chain reaction that might collect in the system. Recirculating systems shall also be considered when there is no possibility of contamination.	Compliance. The cell drain header and cell 10 tank provide for collection of potentially contaminated fire fighting effluent. B Plant is not a fissile facility so criticality concerns are not addressed.
1550-2.5.5	FIRE PROTECTION OF HEPA FILTER ASSEMBLIES	
	91) In providing fire protection for the HEPA filters, the design shall separate prefilters or fire screens equipped with water spray sufficiently from the HEPA filters to restrict impingement of moisture on the HEPA filters. Under conditions of limited separation, moisture eliminators or other means of reducing entrained moisture shall be provided. Moisture eliminators may be omitted where system design provides sufficient filter redundancy to ensure continued effluent filtration in the event of fire within any portion of the system. The HEPA filter fire protection system shall be activated in a manner consistent with the fire protection system in the room or building in which the filters are located and as directed by the cognizant DOE fire protection authority.	TBD. See Item 3. Also see Item 75.

TABLE 4. B Plant Conformance of DOE 6430.1A General Design Criteria for Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Conformance
1670-2	FIRE ALARM AND SUPERVISORY SYSTEMS	
	92) Fire alarm and supervisory systems to comply with NFPA 71, NFPA 1221, and NFPA 70 as appropriate for the location.	Compliance with intent. The upgrade project (B-392) and SDC 7.8 do not specify NFPA71, but 1221 and 72E reference NFPA71.
	93) Outside cable plant for fire alarm and supervisory systems to comply with the standards for telephone cable plant. In the joint use of poles for electric power distribution and for supporting fire alarm and telephone cables, separate fire alarm cable to be placed below the telephone cable.	Not applicable. Fire alarms are relayed to the fire station using radio transmitters.
	94) Fire alarm cables installed in underground ducts to be distinctively marked within manholes that are shared with other communications cables and to be kept physically separated from all power conductors.	Compliance. Fire alarm cables are marked and separated.
	95) Exterior fire alarm pull boxes and emergency-reporting telephones to be installed in weatherproof housings manufactured specifically for the mechanism.	Compliance. Installed in accordance with NFPA standards.

TABLE 4A. B Plant Comparison to CS&Rs: Fire Protection

Applicable Section	Design Criteria Summary	B Plant Implementation
5480.7		
9.0	COMPLIANCE WITH IMPROVED RISK OBJECTIVES	
9a	Threats to the Public Health or Welfare and Hazards to Life: The objectives of having no threats to the public health and welfare and no undue hazards to life from fire can be considered to have been attained when:	
9a2	The potential for fast spreading fires is controlled by severe restrictions on the ratings of interior finish materials for flame spread and smoke development and by compartmentation of hazardous materials.	Compliance. Restrictions on interior finish materials are imposed.
9a2b	Hazardous materials, such as flammable liquids and explosives, shall be severely restricted in quantity and handled in conformance with all applicable codes. Special protection features suitable to the hazard should be installed and limits imposed on the number of people who must be exposed to the hazard.	Compliance with intent: Although large quantities of organic solvent are involved, isolation of the material in the canyon cells provides physical protection and personnel barriers. (It is proposed that this inventory will be reduced.)
9a2c	Where noncompliance with some Life Safety Code provisions may be required for public safety, as in some containment structures, additional protective systems, and personnel limits should be maintained.	Compliance. Although some deviations have been authorized, no additional protective systems have been required.
9a3	The facility containment systems are designed to preclude an offsite release of hazardous amounts of toxic materials under maximum credible fire conditions.	TBD - Noncompliance. Ongoing fire safety analysis is evaluating scenarios for both organic fire and hydrogen explosion. Although protective systems for the HEPA filters are installed, it is not clear they are adequate to prevent a radioactive release from these scenarios.

TABLE 4A. B Plant Comparison to CS&Rs: Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
9a4	Exhaust and ventilation systems, including filters, are protected or isolated from the effects of a credible fire to the extent that hazardous amounts of toxic materials or combustion products will not escape.	TBD - Noncompliance. See Item 9a3.
9a5	Natural or artificial means of controlling liquid runoffs from a credible fire are provided so that contaminated or polluting liquids will not escape the site, including potentially contaminated water resulting from firefighting operations.	Compliance. Currently, the only fire protection systems in contaminated areas are the cell foam and cell spray systems which will drain to the cell drain header.
9c	Property Damage Limitation. The objective of limiting property loss can be considered to have been attained when fire protection systems are provided as follows:	
9c1	When the maximum possible property loss is in the range of $1-25 million, an automatic fire protection system is provided that will limit the probable loss to the lower figure.	TBD - Noncompliance. Complete assessment of fire protection compliance is dependent on the performance of a fire protection design analysis (Ref. DOE 6430.1A [0110-6.2] and DOE 5480.7). This analysis requires an established base line design flowsheet and appropriate accident analysis to establish the DBF and associated risks. This analysis will also establish fire barrier requirements, the fire protection required to establish improved risk, the need for special protection systems, and the heat loads and risk factors.
9c2	When the maximum possible property loss is in the range of $25-50 million, a redundant protection system is provided that, even in the failure of the primary system, should limit the loss to the lower figure.	TBD - Noncompliance. See Item 9c1.

TABLE 4A. B Plant Comparison to CS&Rs: Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
9c3	When the maximum possible property loss exceeds $50 million, redundant systems are provided as in subparagraphs 9c1 and 2 above, and a failure-proof type of fire protection system such as blank walls or physical separation is provided to limit the maximum property loss to $75 million.	TBD - Noncompliance. See Item 9c1.
10.0	ESSENTIAL ELEMENTS OF AN IMPROVED RISK FACILITY	
10a	An improved risk facility is characterized by a sufficiently high level of fire protection to fulfill requirements for insurability by the Factory Mutual System, Industrial Risk Insurers, or other private industrial fire insurance companies that limit their underwriting to the best protected class of industrial risks. A basic requirement is the provision of automatic fire extinguishing systems in all areas subject to serious property damage or business interruption losses as a result of fire. Above all other requirements, to qualify for an improved risk rating, it is necessary that strong, tangible evidence be available attesting to existence of continuing sincere interest by management and employees in minimizing losses from fire and related perils.	TBD - Noncompliance. See Item 9c1.
10b	DOE facilities qualifying as improved risks will incorporate the following physical improvements and internal programs, and maintain records for appraisal of the programs:	
10b1	Review of plans prior to contemplated construction to assure adequacy of fire risk appraisal and protection, and follow up review to ensure that fire protection features are provided where necessary to comply with Paragraph 9 above.	TBD - Noncompliance. See Item 9c1.

TABLE 4A. B Plant Comparison to CS&Rs: Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
10b5	Limitation by physical means (e.g., geographic isolation, firewalls, firedoors, draft barriers) of areas that can be directly damaged in the event of a single fire.	TBD - Noncompliance. See Item 9c1.
10b6	Quality construction which in most cases is defined as fire resistive or noncombustible type buildings with segregation or isolation of particularly hazardous operations.	Compliance.
10b7	Enclosures of adequate fire resistant construction for stairways, elevators, ducts, and other openings coupled with fixed or manual devices (such as self-closing doors or dampers, draft stops, or water curtains) to control or limit both vertical and horizontal fire spread potentials.	Compliance. The B Plant facility complies with the intent of NEPA 101 (Ref. SD-472-FDC-001).
10b8	Protection of special hazards by isolation, segregation, or use of special fire controls systems (e.g., automatic sprinklers, inert gas flooding, explosion suppression) together with devices (e.g., relief valves, filters, roof hatches, scuppers, blast walls) for limiting or controlling damage potentials of fire, hazardous smoke, gases, water runoff, or other occurrences, that may reasonably be anticipated during a fire emergency.	TBD - Noncompliance. See Item 9c1.
10b9	Adequate, reliable fire protection water supplies and distribution systems coupled with adequate hydrants, inside standpipes, and other devices to facilitate utilization of such water during fire emergencies.	Compliance with intent: Two diesel powered raw water cooling water pumps provide back-up water supply (Ref. B Plant SAR 5.10.3). Project B-588 will provided "looped" water supply.
10b10	Adequate automatic and manual means for detecting and reporting incipient fires including, but not limited to, watchman service.	Compliance with intent: Because all fire detection systems are provided with automatic signal to the central alarm station, watchman service is not implemented except when alarm/protection systems are out of service.

TABLE 4A. B Plant Comparison to CS&Rs: Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
RL 5480.7A 5.g	RL Contractors shall take appropriate action to assure that facilities and programs under jurisdiction conform to the improved risk or higher fire protection standards described in DOE 5480.7, this RL supplement, DOE 5480.4; Draft DOE 6430.1A, and The Factory Mutual System for Loss Prevention Data Sheets.	Compliance with intent: Specific compliance with requirements of DOE orders is discussed separately through out this document. The FM System of Loss Prevention Data Sheets is utilized at Hanford.
29 CFR 1926 1926.151 Fire Prevention	(c) Open Yard Storage - No Combustible material shall be stored outdoors within 10 feet of a building or structure.	Compliance with intent: These conditions are variable and evaluated routinely during facility audits and appraisals for specific conditions of noncompliance.
	(d) Indoor Storage - Clearance of at least 36 inches shall be maintained between the top level of the stored material and the sprinkler deflectors.	Compliance with intent: See Item 29 CFR 1926.151 (c) above. (WAC 296-24 Para. 60705 permits 18-in. vertical clearance.)
29 CFR 1926 1926.151	A clearance of 24 inches shall be maintained around the path of travel of fire doors unless a barricade is provided, in which case no clearance is needed. Material shall not be stored within 36 inches of a fire door opening.	Compliance with intent: See 29 CFR 1926.151 (c) above.
1926.152 Flammable and Combustible Liquids	(b) Indoor Storage of Flammable and Combustible Liquids	
	No more than 25 gallons of flammable or combustible liquids shall be stored in a room outside of an approved storage cabinet.	Compliance. Approved storage cabinets are provided. Any specific noncompliance would be identified during routine facility audits/appraisals and corrected.

TABLE 4A. B Plant Comparison to CS&Rs: Fire Protection (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1926.152 (Continued)	(d) Fire control for flammable or combustible liquid storage:	
	At least one portable fire extinguisher having a rating of not less than 20-B units shall be located outside of, but not more than 10 feet from the door opening into any room used for storage of more than 60 gallons of flammable or combustible liquids.	Compliance. Adequate portable extinguishers are provided in accordance with NFPA 10 (ref. SD-WM-SAR-103 Chp. 5).
	At least one portable fire extinguisher having a rating of not less than 20-B units shall be located not less than 25 feet, nor more than 75 feet, from any flammable liquid storage area located outside.	Not applicable. B Plant facility has no outside flammable liquid storage areas.
29 CFR 1910 1910.159 Automatic Sprinkler Systems	For automatic sprinkler systems used to meet OSHA requirements and installed prior to the effective date of this standard, compliance with the National Fire Protection Association (NFPA) or the National Board of Fire Underwriters (NBFU) standard in effect at the time of the system's installation will be acceptable as compliance with this section.	Compliance. The sprinkler systems were installed per NFPA standards.
1910.160 Fixed Extinguishing Systems, General	The employer shall assure that at least one manual station is provided for discharge activation of each fixed extinguishing system.	Compliance. Manual activation is provided for cell foam system and cell sprays. Manual activation not required for fire sprinklers.
	On all total flooding systems, the employer shall provide a pre-discharge employee alarm which complies with 1910.165, and is capable of being perceived above ambient light or noise levels before the system discharges, which will give employees time to safely exit from the discharge area prior to system discharge.	Not applicable. There are no total flooding systems currently installed at B Plant.

TABLE 4A. B Plant Comparison to CS&Rs: Fire Protection (Continued)

Applicable Section		Design Criteria Summary	B Plant Implementation
1910.162 Fixed Extinguishing Systems, Gaseous Agent		The employer shall assure that employees are not exposed to toxic levels of gaseous agent or its decomposition products.	Not applicable. No gaseous agent systems (Halon or CO_2) are currently provided in B Plant.
1910.162 Employee Alarm System	(b)	General requirements.	
		The employee alarm system shall provide warning for necessary emergency action as called for in the emergency action plan, or for reaction time for safe escape of employees from the workplace or the immediate work area, or both.	Compliance. Fire gongs are provided along with public address announcements in accordance with the emergency plan. Evacuation is not the immediate response for production facilities.
		The employee alarm shall be capable of being perceived above ambient noise or light levels by all employees in the affected portions of the workplace. Tactile devices may be used to alert those employees who would not otherwise be able to recognize the audible or visual alarm.	Compliance with intent: In addition to the fire gong and PA system, evacuation sirens can be activated throughout the facility and canyon.
		The employee alarm shall be distinctive and recognizable as a signal to evacuate the work area or to perform actions designated under the emergency action plan.	Compliance. As a production facility, evacuation is not the immediate response to a fire alarm. Supervision will provide special instructions to personnel in accordance with the emergency action plan.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems

Applicable Section		Design Criteria Summary	B Plant Implementation
0110-12.2	1)	Equipment rated greater than 1,000 W and lighting equipment with inductive reactance load component shall have a power factor of not less than 90% under rated load conditions. Utilization of equipment with a power factor less than 90% shall be corrected to at least 90% under rated load conditions. Power-factor corrective devices installed to comply with this criterion shall be switched with the utilization equipment except where this results in an unsafe condition or interferes with the intended operation of the equipment.	Compliance. Although power factor design is not a major safety concern, power factor is considered in the design of B Plant systems. Power factor capacitors are provided for all motor starters rated 75 hp or more.
0110-99.0.2	2)	To ensure both the safety of personnel and the effective administration and control of special facilities, access to hazardous areas (e.g., electrical power and distribution panels) shall be controlled by locked gates, doors, power panels, or other physical barriers.	Compliance. Proper panel protection and control measures are in effect.
1605 Basic Electrical Materials and Methods			
1605-1	3)	All systems shall comply with NFPA 70 and ANSI C2.	Noncompliance. NFPA 70 is the National Electric Code and ANSI C2 is the National Electric Safety Code. Recent upgrades to the electrical systems specify these as applicable for design and construction. Older or original equipment was installed to less strict codes and are likely out of compliance with present NFPA 70 and ANSI C2. In particular original wiring from the MCCs to the cells are of concern.
	4)	Electrical Systems shall be designed so that all components operate within their capacities for initial and projected loads.	Compliance. Sound design practice in B Plant provides margin.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	5) Preferred standard voltages in conformance with ANSI C84.1 shall be used with a single-voltage level characteristic in any classification to minimize stocks of spare equipment and to standardize operating and maintenance practices and procedures.	Compliance. Recent electrical upgrades specify use of C84.1.
	6) Electrical materials and equipment shall be UL or FM tested with label attached for the purpose intended whenever such products are available. Where there are no UL or FM listed products of the type, testing and certification by another nationally recognized testing agency may be acceptable.	Compliance. UL or FM tested products are used when available. Otherwise, components are fabricated and installed per national consensus standards.
	7) Installation methods shall be in accordance with the manufacturer's instructions, with NFPA 70, and with other applicable requirements.	Compliance. FDCs include specific call outs to manufacturers instructions as applicable.
	8) Onsite acceptance testing shall be required for each electrical system and component. Tests shall be specified to demonstrate that each function and important parameter is implemented. Specific criteria shall be included to determine pass/fail acceptance. Tests shall be performed in the presence of a government representative. Copies of all test results shall be submitted for approval.	Compliance. Functional tests, resolution of noncompliant issues, and QA requirements are carefully defined for upgrade projects.
1605-2 Wiring System		
1605-2.1 Raceways		
1605-2.1.1	9) Raceways that penetrate fire-rated assemblies shall be noncombustible.	Compliance. Raceways are metallic.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	10) The complete installation shall be suitably sealed to maintain the established fire ratings as defined in UL Building Materials Directory and UL 1479.	Noncompliance. Fire ratings are not fully defined and established at this time. Older installations are likely deficient in proper fire sealing.
	11) Raceways shall be 1/2-in. minimum in diameter. Raceways embedded in concrete or masonry shall be 3/4 in. minimum and shall be adequate in number and capacity for the initial and projected facility requirements.	Compliance. B Plant installation is per NFPA Articles 34C-352 which specifies 1/2-in. minimum.
1605-2.1.2	12) Electrical Metallic Tubing (EMT) shall be used to enclose circuit power conductors up to 1/0 AWG and shall be used to enclose alarm and signal circuits in indoor nonhazardous and noncorrosive locations.	Compliance. EMT is installed per NFPA 70, Article 348. This article permits conductors larger than 1/0.
	13) EMT shall be installed only where it will not be subjected to physical damage during installation or while in service and where no leaking fluids will exist.	Compliance. B Plant installation is per NFPA 70, Article 348 which specifies this.
	14) EMT shall not be installed in wet areas, underground, or outdoors, and shall not be encased in concrete.	Compliance. See Item 13. NFPA 70, Article 348 allows installation in concrete with additional corrosion protection.
1605-2.1.3	15) Flexible steel conduit shall be used for connection to equipment subject to vibration and between junction boxes and recessed lighting fixtures.	Compliance. B Plant installation is per NFPA 70, Article 350.
	16) Equipment served via flexible steel conduit shall have a separate equipment ground conductor installed in the raceway.	Noncompliance. NFPA 70, Article 350 allows the use of the flexible metal conduit as the ground in some circumstances.
	17) Liquid-tight flexible conduit shall be used in wet, oily, or hazardous locations or where the atmosphere is corrosive.	Compliance. See Item 15.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1605-2.1.4	18) Rigid steel conduit or intermediate metal conduit shall be used in locations classified as hazardous by NFPA 70.	Compliance. Rigid steel conduit or intermediate metal conduit is used per NFPA 70, Article 345 and 346.
	19) Only rigid steel conduit or intermediate metal conduit shall be used to route secure circuits through nonsecured areas. Such circuits shall be capable of detecting tamper with the line.	Compliance. No secure circuits exist in the B Plant.
1605-2.1.5	20) Aluminum conduit shall be used for high-frequency circuits where steel will cause magnetic problems or in atmospheres where steel conduit is unsuitable.	Compliance. Aluminum conduit is used with discretion under guides of NFPA 70, Article 346.
	21) Aluminum conduit shall not be used to enclose secure conductors carrying classified information (as defined by the cognizant DOE authority).	Compliance. There are no conductors carrying classified information.
	22) Aluminum conduit shall not be installed underground, encased in concrete, or where the atmosphere is corrosive to aluminum.	Compliance. NFPA 70, Article 346 allows installation is concrete. However, no aluminum conduit is installed as such.
1605-2.1.6	23) Nonmetallic conduit shall be used only where permitted by NFPA 70.	Compliance. Installation is per NFPA 70, Article 347.
	24) Nonmetallic conduit shall not be used in electromagnetically sensitive areas or to enclose secure conductors, except when required in red/black design in accordance with NACSIM 5203.	Compliance. There are no such areas in B Plant.
1605-2.1.7	25) Surface metal or nonmetallic raceways and multi-outlet assemblies shall be used only where permitted by NFPA 70.	Compliance. Surface raceways are installed per NFPA 70, Article 352. Multi-outlet assemblies are installed per Article 353.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	26) Surface metal raceways passing from one floor to another shall have mechanical protection to a height of 4 ft above the floor level.	Compliance. See Item 25.
1605-2.1.8	27) The use of cable trays shall be considered for large multiple cable applications in both interior and exterior locations.	Compliance. Cable trays are installed per NFPA 70, Article 318.
	28) Cable trays that penetrate security barriers shall provide the same degree of penetration resistance as required by the site-specific security plan for the barrier through which they penetrate. This provision applies when the opening at the point of the barrier is penetrated more than 96 sq in. in area and over 6 in. in smallest dimension and is located less than eighteen ft above uncontrolled ground, roofs, or ledges; fourteen ft diagonally or directly opposite windows, fire escapes, roofs, or other openings in uncontrolled buildings; or six ft from uncontrolled openings in the same barrier.	Not applicable. Evaluation of existing penetrations in relation to existing security plans is beyond the scope of this study.
1605-2.2 Conductors		
1605-2.2.1	29) Conductors for interior electrical systems shall be copper; aluminum conductors size No. 4 AWG and larger may be used.	Compliance. Recent electrical upgrades specify copper conductors.
	30) Conductors for power and lighting branch circuits shall not be smaller than No. 12 AWG.	Compliance. NFPA 70, Article 310 specifies conductors.
	31) No. 10 and No. 12 AWG conductors for power and lighting branch circuits shall be solid.	See Item 30.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	32) No. 8 AWG conductors and larger shall be stranded.	Compliance. NFPA 70, Article 310-3 requires stranded conductors in raceways for wire No. 8 and larger.
	33) Conductors for Class 1 remote-control and signal circuits shall be enclosed in cable and shall comply with NFPA 70.	Compliance. Installation is per NFPA 70, Article 725-16.
	34) Conductors for Class 2 low-energy remote-control and signal circuits shall not be smaller than No. 18 AWG.	Compliance. Installation is per NFPA 70, Article 725-40.
	35) Power and lighting conductors shall be 600-volt, Type THW, XHHW, or THWN.	Compliance. Conductors are per Hanford Plant Standard SDC-7.5.
	36) Conductors required to be rated 90 degrees C in accordance with NFPA 70 shall be Type RHH, THW, or THHN.	See Item 35.
	37) Conductors in high-temperature areas shall be type AVA, UL 115.	See Item 35.
	38) Direct-burial conductors shall be Type UF, UL 493.	Compliance. There are no direct buried cables in B Plant.
	39) Bonding and grounding conductors shall be ASTM B1 solid, bare copper for sizes No. 8 AWG and smaller and shall be ASTM B 8-81 Class B stranded copper for wire sizes No. 6 AWG and larger.	Noncompliance. Grounding conductors for B Plant are based on NFPA 70, Article 250, which is not specific as to ASTM spec or stranded vs. solid. However, intent is met.
	40) Each set of contract documents shall indicate the basis for the size of the conductors shown on those plants when the option for aluminum conductors has been chosen.	Compliance. Options for aluminum for use in B Plant are not given.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1605-2.2.2	41) The termination of aluminum conductors, the connection of aluminum terminating logs to copper or aluminum pads, and the use of Bellville washers shall comply with IEEE 141.	Compliance. Aluminum conductors are not used in B Plant.
	43) Setscrew termination for aluminum conductors shall be permitted for connection to approved circuit breakers.	See Item 41.
	44) Split-bolt terminators shall not be used for aluminum conductor termination.	See Item 41.
1605-2.2.3	45) Voltage levels, grounded conductors, equipment grounding conductors, and ungrounded phase conductors shall be identified.	Compliance. Cable markings are in compliance per Hanford Plant Standards.
	46) Existing field center wire color-code systems shall be used. If no present field center wire color code exists, the color-coding system described in this section shall be used.	Compliance. See Item 45.
1605-2.3 Receptacles	47) Receptacles shall comply with general grade as defined in FS W-C-596.	Compliance. Receptacles comply with NFPA 70, Article 410-L, and are in compliance with Federal Specification W-C-596.
	48) Receptacle circuits shall be provided with ground-fault circuit-interrupters as directed by NFPA.	Compliance. NFPA 70, Article 210-8, specifies receptacle GFI only in hotels or dwellings, so this is not applicable to B Plant.
	49) Receptacle circuits that serve receptacles installed outdoors (except receptacles that are in secure circuits are not readily accessible) and within 6 ft of sinks and building entrances shall be provided with ground-fault circuit-interrupters.	Compliance. Outdoor circuits for recent upgrades have GFI.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1620 Power Generation		
1620-1 General	50) Generally, purchased power from an available offsite utility company shall be used in lieu of central onsite generating stations. Cogeneration shall be considered if steam is being produced for onsite processes of if it is possible to achieve greater economy in power costs. Where an onsite central station is justified, design shall be coordinated with utility company.	Not applicable. Provisions for supply power to B Plant from site utilities is generally out of the scope of this study. "Normal" power is provided by 251-W substation 8 via two independent 13.8 kv lines. "Emergency" power is provided from the 284 power house via a 2400 V line. Power is provided to the Hanford loop by the Bonneville Power Administration. There is also capability to sectionalize the utility feeds.
1630 Exterior Electrical Utility Services		
1630-1.1 Load Requirements	51) Demand and diversity factors shall comply with NFPA 70.	See Item 50.
	52) Demand and diversity for feeder and substation load calculations shall be as stated in Fink and Beaty, Standard Handbook for Electrical Engineers.	See Item 50.
	53) Electric service quality and reliability shall be considered in conformance with IEEE 493 to ensure that they meet the load requirements.	See Item 50. Two independent lines are provided to B Plant to increase reliability.
	54) Where loads require a high degree of voltage and frequency stability, the available short-circuit MVA at the service connection and the stability of the supplying utility system shall be considered to ensure adequate power quality.	See Item 50.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section		Design Criteria Summary	B Plant Implementation
1630-1.2 Power Factor	55)	An overall power factor of not less than 85% shall be achieved.	See Item 50.
	56)	When power-factor correction is required, the amount of correction shall be coordinated with the billing tariff to prevent uneconomical overcorrection.	See Item 50.
	57)	Switched capacitor banks shall be used only when necessary to prevent overvoltages during off-peak hours during low power consumption.	See Item 50.
	58)	Capacitors on large inductive loads shall be located as near to the loads as practical.	See Item 50.
	59)	Capacitors for large inductive loads shall be switched simultaneously with the load.	See Item 50.
1630-1.3 Redundancy	60)	Facilities designated by the cognizant DOE authority as critical shall be served by dedicated, redundant circuits.	See Item 50. B Plant is provided with redundant circuits.
	61)	The two services shall be separated by a 4-hr fire-rated barrier and shall be served from separate sources.	See Item 50.
	62)	In lieu of providing two separate services, a single service supplied from a loop-type transmission or distribution system having sectionalizing features may be provided when the reliability of the single service proves adequate when considered in conformance with IEEE 399 and IEEE 493.	See Item 50. Two separate services are used.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1630-1.4 Utility Corridors	63) Electric circuits shall be located in utility corridors established on master utility plans.	See Item 50.
	64) Utility corridors that penetrate security barriers shall provide the same degree of penetration resistance as required by the site-specific security plan for the barrier through which they penetrate. This provision applies when the free area within the utility corridor is more than 96 sq in. in area and over 6 in. in the smallest dimension.	See Item 50.
1630-2 Supply Equipment		
1630-2.1 General	65) Exterior electrical systems shall be designed and constructed with regard to existing electrical system construction in adjacent areas.	Compliance. Construction of exterior services corridors existing structures.
	66) Design shall be coordinated with the utility company.	Compliance. Design and construction of exterior substations are properly approved.
	67) Relaying shall comply with IEEE 242, and switchgear shall comply with IEEE C37 series.	Compliance. IEEE 242, "Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems" guidelines are effectively met by the redundant circuit substation design. IEEE/ANSI C37-100, "Definitions for Power Switchgear," is called out specifically in the substation FDC and CDR.
1630-2.2 Power Supply Lines		
1630-2.2.1	68) Circuits shall be arranged so that faults, failures, or maintenance on less critical circuits will not jeopardize critical loads.	Compliance. Critical circuits for canyon ventilation are provided with separately routed power from the 284 power house in addition to normal power from 251-W.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	69) Protective devices shall be used and coordinated for sequential operation from the load to the source.	Compliance. Protective devices are sized to provide this.
	70) Line location shall be established in accordance with clearance requirements stated in ANSI C2 and shall be routed within established rights-of-way for each facility.	Compliance. Recent projects to install power supply lines specifically cite ANSI C2.
	71) Minimum rights-of-way shall extend 5 ft beyond outside conductors.	Compliance. Exterior power supply lines are spaced per ANSI C2 and are generally run underground to the building and substation.
	72) The cognizant DOE authority shall establish facilities and areas that require additional clearances for security and safety.	Compliance. DOE approval for construction is required.
1630-2.2.2	73) Overhead power supply lines shall be used where service is to be installed in remote, unsettled, or industrial areas. Maximum use shall be made of single-pole structures.	Not applicable. Distribution to the B Plant substation outside the scope of this study and is under cognizance of the site power authority.
	74) Joint use of poles for power and communications distribution shall maintain safety standards and shall limit electrical interference to communications services.	See Item 73.
	75) In the joint use of power, either for multiple electrical distribution systems or for both electrical distribution and communications lines, underbuilt lines or cables shall be of vertical construction.	See Item 73.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	76) Use of double-stacked crossarm construction shall be permitted only where proper clearances for hot-line maintenance work can be ensured. Clearances shall comply with ANSI C2.	See Item 73.
1630-2.2.3	77) In congested areas and where required for safety, for service continuity, or for conformance with local practices, primary and secondary power distribution circuits shall be placed underground.	Compliance. Circuits are run underground from the substations to the buildings.
	78) Underground distribution circuits may consist of direct-burial cable installations or of cable installed in manholes and duct.	Compliance. Underground lines are encased in duct and concrete.
	79) Direct-burial cables shall have physical protection where hazards from rodents or soil will impair their safe operation.	Compliance. There are no direct buried cables used for power distribution to B Plant.
	80) Underground cables or duct systems shall be suitably identified under the ground surface and above the cable protective system or duct bank.	Compliance. The underground duct is labeled.
	81) Direct-burial cable shall be used for secondary (600 volts or below) single-circuit installations through areas not likely to be disturbed by excavation and where service reliability is not of critical importance.	Compliance. Reliability is a consideration, so direct buried cable is not used.
	82) Where direct-burial cables are connected to above-grade junction or terminating boxes, they shall be encased in rigid steel conduit from the elevation of the cable to the box.	See Item 79.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	83) For primary circuits (above 600 volts) and where secondary circuit service reliability is a prime consideration, cable in duct shall be used.	Compliance. Power from overhead lines C8-L6 and C8-L7 is run underground in duct banks from the poles to the B Plant substation. Duct for the emergency power underground line is PVC-coated and conforms to requirement of NFPA 70, Article 346 and Article 300-6, for underground installations.
	84) Duct banks shall be concrete encased.	Compliance. Duct banks are concrete encased (see Item 83).
	85) Minimum duct size shall be 2 in.	Compliance. Recent upgrade projects use of 2-in. or 4-in. duct.
	86) In seismic zones, ducts may be direct-buried when the risk of loss due to earthquakes is greater than the cost of future utility work adjacent to the circuit.	Compliance. B Plant is not in a seismic zone.
	87) Electric manhole covers shall be appropriately labeled.	Compliance.
	88) A minimum of 25% spare ducts (but not less than two spare ducts) shall be provided in each duct run. Spare ducts shall include nylon or plastic cords of a 200 pound minimum breaking strength to facilitate future cable installation. Spare ducts shall be plugged or capped to prevent contamination.	Compliance. Hanford Plant Standards require design for future expansion.
	89) Underground duct runs that penetrate security barriers shall provide the same degree of penetration resistance as required by the site-specific security plan for the barrier through which they penetrate. This provision applies when the free area within the duct run is more than 96 sq in. in area and over six in. in the smallest dimension.	Not applicable. See Item 28.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1630-2.3 Substations and Switching Stations		
1630-2.3.1	90) Design of substations and switching stations shall be coordinated with the utility company.	Compliance. Recent upgrades to the B Plant substations are properly approved.
	91) When transformation is their main function, the substations shall be located to optimize the lengths of secondary conductors.	Compliance. Substations are located as close to the B Plant buildings as possible considering the locations of existing facilities.
	92) When switching is their main function, switching stations shall be located as determined by circuit routings.	Compliance.
	93) Substation and switching stations providing or distributing power to critical facilities shall be located within the protected site perimeter of the critical facility.	Compliance. The substation for B Plant are within the site perimeter.
1630-2.3.2	94) Electric energy metering shall be furnished at each substation of 500 kVA or larger capacity. Demand metering shall be furnished as required for load management purposes.	Compliance. Metering is provided and communication to the Hanford Energy Monitoring and Control System is provided.
1630-2.3.3	95) Station grounding shall comply with Section 1639-2, Substation and Switching Station Grounding.	See Item 110.
1630-2.3.4	96) Surge protection shall be included to limit the potential difference across the terminals of the protected device below the BIL of the device.	Compliance. Surge protection is provided per NFPA 70, Article 280. Sizing of the surge arrestor is based on Article 280 requirements which are generally more stringent or equivalent to sizing based on the device basic impulse insulation level.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1630-2.3.5 Oil Filled Equipment	97) Dikes and drainage provisions shall be built as required by the local SPCC in conformance with 40 CFR 112.	Compliance. Spill Prevention and Control Countermeasures are implemented by existing Hanford procedures for handling transformer oils.
	98) PCB or PCB-contaminated electrical equipment and the treatment of PCB oil spills shall comply with 40 CFR 761. Existing PCB or PCB-contaminated equipment shall be provided with warning signs and shall not be relocated or reused in other existing or new facilities.	Compliance. Recent upgrades specify no PCBs. Older equipment containing PCBs were removed in a comprehensive program for the Hanford site.
	99) Oil-filled transformers installed near buildings shall comply with FM 5-4/14-8.	Compliance. Recent upgrades include FM specifications as a specific call out.
	100) Electrical equipment cooling material shall be handled in accordance with 29 CFR 1910.1200.	Compliance. 1910.1200 requires proper labeling and handling of transformer oils as a hazardous chemical. Transformer oils are stored and handled per manufacturers instructions to prevent chemical hazard problems.
1630-3 Power for Exterior Lighting		
1630-3.1 Primary Power	101) Where discharge lighting loads are used, the ballasts shall operate at 480 volts when 480Y/277-volt service is available and cost effective.	Compliance. Lighting from 120/240 V circuits was selected for B Plant use. Street lighting is provided by RHO Utilities and is out of scope of this study.
1630-3.2 Emergency Power	102) Sites or facilities requiring continuous lighting for safety or security reasons shall have an emergency power source for such lighting.	Compliance. Emergency lighting is provided by maintained, battery-powered units energized on loss of power to lighting circuits. The lighting circuits are supplied by redundant 100 kVA transformers to improve reliability.
1630-3.3 Switching	103) Selective manual/automatic switching systems shall be used to turn off all unnecessary lighting during inactive periods, consistent with safety and security requirements.	Compliance. Most areas of B Plant require continuous lighting for security/safety. Manual switches are available in areas not requiring continuous lighting. Exterior lighting is generally controlled by daylight sensing switches.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1630-4 Power Supply for Buildings		
1630-4.1 General	104) The following factors shall be considered in the selection of power supply for buildings: initial and projected demand for motor, lighting, and power loads and their individual proportions to the total facility load; power utilization equipment characteristics; power supply options available from existing onsite distribution systems; available maximum short-circuit current at the service connection to the facility; rate structure of the utility company; investment, operating, and maintenance costs of power service options, and of the facility's main service equipment.	Compliance. The main consideration was supplying normal power via two separately routed feeders to improve reliability. Most other considerations were addressed by the site power authority and are outside the scope of this study.
1630-4.2 Voltage Levels	105) Electric service voltage shall comply with DM-4.04. For small facilities without three-phase power requirements, 240/120 volt single-phase service may be used.	Compliance. Preferred system voltages are per ANSI-C84 and Hanford Plant Standard SDC-7.5 which are equivalent to guides in the Naval Facilities Engineering Command (NAVFAC) DM-4.04.
1630-5 Lighting Protection	106) Lightning protection systems shall comply with NFPA 78.	Noncompliance. Although appropriate surge arrestors are included in recent upgrades, it is not clear that all structures are properly protected. Grounding is provided per Plant Standard D-20-9B. A formal assessment of lighting protection is needed (See Item 107).
	107) Lightning protection systems should be considered for buildings containing facilities for the use, processing, and storage of radioactive, explosive, and similarly hazardous materials; for buildings over 50 ft in height; and for buildings containing valuable equipment. A risk assessment using the guide in Appendix I of NFPA 78 shall be made of these buildings to determine the risk of loss due to lightning.	Noncompliance. A risk assessment should be done and appropriate protective features, if needed, should be installed.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	108) Electric power and communication services to all buildings and facilities and to underground power cables where connected by overhead power distribution lines shall have lightning and surge protection.	Compliance. The substations are properly grounded and equipped with surge arrestors.
1639 Grounding		
1639-1 General	109) Grounding systems shall comply with NFPA 70 and IEEE 142. A separate ground conductor shall be used. Raceway systems shall not be used as a ground path.	Compliance. B Plant grounding conforms with NFPA 70, Article 250.
1639-2 Substation and Switching Station Grounding	110) Substation and switching station grounding systems shall comply with IEEE 80. Grounding connections shall comply with IEEE 837.	Compliance. Grounding for the substation is per drawing H-2-93738 which follows NFPA 70, Article 250, which meets the intent of IEEE recommendations.
1639-3 Fence Grounding	111) Permanent fence grounding shall comply with ANSI C2. Grounding of temporary fences shall depend on the type of fence, considerations of the potential hazards, the expected duration of use, and guidance from cognizant DOE safety personnel.	Compliance. Fences are grounded.
1639-4 Isolated Ground Systems	112) Isolated ground systems may be required to meet special instrumentation or other equipment needs. Such ground systems shall be clearly identified, protected against improper usage, and installed in conformance with NFPA 70.	Not applicable. Isolated ground systems for power are not used in B Plant.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1640 Interior Electrical Systems		
1640-1.1 Demand and Diversity Factors	113) Interior electrical system demand and diversity factors shall comply with Section 1630-1.1, Load Requirements.	Compliance. B Plant demands are based on NFPA 70, Article 220 as specified by section 1630-1.1.
1640-1.2 Power Factor	114) Interior electrical system power factor shall comply with Section 1630-1.2, Power Factor.	Compliance. Correction capacitors are provided for all motor loads greater than 75 HP.
1640-1.3 Voltage Levels	115) Standard voltages shall comply with DM-4.04 or shall continue to 240/120-volt single-phase service provided, as applicable.	Compliance. Preferred system voltages are per ANSI-C84 and Hanford Plant Standard SDC-7.5 which are equivalent to guides in the Naval Facilities Engineering Command (NAVFAC) DM-4.04.
1640-1.4 Power System Reliability	116) Power system reliability consideration shall comply with IEEE 493 to ensure continual power supply to systems and equipment designated as critical by the cognizant DOE authority.	Noncompliance. IEEE 493 requires substantial analysis for reliability verification. However, the redundant 13.8 kV transformer in the substation and the emergency feed from line L8-66 likely provide reliability which meets the intent of IEEE 493.
	117) The need for multiple transformer-switchgear service equipment to ensure power supply continuity within the facility during scheduled or emergency equipment outages shall also be considered.	Compliance. Multiple transformer switchgear service is provided.
1640-1.5 Power Quality	118) Adverse effects of voltage level variations, transients, and frequency variations on equipment operation shall be minimized.	Compliance. The signal lines for the Bailey System are independently grounded to prevent spurious signals. Other transient effects are handled through diverse power distribution to minimize equipment effects.
	119) Sensitive electrical equipment such as data processing equipment shall be isolated as needed for protection. Uninterruptible power systems, motor-generator sets, or power conditioners may be used for isolation.	Compliance. The Bailey System has isolated signal grounding and is provided with an UPS.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1640-1.6 System Protection	120) System protection shall comply with IEEE 242.	Compliance. Protection features are in compliance with NFPA 70, Article 240, Overcurrent Protection. This effectively implements IEEE 242. See Item 67.
1640-1.7	121) Ground-fault protection shall comply with NFPA 70. See also Section 1605-2.3, Receptacles.	Compliance. See Item 48. Ground fault interruptors are used at each MCC and at each motor starter circuit greater than 20 hp.
1640-1.8 Neutral Conductors	122) The neutral conductor for electric discharge lighting and for data processing and other similar equipment shall be sized in accordance with NFPA 70. Calculations shall include harmonic current.	Compliance. Recent upgrade projects specify NFPA 70 for such applications.
1640-2 Service Equipment and Facilities	123) Interior electrical systems shall comply with NFPA 70.	Noncompliance. See Item 3.
	124) Interior electrical system switchgear criteria shall comply with IEEE C37 series.	Compliance. See Item 67.
1640-2.2 Metering	125) Energy metering requirements for new buildings and building additions shall comply with Section 1595-11 Energy Metering.	Compliance. 1595-11 specifies metering per 10 CFR 435. Metering provided at B Plant meets the intent. See Item 94.
	126) Conventional kilowatt-hour meters shall be used for measuring and recording electric energy use at the incoming power service to the building and at the internal service points of significant process loads.	Compliance. Kilowatt meters are supplied at both substation transformers.
	127) Where a facility load management program is used, individually for the facility or as part of a site load management program, demand (kw) metering shall be used.	Compliance. Demand can be assessed.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	128) Metering devices shall be compatible with existing or projected EMCs. See Section 1595-10, Energy Monitoring and Control Systems.	Compliance. B Plant meters are interfaced to the Hanford EMCS.
	129) Where a facility is to be served directly by a utility company, service metering requirements, equipment to be used, and service metering equipment locations shall be coordinated with the utility company.	Not applicable for B Plant which is serviced by site Utilities.
1640-2.3 Transformers	130) Interior service transformer installation shall comply with NFPA 70.	Compliance. Recent upgrades specify NFPA 70 for installation.
	131) The minimum number of transformers necessary to satisfy initial and projected facility loads and operational continuity, safety, and security requirements shall be used.	Compliance. Transformers for expansion are not installed until needed.
	132) Transformer protection and appurtenances shall comply with IEEE C37.91.	Compliance. See Item 67.
	133) Transformer installation shall comply with FM 5-4/14-8.	Compliance. See Item 99.
1660-1 General	134) Emergency systems shall be provided to support systems or equipment components whose operating continuity is determined to be vital by the cognizant DOE authority for protection of health, life, property, safeguards, and security systems.	Noncompliance. Items 134 through 141 address the application and requirement for emergency and uninterruptible power. Although the 2300 volt feeder from the emergency power house provides some power supply diversity, it does not meet the stringent requirements of an emergency system per the applicable consensus standards in items 137, 139, and 141.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	135) Legally required and optional standby systems shall be provided for production process operations in cases where the cognizant DOE authority determines that the process will become unstable on loss of power or that a severe monetary loss will result. Uninterruptible power shall be provided for equipment designated by the cognizant DOE authority as safety-class equipment.	See Item 134.
	136) Emergency power equipment areas shall be ventilated to exhaust hazardous gases (if applicable) and to maintain satisfactory ambient temperatures without backdraft dampers.	See Item 134.
1660-2 Emergency Power Systems	137) Emergency power systems shall comply with NFPA 37, NFPA 70, NFPA 101, NFPA 110, and IEEE 446. Emergency power systems shall be capable of maintaining full operation of emergency load for the full time period specified by the cognizant DOE authority.	See Item 134.
	138) Emergency power systems legally required by NFPA 70 shall be installed to meet normal emergency power requirements. More stringent emergency power requirements shall be identified by the cognizant DOE authority on a case-by-case basis.	See Item 134.
1660-3 Uninterruptible Power Supplies	139) Uninterruptible power supplies shall be provided for those loads requiring guaranteed continuous power. Applications of UPSs shall comply with IEEE 446, as modified by the cognizant DOE authority.	See Item 134. UPS are supplied for the Bailey System and canyon lighting.

TABLE 5. B Plant Implementation of DOE 6430.1A General Design Criteria for Electrical Systems (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1660-90 Special Facilities		
1660-99.0 Non-reactor Nuclear Facilities - General		
1660-99.0.1 Safety Class Electrical Systems	140) Electrical power and electrical instrumentation and control systems are designated safety class electric if they are required to satisfy the safety class criteria in Section 1300-3.1, General, through Section 1300-3.4, Equipment Environment Considerations. These components and systems are subject to IEEE standards and to higher quality assurance requirements as needed.	See Item 134.
	141) Safety class electric systems shall be provided with suitable redundancy and separation to ensure that adequate capacity and capability are available with the addition of a single failure. Redundant safety class electric systems shall be physically protected or separated to prevent a common external event from causing a failure of the redundant systems. IEEE 379 and IEEE 384 shall be used as redundancy and separation criteria.	See Item 134.

TABLE 5A. B Plant Comparison to CS&Rs: Electrical

Applicable Section	Design Criteria Summary	B Plant Implementation
29 CFR 1926.402 Installation Safety Requirements (for Construction Work)	Sections 1926.402 through 1926.408 contain installation safety requirements for electrical equipment and installation used to provide electric power and light at the job site. Section 1926.402 states if the electrical installation is made in accordance with the National Electrical Code ANSI/NFPA-70 it will be deemed in compliance.	Compliance. Specifications for construction for B Plant upgrades reference the use of NFPA-70, so it is assumed that construction projects will be in compliance.
29 CFR 1910.302 Through 29 CFR 1910.308	Sections 1910.302 through 1910.308 contain design safety standards for electrical utilization systems.	General Compliance. These OSHA requirements are effectively duplicated by similar requirements in DOE 6430.1A.
40 CFR 264.32 Communications	All hazardous waste facilities must be equipped with an internal communications or alarm system and a device capable of summoning emergency assistance.	Compliance. Communication systems include those for fire and evacuation, a PA system, telephones, and portable radios as appropriate. The canyon area has a klaxon alarm to annunciate canyon evacuation.
40 CFR 264.34 Communications	Whenever hazardous waste is being handled, all personnel involved in the operation must have immediate access to an internal alarm or emergency communication device, either directly or through visual or voice contact with another employee.	Compliance. Communication devices are available. It is general practice to assign two or more people to special jobs e.g., sampling, canyon cleanup, maintenance work.
5820.2A I-3b(2)(k) Special Systems	Upon loss and subsequent recovery of normal electrical power, high-level waste transfer equipment shall not have the capability to restart without active operator action.	Compliance. Transfers are generally accomplished by steam jets and pumps which require manual action and cannot be automatically actuated.

TABLE 6. B Plant Implementation of DOE 6430.1A General Design Criteria for Utilities and Services

Applicable Section	Design Criteria Summary	B Plant Implementation
0200-99.0.3	Special Facility Services	
	1) Utility systems essential to the support of safety class items shall be designed as safety class items.	Compliance. WHC safety analysis criteria include this stipulation for safety class utilities.
0273-4	Wastewater Treatment	
	2) Industrial wastewater and toxic pollutants shall be excluded from sanitary wastewater treatment and disposal systems except where pretreatment systems suitably remove objectionable constituents cost effectively. Measures shall also be taken to exclude storm water runoff, surface drainage, and subsurface drainage from sanitary wastewater treatment and disposal systems.	Compliance. Ref. B Plant SAR 7.2.5.
0273-99.0	Non-Reactor Facilities - General	
	3) There shall be no interconnection between the sanitary waste radioactive or other hazardous material handling areas. The sanitary waste system at each facility shall be monitored or sampled and analyzed (e.g., alpha emitters) for radioactivity unless the site sanitary treatment system is monitored. In addition, there shall be no interconnections between the potable water system, the sanitary waste system, and process systems.	Compliance. Ref. B Plant SAR 7.2.5.
0275-4	Control of Pollution From Other Sources	
	4) Precautions shall be taken to prevent contamination of surface water, ground-water, soil, or other environmental resources in the vicinity of storage or treatment tank systems for petrochemical, hazardous material, or hazardous wastes.	Compliance. Ref. "Project B-659, 211-B Chemical Tank Farm Environmental Upgrade," SD-WM-TA-013, B.1.22.

TABLE 6. B Plant Implementation of DOE 6430.1A General Design Criteria for Utilities and Services

Applicable Section	Design Criteria Summary	B Plant Implementation
	5) In 40 CFR 280.21 (draft) it is required that all existing tanks be upgraded to meet the same performance standards as new tanks and piping within 10 years from the effective date of the final regulations.	Compliance. Until the draft directive is issued, this is not required. However, ongoing assessments will likely indicate the need to replace several outside storage tanks in 211-B.
0275-99.0.1	Industrial Waste	
	6) Industrial wastes such as discharges from mop sinks, overflow from positive pressure circulating waste systems, and process steam condensate shall be collected and transferred to a waste treatment plant or similar treatment area. The use of retention systems shall be considered.	Noncompliance for mop sinks. Compliance for process and steam condensates and cooling water effluents.
1300-6.1	Radiation Protection	
	7) Specific facilities shall be designed to minimize personnel exposures to external and internal radiological hazards. Primary radiation protection shall be provided by the use of engineered controls (e.g., remote handling, equipment layout, and shielding; secondary radiation protection shall be provided by administrative control).	Noncompliance. Improvement in this general area is needed to respond to the very old canyon sampler design and current philosophy of personnel exposures being ALARA. Ref. B Plant SAR 6.11.
1300-8.1	Waste Management, General	
	8) Volume reduction equipment for both liquid and solid wastes shall be considered and shall be designed for process capability and capacity commensurate with the types and quantities of wastes expected.	Compliance. Volume reduction was considered but is not a general practice.

TABLE 6. B Plant Implementation of DOE 6430.1A General Design Criteria for Utilities and Services

Applicable Section	Design Criteria Summary	B Plant Implementation
1323-4.2	Collection Systems	
	9) Individual lines shall be used for each waste stream fed to central collection tanks, where necessary, to prevent chemical reactions or introduction of contaminants such as complexing agents that could interfere with waste decontamination.	Compliance. Although specific plans for the treatment of the variety wastes are not developed, avoidance of reactions is considered in the process flow sheet development and system design.
	10) The use of traps in radioactive liquid waste lines shall be avoided, and piping shall be designed to minimize entrapment and buildup of solids in the system.	Compliance. Additionally, flushes can be routinely performed.
	11) Bypasses that would permit waste streams to be routed around collection tanks shall be avoided.	Compliance. See Item 14.
	12) Measurement capability shall be provided to determine the volume and radioactivity of wastes fed to collection tanks(s).	Compliance. Ref. B Plant SAR-1985, 6.10. Inventory measurement and the sampling and analyses of wastes complies with the intent.
1323-4.3	Storage and Transfer Systems	
	13) Equipment, waste routing, and spare storage volume shall be installed and available to transfer the contents of one tank to another if a tank shows indications of excessive leakage or other conditions that warrant taking the tank out of service. The minimum spare volume shall exceed the maximum liquid content of any one tank.	Compliance. B Plant operations in the past have operated on this sparing philosophy. Routing choices are very flexible. Stored concentrated Sr and Cs solutions always had an "installed spare" tank available.
	o Provisions shall be made so that liquids can be analyzed prior to transfer.	Compliance. Ref. B Plant SAR 6.11.
	o All transfer lines have individual identification.	Compliance. Lines external to B Plant are so identified. Lines interconnecting cell equipment are adequately identified by the nozzles they connect.

TABLE 6. B Plant Implementation of DOE 6430.1A General Design Criteria for Utilities and Services

Applicable Section	Design Criteria Summary	B Plant Implementation
1323-4.4	Treatment Systems Single Failure	
	14) There shall be no bypass or drains in the radioactive liquid waste treatment facility by which waste may inadvertently be released directly to the environment.	Compliance based on drawings. It is not clear that there are no drains or bypasses in the BCE, BCS, BCP, and CBC systems. A walk through will be performed and bypasses, if any, will be removed.
	15) Provisions shall be made so that effluents from a treatment facility can be analyzed.	Compliance. B Plant SAR-1985, 6.11. Various sampling techniques are available.
1323-4.4	Treatment Systems	
	16) Recirculating closed-loop cooling systems shall be required for facilities and equipment associated with the storage or treatment of high-heat, high-level radioactive liquid waste.	Noncompliance. Once-through system exists.
1460	Cranes	
	17) Overhead cranes and related equipment for special facilities shall be designed and installed to the same requirements in effect in the building location in which they are installed. Cranes shall have wheel restrainers.	Compliance when Project W-002 is completed. Ref. SD-WM-TA-013, B.1.18.
1530-99.0	Fire Protection - Special Facilities	
	18) When the process produces combustible gases or vapors, the design shall include features such as inert gas purging and increasing the airflow within process confinement barriers to provide the dilution required to maintain the concentration of gases or vapors below the lower limit for flammability.	Compliance. There are manually controlled air purging systems based upon the calculated rate of hydrogen the generation by radiolysis and analytical determination of tank contents. Ref. B Plant SAR 11.4.1

TABLE 6. B Plant Implementation of DOE 6430.1A General Design Criteria for Utilities and Services

Applicable Section	Design Criteria Summary	B Plant Implementation
1540-1.1	Plumbing General	
	19) Domestic water shall be supplied by a separate service line and shall not be a combined fire protection and potable water service or a combined process water and potable water system within the building.	Compliance. Ref. B Plant SAR 5.10.5.2.
1540-1.5	Safety Devices	
	20) As directed by project criteria, emergency eye washes, emergency showers, or combination eye-wash/showers shall be provided where corrosive or other skin or eye irritant chemicals are stored, handled, used, or dispensed. Equipment shall comply with ANSI Z358.1 and be serviced by the potable water system.	Compliance. Located where the need exists. Strict conformance to Z358.1 is TBD.
	21) Backflow preventers and air gaps shall be used to prevent cross-connection (contamination) of potable water supplies.	TBD. While The potable (sanitary) water supply is a dedicated line, it also supplies the process water to the demineralizer, Ref. B Plant SAR 5.10.3.5. It is not clear how the demineralizer regeneration chemicals (caustic and sulfuric acid) are prevented from entering the sanitary water line. Backflow preventers are installed but a review of this system is recommended.
1540-99.0.1	Cooling System Criteria	
	22) The cooling water system shall be provided with at least two sources of motive power.	Compliance. The emergency wells provide two diesel-powered pumps to back up the primary electric pumps. Ref. B Plant SAR 5.10.3.

TABLE 6. B Plant Implementation of DOE 6430.1A General Design Criteria for Utilities and Services

Applicable Section	Design Criteria Summary	B Plant Implementation
1540-99.0.1 (Continued)	23) These criteria and requirements are for cooling water and water supply systems including all components that transfer heat from sources in the facility to the ultimate heat sink that are classified as safety class items in accordance with Section 1300-3.2 Safety Class Items. The function of the safety class water system is to provide a sufficient quantity of water to satisfy the safety needs of the following: o Cooling systems that remove heat from storage pools or process vessels that contain radioactive water. o Cooling needs of other equipment or systems requiring a supply of water to perform their safety functions. Water systems shall be designed to incorporate sufficient redundancy and independence to ensure that other systems and structures are adequately cooled and emergency supplies of water are available during normal operations, anticipated operational occurrences, and DBA conditions with the addition of a single failure of a component in the water system. The cooling system shall have a heat utilization capability of at least equal to the maximum heat load imposed under any mode of normal operation, anticipated operational occurrences, and DBA conditions.	TBD. Since a recirculating closed-loop system is required (See item 16), all of these criteria will need to be applied to that system. Additionally, the DBA and DBE requirements, if any, and OSR and Process Flow Sheet Requirements need to be determined so that the required functions can be designed into the system.
	24) The water system shall be designed to a national piping (i.e., ASME Boiler and Pressure Vessel Code, Section III, or ASME B31.3). The design of systems that must provide cooling water during a DBE shall include the forces resulting from a DBE.	Noncompliance. Piping through the canyon walls to the cells was not designed and installed to these specifications.

TABLE 6. B Plant Implementation of DOE 6430.1A General Design Criteria for Utilities and Services

Applicable Section	Design Criteria Summary	B Plant Implementation
	25) The water system design shall include provisions for isolating leaking components such as heat exchangers.	Compliance. Individual systems can be valved out.
	26) Components of the water system that are powered by electricity only shall be considered as safety class loads.	Compliance. This refers to safety class water systems. No safety class water system components have been identified in the current safety analysis.
	27) System redundancy requirements include the following:	
	o The cooling system shall be composed of at least two water sources, each capable of performing the necessary safety functions, unless it can be demonstrated by safety analysis that there is an extremely low probability of losing the capability of a single source.	Compliance. Two sources exist. Ref. SAR 5.10.3.9.
	o Where conduits and pumps are required as a part of the cooling system, the use of at least two complete delivery systems shall be considered.	Compliance assuming that a second complete system was considered. The existing design redundancies appear adequate.
	28) Means shall be provided to detect and control leakage of radioactive material into the coolant.	Compliance. In-line monitors provide for detection and control. Ref. B-Plant SAR 7.2.1 and Project B-499, "B Plant Liquid Effluent Measurement and System Upgrade," SD-WM-TA-013, B.1.5.
	29) Leakage of coolant into waste storage vessels shall be detectable and the volume of coolant that may enter the waste tank shall be controlled to prevent overflow.	Compliance. Administrative control by waste tank surveillance procedures.

TABLE 6. B Plant Implementation of DOE 6430.1A General Design Criteria for Utilities and Services

Applicable Section	Design Criteria Summary	B Plant Implementation
1540-99.0.2	Water Collection System	
	30) Collection systems shall be provided for water runoff from areas within special facilities containing radioactive material. Nuclear criticality prevention (if necessary), confinement, sampling, volume determination, and retrievability of liquids and solids shall be provided for.	Compliance. B Plant SAR-1985, 6.7.6.1.1 An effluent monitor activates a diversion valve to route chemical wastes and other BCE effluents to the Cell 10 collection tank.
1540-99.0.3	Other Collection Systems	
	31) Consideration shall be given to the collection and monitoring of radioactive and non-radioactive contaminants in natural runoff and blowdowns from heating and cooling systems before discharge to the environment.	Consideration was probably given, but collection of natural runoff is not a general practice.
	32) Safety shower water and personnel decontamination shower water shall drain to the contaminated process wastewater system.	Compliance. Ref. B Plant SAR-1985, 7.2.4.2 and SAR Table 7-8.
1540-99.0.4	Equipment Qualification	
	33) Testing or a combination of testing and analysis shall be the preferred method of demonstrating the operability of fluid system components, mechanical equipment that are required to operate during and after a DBE.	Compliance. Current safety analysis shows no need for process air or cooling during and after a DBE.

TABLE 6. B Plant Implementation of DOE 6430.1A General Design Criteria for Utilities and Services

Applicable Section	Design Criteria Summary	B Plant Implementation
1550-2.2.2	34) Where buildings are connected to the central plant heat generation/distribution system, one of the following shall be provided: o Steam-to-building hot water heat exchange o HTW-to-building hot water heat exchange o Steam-pressure-reducing station	Compliance. Pressure-reducing stations are provided. B Plant SAR 5.10.2.
	35) For process-related or other high temperature requirements, the DOE project criteria shall indicate the capacities and temperature and pressure requirements.	Compliance. A final process flow sheet will be used to determine high temperature and pressure requirements for inclusion in project criteria.
	36) For facilities with a central plant condensate return system, a condensate receiver with duplex pumps shall be specified.	Not applicable to B Plant.
1555-3.2	HVAC Steam	
	37) Steam shall be supplied to the distribution system of the lowest pressure that will adequately serve the connected load unless economies dictate otherwise.	Compliance. Ref. B Plant SAR 5.10.2.
	38) Piping insulation containing asbestos materials shall be prohibited.	Compliance. Asbestos materials are specifically prohibited in upgrade projects. However, there may be some asbestos in old systems.
1660-2		
	39) Steam-turbine generators may be used as emergency power systems if steam is being produced for onsite processes.	Not applicable to B Plant. Ref. B Plant SAR 5.10.1. However, a steam-turbine is used as a direct drive for standby stack ventilation.

TABLE 6A. B Plant Comparison to CS&Rs: Utilities and Services

Applicable Section	Design Criteria Summary	B Plant Implementation
RL 5480.10A Att. D-1, 3f Heat Exchangers	If backflow protection is required, the backflow preventer may be installed on the potable water supply line to the heat exchanger, on the service line to the facility, or both. All backflow preventers used as service protection shall be an approved type and model.	Compliance. Potable water is not connected to the heat exchangers. Ref. B Plant SAR-1985, 5.10.3.6.
RL 5480.10A Att. D-1, 3l	Only those backflow prevention assemblies that have been approved by the Washington State Board of Health shall be approved for installation at Hanford.	Compliance. Drawing H-2-7255 indicates WSBH approval.
RL 5480.10A, Att. D-1, 3b Hanford Water Systems Cross-Connection Prohibited	Cross connections between potable water systems and other systems or equipment containing water or other substances of questionable safety are prohibited except where suitable protective assemblies are installed, tested, and maintained to ensure proper operation on a continuing basis.	Compliance. Potable (sanitary) water is not cross connected with other systems. However, the emergency line can be manually connected only if required during abnormal operations.
5820.2A I 3b(2)(j) High Level Waste Storage and Transfer Operations	Each facility shall utilize remote maintenance features and other appropriate techniques to minimize personnel radiation exposure in accordance with DOE 5481.1B.	Compliance generally. B Plant is remotely operated and maintained. Some improvement in canyon sampling equipment will enhance ALARA compliance.
29 CFR 1910 1910.179 (g)(3) Controllers	Cranes not equipped with spring-return controllers or momentary contact push buttons shall be protected with a device which will disconnect all motors from the line on failure of power and will not permit any motor to be restarted until the controller handle is brought to the "off" position, or a reset switch or button is operated.	Compliance. Crane is equipped with spring return controllers and momentary contact push buttons.

TABLE 6A. B Plant Comparison to CS&Rs: Utilities and Services (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
29 CFR 1910.179 (e)(4) 29 CFR 1926.550 (d)(2) WAC 296-24-23509	Bridge Trucks shall be equipped with sweeps which extend below the top of the rail and project in front of the truck wheels.	Compliance. When upgrade project W-002 is completed. Ref. SD-WM-TA-103, B.1.8.
WAC 296-24-23503 New and Existing Equipment	All new overhead and gantry cranes constructed after the effective date of these standards shall meet the design specifications of AMSSC for Overhead and Gantry Cranes, ANSI B30.2.0-1967. Overhead and gantry cranes constructed before the effective date of these standards should be modified to conform to those design specifications, unless it can be shown that the crane cannot feasibly or economically be altered and that the crane substantially complies with the requirements of this section.	Compliance. When upgrade project W-002, "B Plant Canyon Crane Replacement" is completed. Ref. SD-WM-TA-013.
WAC 296-24-24503 Modifications	Cranes may be modified and rerated provided such modifications and the supporting structures are checked thoroughly for the new rated load by a qualified engineer or the equipment manufacturer.	TBD. Pending W-002 design details. Compliance is likely. The repair and replacement of the rails should be considered as a modification to the supporting structure and must be rerated as specified.
WAC 296-24-23505	The clearance of the cab above the working floor or passageway should not be less than seven ft.	TBD. Pending B-602 design details. Compliance is not likely because of limited space and the need to keep the cab below the shielding parapet. Administrative controls to restrict access to the craneway are in place to prevent personnel contact with the crane.
WAC 196-24-23517 (1)(c)	Except for floor operated cranes, a gong or other effective warning signal shall be provided for each crane equipped with a powered traveling mechanism.	Noncompliance. No warning signal in installed. However, personnel access to the crane and to the canyon area during crane operations is strictly controlled.

TABLE 6A. B Plant Comparison to CS&Rs: Utilities and Services (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
29 CFR 1910.134 Respiratory Protection paragraph (d) Air Quality	Compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration shall be of high purity. Oxygen shall meet the requirements of the United States Pharmacopoeia for medical or breathing oxygen. Breathing air shall meet at least the requirements of the specification for Grade D Breathing air as described in Compressed Gas Association Commodity Specification G-7.1-1966. Compressed oxygen shall not be used in supplied-air respirators or in open circuit self-contained breathing apparatus that have previously used compressed air.	Not applicable. The 221-B building breathing air system described in B Plant SAR-1985, 5.10.4.3 is no longer in use. Scott Air Paks are installed throughout the plant and Scott SKA-Paks are available.
40 CFR 280.21	This draft regulation requires that all existing tanks be upgraded to meet the same performance standards as new tanks and piping within 10 years from the effective date of the final regulations.	Not applicable at this time. If this requirement is implemented (it is still in draft) the impact could be major.

TABLE 7. B Plant Implementation of DOE 6430.1A General Design Criteria for Process Piping/Process Vessels/Confinement

Applicable Section	Design Criteria Summary	B Plant Implementation
0275-99.0.2	Process Wastes	
	1) Liquid process wastes containing radioactive or other hazardous material shall be collected and monitored near the source of generation before batch transfer through appropriate pipelines or tank transfer to a liquid waste treatment plant or area.	Compliance. Wastes from a cell operation are held in or near that cell before transfer. Monitoring is provided by sampling.
	2) These wastes shall be individually collected at that facility in storage tanks that are equipped with stirrers or other accepted means of mixing, sampling, and volume measuring devices, and transfer systems.	Compliance. Ref. B Plant SAR-1985, 5.8.1, 6.10, and 6.11.
	3) Waste storage tanks and transfer lines shall be designed and constructed so that any leakage shall be detected and contained before it reaches the environment.	Noncompliance. B-Plant SAR-1985, 5.3.3.3 and 7.2.6 indicate intent of compliance in 221-B but the low level waste routes external to 221-B may not be adequately monitored.
	4) Transfer lines shall have inspection and collection pits at practical intervals into which leakage can drain by gravity.	Noncompliance. Inspection and collection pits do not exist.
	5) Double-walled transfer pipelines or multi-pipe encasements shall be used for high-level radioactive liquid wastes and other equally hazardous nonradioactive liquid wastes as defined by safety analysis.	Compliance. Current safety analysis and system design includes criticality issues; however, criticality is not a major concern because of the separation and small quantities of fissionable material.
	6) Nuclear criticality safety shall be considered in the design of liquid radioactive waste processing systems.	Compliance. Current safety analysis and system design includes criticality considerations. However, criticality is not a major concern because of the separation and small quantities of fissionable material.

TABLE 7. B Plant Implementation of DOE 6430.1A General Design Criteria for Process Piping/Process Vessels/Confinement (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1300-3.2	Confinement Safety Class Items	
	7) Safety class items shall be designed to the ASME Boiler and Pressure Vessel Code and shall comply with 6430.1A Section 0140, Quality Assurance.	Compliance. No safety class vessels have been identified in the current safety analysis.
1300-6.1	Radiation Protection	
	8) Specific facilities shall be designed to minimize personnel exposures to external and internal radiological hazards. Primary radiation protection shall be provided by the use of engineered controls (e.g., confinement, ventilation, remote handling, equipment layout, and shielding; secondary radiation protection shall be provided by administrative control).	Noncompliance. Radiation protection is a key objective, but as far as confinement is concerned, measures to reduce personnel exposure from instrument tube blowback should be implemented to achieve ALARA. Steam supply pressure relief risers discharge directly to the atmosphere on the north side of 221-B with no monitoring. The steam lines at the concentrators are contaminated and these releases are contaminated. In view of ALARA objectives, confining these discharges or decontamination and protection of the steam lines from contamination should be considered.
1300-7	Confinement Systems	
1300-7.2	General	
	9) Confinement capabilities shall maintain a controlled continuous air flow pattern from the environment into noncontaminated areas, then to potentially contaminated areas, and then to normally contaminated areas.	Compliance. The canyon ventilation meets this requirement. The gallery and Building 271-B ventilation also meet this requirement.
	10) Sufficient redundancy shall be provided in the event of a confinement system failure. At least one of the confinement systems (primary or secondary) shall be designed to withstand the effects of severe natural phenomenon and man-made events for criteria of DOE 6430.1A Section 0111-99.0.	Noncompliance. The cell drain header may not survive a DBE. Secondary and tertiary confinement are thus effectively lost. The primary confinement systems are not qualified for seismic resistance.

TABLE 7. B Plant Implementation of DOE 6430.1A General Design Criteria for Process Piping/Process Vessels/Confinement (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	11) The secondary and tertiary barriers may exist in common as a single structural envelope (e.g., walls, roof slab, floor slab), provided the barrier can withstand the effects of man-made events and DBAs including the DBE, and does not contain access ways that permit the transfer of personnel, equipment, or materials directly from the exterior of the facility.	TBD. Secondary and tertiary barriers are considered common. Seismic analysis for DBE continues and its findings are required before this item can be resolved. Appropriate air locks exist for access.
	12) Design of confinement areas shall provide adequate means for decontamination prior to entry or breaching for maintenance purposes.	Compliance. Remote handling aspects and availability of proper personnel protective equipment provide maintenance capability for decontamination as necessary.
1300-7.3	Access Ways	
	13) Special features shall be considered for access through confinement barriers. Provisions for emergency equipment shall be provided in or adjacent to the access ways.	Compliance. Appropriate airlocks are available for access to the canyon.
1300-7.4	Transfer Pipes and Encasements	
	14) Double-walled pipes or pipes within a secondary confinement structure encasement shall be used in all areas where the primary pipe leaves the facility.	Compliance. Transfer lines (for example to the 212-B cask unloading station) are adequately encased but not double-walled. The site primary transfer lines are also encased.
1323	Radioactive Liquid Waste Facilities	
1323.3	Nuclear Criticality Safety	
	15) Nuclear criticality safety at radioactive liquid waste facilities is applicable to those facilities that process TRU contaminated liquid wastes.	Compliance. Based on the small quantity and physical separation of fissionable material, analysis shows that existing controls adequately address criticality concerns.

TABLE 7. B Plant Implementation of DOE 6430.1A General Design Criteria for Process Piping/Process Vessels/Confinement (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1323-4.1	Confinement	
	16) The use of multiple barriers shall be emphasized, when necessary, to restrict the movement of radioactive liquid waste that has the potential for human contact or for reducing ground water quality below requirements of DOE 5480.	Compliance. Proper process drains and monitored lines are used to ensure confinement of liquid waste.
1323-5	Confinement Systems	
1323-5.1	General	
	17) The degree of confinement in a radioactive liquid waste facility shall suit the most restrictive case anticipated. Systems, components, and structures shall be designed to ensure their integrity for all normal operations, anticipated operational occurrences, and DBAs they are required to withstand.	Compliance. Current safety analysis assumes worst-case conditions in considering consequences from confinement failures. System integrity by design is addressed below.
	18) Unless it can be demonstrated that the risk is acceptable, the process system, tanks, and supports shall be designed to be functional following a DBE, and shall facilitate the maintenance of a safe shutdown condition. As a minimum, portions of the process system and/or primary storage tanks whose failure would result in an unacceptable risk and whose functions are necessary to facilitate a safe shutdown condition shall remain functional following a DBE.	Compliance. Current safety analysis indicates that none of the process vessels or piping are safety class and do not present unacceptable risks from a DBE.
	19) The primary confinement system shall be designed to operate under process conditions that prevent or minimize the probability of potential explosive chemical reactions.	Compliance. A process vessel purge system to prevent buildup of potentially explosive mixtures is in place.

TABLE 7. B Plant Implementation of DOE 6430.1A General Design Criteria for Process Piping/Process Vessels/Confinement (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	20) Spills, overflow, or leakage shall be collected and retained within a suitable secondary confinement structure. That structure shall be capable of retaining the maximum radioactive liquid waste inventory that may be released. The capability shall exist to transfer such collected liquid to a suitable storage location.	Compliance. The cells and cell drain header to carry wastes to Cell 10 provide this function.
1323-5.2	High-Level Liquid Waste Confinement	
	21) At least one confinement system shall be designed to withstand the effects of man-made events and DBAs. The process cell and/or secondary storage tank confinement shall be designed to remain functional during normal operations, anticipated operational occurrences, and for the DBAs they are required to withstand.	Noncompliance. It is not clear that the secondary confinement provided by the canyon walls, roof, and cells will survive DBAs.
	22) Tank and piping systems used for high-level liquid waste collection, treatment, and storage shall be of welded construction to the fullest extent practicable.	Compliance. Most process systems are ISO-100 Class I systems which require welded construction. Major portions of the piping are not welded to facilitate practical remote handling.
	23) Potential non-uniform distribution of decay heat caused by solids in the waste shall be considered in the design of storage tanks and any associated cooling system. Agitation of tank contents shall be provided, when necessary, to maintain temperature gradients in the waste within acceptable limits.	Compliance. Agitation and cooling are provided as necessary.
	24) Double-walled piping, multi-pipe encasements, and double-walled tanks shall be used to establish the primary and secondary confinement boundaries in underground portions of high-level liquid waste systems.	Compliance. Outside underground pipes for HLW are effectively encased in concrete forming multipipe encasements.

TABLE 7. B Plant Implementation of DOE 6430.1A General Design Criteria for Process Piping/Process Vessels/Confinement (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	25) Process and waste storage vessels shall be vented through appropriate treatment systems that control the release of radioactive material in gaseous effluents to the extent that the guidelines referenced in Section 1300-1.4.3, Routine Releases, are not exceeded and these releases are ALARA. The design shall ensure the following:	Compliance.
	o The venting system will prevent the buildup of hydrogen from radiolysis.	Tank air purging and the vessel vent system provides this function.
	o Tank overflows will be directed to collection systems.	Tank overflows to the cell and cell drain header.
	o The venting system will prevent overpressure or vacuum conditions from occurring within vessels.	Project W-024 upgrades prevent overpressure.
	26) Integrity of the primary confinement boundary shall be determined by some or all of the following:	Compliance. Integrity can be assessed using features discussed below.
	o Vessel inventory measurement	Vessel levels are directly measured.
	o Online leakage monitoring for interspace between double-walled confinement barriers	Not provided.
	o Leakage outside confinement barriers such as by monitoring wells	Process effluent streams are monitored.
	o Visual surveillance including CCTV	Observations from the crane are used to detect leaks.
	o Periodic evaluation of test coupons for corrosion rate of primary vessel	Not provided. However, historical Hanford Site experience with equipment should fulfill this requirement.
	o Other	Routine testing of the cell drain header by transfer of a known quantity of effluent and point to point measurement is planned.

TABLE 7. B Plant Implementation of DOE 6430.1A General Design Criteria for Process Piping/Process Vessels/Confinement (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1323-6.2.1	Contaminated Liquid Waste	
	27) Disposal operations involving discharge of low-level liquid wastes directly to the environment or on natural soil columns is prohibited unless specifically approved by the cognizant DOE authority.	Compliance. Disposal of low-level wastes to the environment is not planned under normal operations. All low-level liquid wastes terminate in impoundments or soil columns, presumably with cognizant DOE authority. Projects have been or are being considered for treatment of these wastes. Ref. SD-WM-TA-013, Page 32.
1530-99.0	Non-reactor Nuclear Facilities - Fire Protection	
should	28) Confinement systems, particularly the building structural shell and its associated ventilation system, shall be designed with the capability of retaining the confinement function during the DBF.	Compliance. With recent upgrades, the building ventilation survive the DBF, but analysis continues.
1540-99.0.6	System Installation	
	29) The following design features represent recommended practices for the installation of piping and valves carrying hazardous process fluids.	General compliance. However, due to limited space in cells and remote maintenance practicality, all recommendations are not completely met.
	o Pipe and valve locations as specified on approved drawings (not located at the discretion of the installer).	Compliance per Hanford Specifications.
	o Valves designed and installed to operate in the stem-up orientation.	Not necessarily. Cell space and position requirements rule the design and installation.
	o Valves and other connections located to minimize the consequences of leaks.	Not an issue since appropriate collection systems exist.
	o Block valves in pipes that enter or exit a process area.	Generally true for chemical add lines; however, instrument tubing is an exception.

TABLE 7. B Plant Implementation of DOE 6430.1A General Design Criteria for Process Piping/Process Vessels/Confinement (Continued)

Applicable Section			Design Criteria Summary	B Plant Implementation
(Continued)	29)	o	Piping not embedded in concrete slabs.	Original canyon piping is often directly embedded.
		o	Pipe sleeves where piping passes through nonshielding concrete walls, floors, and roofs.	Generally true.
		o	Sleeves sloped to drain toward the controlled area.	Not necessarily.
		o	Space between the pipe and sleeve to be packed and sealed.	Generally true at fire barriers or ventilation zones.
		o	Process valves not located at low points in the piping.	Generally true.
		o	Corrosion resistance of block valve and/or check valve and associated process piping equivalent and adequate.	Hanford Standards require compatibility.
		o	Welded joints rather than flanged connections wherever possible; butt-welded joints rather than socket-welded joints if joint strength is not overriding factor.	Generally true when practical.

TABLE 7A. B Plant Comparison to CS&Rs: Process Piping/Process Vessel/Confinement

Applicable Section	Design Criteria Summary	B Plant Implementation
5820.2A I 3b(2) High-Level Waste Storage And Transfer Operations	Storage and Transfer Operations	
	(a) All new high-level waste handling, transfer, and storage facilities (e.g., tanks, bins, pipelines, and capsules) shall be double contained.	Compliance. Secondary and tertiary confinement are provided.
	(b) Singly contained pipelines may be used routinely for liquid waste that has a total radioactivity concentration of less than 0.05 Ci/gal. They may be used on a temporary basis for higher activity waste, if appropriate design and administrative controls are in place to mitigate adverse effects from a pipeline failure.	Compliance. BCE, CBC, BCP, BCS transfer lines likely have low radioactivity concentrations and are single, direct-buried pipes. Requirements of 6430.1A, 0275-99.0.2 are more restrictive than this requirement.
	(c) Leaking waste storage systems shall not be used to receive waste unless secondary containment is maintained (e.g., liquid level maintained below leak point) and it can be shown with the support of formal documentation (e.g., Safety Analysis Reports, Operational Safety Requirements, Operating Standards) that temporary operation can be performed without releasing radioactive liquid to the environment.	Compliance. Administrative controls restrict the use of leaking primary confinement systems.
	(d) Secondary containment systems shall be capable of containing liquids that leak into them from the primary system and shall be equipped with transfer capability to retrieve the leaked liquid. Secondary containment systems for solidified high-level waste shall provide for physical isolation of the waste from the environment.	Compliance. The cells and cell drain header carry leaks from the primary system to cell 10. The HLW line encasements external to B Plant drain to a 200-E tank farm collection tank.

TABLE 7A. B Plant Comparison to CS&Rs: Process Piping/Process Vessel/Confinement (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	(g) Facilities using cathodic corrosion protection systems shall include engineered features that protect against abnormal conditions such as stray currents or system failure. The cathodic protection systems shall be calibrated annually, and all sources of impressed current shall be inspected and/or tested at least every other month.	Compliance. Cathodic protection is routinely applied for B Plant facilities.
I 3b(4)(d)	For emergency situations involving liquid high-level waste, spare capacity with adequate heat dissipation capability shall be maintained to receive the largest volume of liquid contained in any one tank. Adequate transfer pipelines also shall be maintained in operational condition. Interconnected tank farms with adequate transfer capabilities and spare capacity shall be considered as a single tank farm for purposes of this requirement.	Compliance. Spare in-cell tanks are available for emergency receipt of HLWs.
40 CFR 264.190 Tank Systems	The requirements of this subpart apply to operators of facilities that use tank systems for storing or treating hazardous waste. Tanks used to store or treat hazardous waste and which contain no free liquids and are inside a building with an impermeable floor are exempted from 264.193.	
40 CFR 264.193 Containment and Collection of Releases	This section covers the requirements for secondary containment regarding prevention of the release of hazardous materials to the environment.	

TABLE 7A. B Plant Comparison to CS&Rs: Process Piping/Process Vessel/Confinement (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
40 CFR 264.193 (Continued)	(d) Secondary containment for tanks must include one or more of the following devices: o a liner (external to the tank), o a vault, o a double walled tank, or o an equivalent device.	Compliance. The secondary confinement for the process tanks are the cells, cell drain header, and Tank 10-1. The cells are an effective vault, the cell drain header will be a lined transfer pipe, and Tank 10-1 which has Cell 10 as a secondary confinement is an effective equivalent device.
	(e) This secondary containment system must satisfy the following requirements:	
	o Designed to contain 100% of the largest tank within its boundary.	Compliance. The 10-1 tank and cell 10 have sufficient capacity.
	o Designed or operated to prevent run-on or infiltration of precipitation in the secondary confinement system.	Compliance. There is no credible means of precipitation infiltration.
	o Liners must be free of cracks and gaps.	Noncompliance. The cell drain header liner as currently designed may have a gap at the junctions at the downcomers and the header.
	o Vaults must be constructed with chemical resistant water stops in place at all joints.	Compliance. The cells have no joints.
	o Vaults must be provided with an impermeable interior coat or lining that is compatible with the stored waste and will prevent migration of the waste into the concrete.	Noncompliance. The cell walls are not protected from migration.
40 CFR 264.220 40 CFR 264.221 Surface Impoundments	(a) Any surface impoundment must have a liner for all portions of the impoundment except for existing portions of such impoundments.	Compliance at this time for the existing B Plant impoundment.

TABLE 7A. B Plant Comparison to CS&Rs: Process Piping/Process Vessel/Confinement (Continued)

Applicable Section		Design Criteria Summary	B Plant Implementation
40 CFR 264.220 40 CFR 264.221 (Continued)	(c)	Each new surface impoundment, each replacement impoundment, and each lateral expansion of an existing impoundment must install two or more liners and a leachate collection system between the liners.	Compliance at this time. Note appropriate measures are required if expansion of the existing impoundment is needed.
	(f)	A surface impoundment must be designed, constructed, and operated to prevent overtopping from normal or abnormal operations.	Compliance at this time. See 40 CFR 264.221 (c).
	(g)	A surface impoundment must have dikes that are designed, constructed, and maintained to prevent massive failure of the dikes.	Compliance at this time. See 40 CFR 264.221 (c).
40 CFR 264.170 40 CFR 264.171 40 CFR 264.172 Use And Management Of Containers		This subpart applies to storage of hazardous waste in containers. The containers must be in good condition. Container interior or lining must be compatible with the waste stored.	Compliance. High-level solid waste is temporarily stored on the canyon deck and in canyon cells. Routinely, precast concrete burial boxes (steel lined, if appropriate) are loaded and sent to the burial ground. (Ref. B Plant SAR-1985 7.3.1, 7.3.2., 7.4.4.)
40 CFR 264.173 40 CFR 264.174		Containers must be managed so as to preclude leakage; areas are inspected weekly.	Noncompliance. The inspections, using the gantry crane optics, were previously made on a nonroutine basis. The crane has been out of service for about a year.
40 CFR 264.175		Container storage areas must have impervious bases, sloped to contain leaks. Capacity of 10% of the container inventory or the largest container volume.	Compliance. Containers are stored in the cells (Ref B Plant SAR 7.3.1.) which effectively contain any leaks and which drain to the cell 10 collection tank.

TABLE 7A. B Plant Comparison to CS&Rs: Process Piping/Process Vessel/Confinement (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
WAC 173-303-640 Tanks	Facilities shall not treat or store dangerous waste in covered underground tanks that cannot be entered for inspection unless such tanks are used for treating or storing only moderate risk wastes and can be externally inspected or have secondary containment structures that allow for monitoring, containment, and removal of leaks or can be tested for leakage.	Not applicable. There are no underground tanks used to or store dangerous wastes at B Plant.

TABLE 8. B Plant Design Criteria Comparison to DOE 6430.1A General Design Criteria for Instrumentation and Control

Applicable Section	Design Criteria Summary	B Plant Implementation
1300	GENERAL REQUIREMENTS	
1300-3.2 Safety Class	1) Safety class instruments are: o Those required to maintain operating parameters within the safety limits specified in the OSRs during normal operations and anticipated operational occurrences. o Those required for nuclear criticality safety. o Those required to mitigate the consequences of DBAs to the extent that the guidelines of Section 1300-1.4.2 are not exceeded. o Those required to monitor the release of radioactive materials to the environment during and after a DBA. o Those required to achieve and maintain the facility in a safe shutdown condition. o Those that monitor or control the safety class items.	Compliance. The identification of safety class items by WHC safety analysis criteria is consistent and more comprehensive than this 6430.1A directive. Systems identified as candidates at this point in the safety analysis include: o Stack monitor and gallery exhaust monitor, o BCE and CBC diversion systems, o Control loops or Bailey Systems controls at cells 18, 20, 37, and o Canyon and gallery ventilation controls.
1300-3.4	Equipment environment considerations	
1300-3.4.3	Equipment Operability Qualification	
	2) Testing or a combination of testing and analysis shall be the preferred method of demonstrating the operability of instrumentation that are required to operate during and following a DBE. Seismic experience data may be used as an alternative to testing or dynamic analysis where such data have been documented and validated.	TBD. Once safety class instrument systems are completely identified, it is presumed that appropriate specifications to meet this criterion will be implemented.
	3) Safety class items shall be designed to permit inspection, maintenance, and testing to ensure their continued functioning, readiness for operation, and accuracy.	Compliance. Existing inspection and test procedures implemented through OSRs will comply.

TABLE 8. B Plant Design Criteria Comparison to DOE 6430.1A General Design Criteria for Instrumentation and Control (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1300-4	4) A criticality alarm system (gamma or neutron) shall be provided, where necessary, to meet the requirements of DOE 5480.5 and ANS 8.3.	Compliance. Fissionable material in B Plant is restricted to less than the minimal required amounts which require monitoring. 5480.5 minimum quantities are 700 grams of U-235, 520 grams of U-233, 450 grams of Pu or 450 grams of any combination of these three.
1300-6.5	Monitoring, Warning, and Alarm Systems	
1300-6.5.1	General	
	5) All radiation monitoring, alarm, and warning systems that are required to function during a loss of normal power shall be provided with an emergency UPS.	Noncompliance. Although the 2300 volt feeder from the emergency power house provides some power supply diversity, it does not meet the stringent requirements of an emergency system or UPS.
1300-6.5.2 Air Monitoring and Warning Systems	6) Air monitoring and warning systems shall be installed in work areas where radioactive material is handled. Air monitoring systems shall comply with ANSI N13.1.	Noncompliance. Placement of monitors was based on judgement rather than N13.1 guidelines.
1300-6.5.5 Warning and Alarm System Features	7) Warning and alarm systems shall be designed, installed, and tested to ensure that they can be heard in ambient conditions of the area they are intended to cover. Evacuation alarm systems shall comply with ANSI N.2.3.	Compliance. Reference B Plant SAR 1985, 4.5 and 5.7.1.1.
1300-9	Effluent Monitoring and Control	
	8) All effluent streams shall be sampled or monitored as appropriate to ensure accurate measurements under normal operations, anticipated operational occurrences, and DBA conditions. The design of radioactive effluent monitoring systems shall appropriately comply with ANSI N42.18 and "DOE Requirements for Radiological Effluent Monitoring and Environmental Surveillance for U.S. Department of Energy Operations."	Partial compliance. Waste effluents and the stack are properly monitored except under loss of power or DBE conditions (See Item 5).

TABLE 8. B Plant Design Criteria Comparison to DOE 6430.1A General Design Criteria for Instrumentation and Control (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1300-12	Human Factors Engineering	
1300-12.4	System Design Considerations	
1300-12.4.6	Display Devices	
	9) Display shall provide only the information about system status and parameter values that is needed to meet task requirements in normal, abnormal, and emergency situation.	TBD. The OSR and Process Flow Sheet are required which will provide the bases for determination of these needs.
	10) Status, rather than demand information, shall be displayed for important parameters. Display shall indicate whether they reflect demand or actual status.	Compliance. Displays analog instruments effectively meets display criteria. Displays on the Bailey system are also adequate.
	11) Each display device shall be formatted and designed to ensure that both the display and display content are readable, understandable, and accessible.	See Item 10.
	12) Failure of a display of any type shall be easily recognized and shall not affect equipment or system performance.	See Item 10.
	13) Where CRTs are used, rapid, error-free access to the information required for the task shall be accomplished by ensuring that system response to any query is less than 2 seconds and that user feedback to control action is less than 0.2 seconds or faster wherever possible.	TBD pending final Bailey system configuration. However, there are no control process functions which require rapid response. Response within several seconds should be adequate.
1300-12.4.8	Warning and Annunciator Systems	
	14) For the special case of control room annunciators, see NUREG 0700, Section 6.3. For auditory signals guidelines, see NUREG 0700, Section 6.2.2.	TBD. Conformance is likely. Annunciators appear adequate. Absolute conformance would require satisfactory response on the 111 item check lists in the NUREG 0700 reference that covers both systems.
	15) Provision shall be made for active acknowledgment and for silencing of auditory alarms after they have been acknowledged.	Compliance. Ref. B Plant SAR 1985, 4.5.

TABLE 8. B Plant Design Criteria Comparison to DOE 6430.1A General Design Criteria for Instrumentation and Control (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	16) Provision shall be made for maintaining personnel awareness of alarm conditions until they have been corrected or "cleared." Clearing of the alarm shall require a positive response from the assigned personnel.	Compliance. Broadly implied in B Plant SAR-1985, 4.9.
	17) Visual alarm tiles shall be grouped by function or system within panels having horizontal and vertical alphanumeric labeling for ready coordinate designation of individual tiles.	Compliance. Alarm tiles in dispatcher's office are effectively grouped. Ref. SO-WM-TA-013, Rev. 0, CENTRC-25.
	18) It shall be possible to test the warning system periodically.	Compliance. Ref. B Plant SAR-1985, 12.7. System tests are required.
1304-5 Special Design Features	19) Leakage from a primary pipe shall be collected in a geometrically favorable location. It shall be continuously detectable by a liquid-detection system or by a radiation detection system.	Compliance. Leaks are collected in the drain header and transferred to Cell 10. Cell 10 is equipped with liquid and flow detection.
1323-4.2 Collection Systems	20) Measurement capability shall be provided to determine the volume and radioactivity of wastes fed to a collection tank.	Compliance. Ref. B-Plant SAR-1985, 6.10. The sampling and analyses of wastes for radioisotopes complies with intent of 1323-4.2.
1323-4.4	21) Instrumentation and control systems shall be required at a Radioactive Liquid Waste Facility to provide monitoring and control capabilities associated with confinement, nuclear criticality safety, and/or radiation protection.	Compliance. Confinement instruments are provided per Items 19, 22, 23, and 24. Nuclear criticality instruments are not applicable (See Item 4). Radiation monitoring is provided per Items 8, 26, 27, 28, and 29. Compliance to applicable criteria are discussed at each of those items.

TABLE 8. B Plant Design Criteria Comparison to DOE 6430.1A General Design Criteria for Instrumentation and Control (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1323-5.2 High-Level Liquid Waste Confinement	22) Integrity of the primary confinement barrier shall be determined by <u>some</u> or all of the following measures:	
	o Vessel inventory monitoring, (e.g., liquid level sensors).	Compliance. Reference B Plant SAR 6.10.
	o Online leakage monitoring for the interspace between double-walled vessels (e.g., sump level sensors, conductivity cells).	Not applicable in B Plant. There are no double-walled vessels.
	o Leakage monitoring outside confinement vessels (e.g., surveillance wells to detect leakage to groundwater).	<u>Noncompliance</u>. Although leaks from primary process vessels are effectively detected, leaks from effluent transfer lines may not be effectively detected by the existing ground water monitors.
	o Capability for periodic visual surveillance, including remote visual surveillance with CCTV.	Compliance. Gantry crane optical system provides for this surveillance.
	o Periodic evaluation of test coupons of primary tank construction materials that were installed before tank was placed in service.	Compliance. Historical experience of B Plant equipment life should fulfill this requirement.
	o Other surveillance or testing measures, as appropriate.	Compliance. As needs are determined.
1550-99.0.1 General	23) Adequate instrumentation and controls shall be provided to assess ventilation and offgas system performance and permit the necessary control of system operation.	Compliance. Reference B Plant SAR 5.7.1. Does not adequately cover control during a DBA, however. See Table 8, Item 5.
	24) Process areas that use non-radioactive hazardous materials shall have ventilation systems designed to ensure that the hazardous material concentrations do not exceed the limits referenced in DOE 5480.10 and are ALARA in the workplace environment. Effective loss-of-ventilation alarms shall be provided in all of these areas.	<u>Noncompliance</u>. Ventilation to the chemical tank areas on the 271-B third floor is currently being upgraded; however, loss of ventilation alarms are not provided.

TABLE 8. B Plant Design Criteria Comparison to DOE 6430.1A General Design Criteria for Instrumentation and Control (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1550-99.0.4	25) Testing or a combination of testing and analysis shall be the preferred method of demonstrating the operability of fluid system components, mechanical equipment, instrumentation, and electrical equipment that are required to operate during and following a DBE. Seismic experience data may be used as an alternative to testing or dynamic analysis where such data have been documented and validated.	See item 2.
1589	AIR POLLUTION CONTROL	
1589-99	Special Facilities	
	26) All exhaust ducts that may contain radioactive airborne effluent shall be provided with two monitoring systems. One shall be of the CAM type and the other a fixed sampler.	Compliance. The stack is equipped with a compliant monitoring system (Ref. Upgrade B-432).
	27) The sampling systems for both types of monitoring capabilities (on-line detector and sampler) shall be designed in accordance with ANSI N13.1 and associated appendices to ensure representative sampling of the effluent stream.	Compliance. Stack monitor system upgrade B-432 cites ANSI N13.1 use.
	28) Isokinetic sampling shall be provided for effluent streams that are expected to contain particulate radionuclides.	Compliance. The stack monitoring system provides isokinetic sampling.
	29) The design of effluent monitoring systems shall comply with ANSI N42.18 and "DOE Requirements for Radiological Effluent Monitoring and Environmental Surveillance for U.S. Department of Energy Operation."	Compliance. Although N42.18 was not specifically cited for use in the B-432 project, the system appears to be in compliance.

TABLE 8. B Plant Design Criteria Comparison to DOE 6430.1A General Design Criteria for Instrumentation and Control (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
1639	GROUNDING	
1639-4	Isolated Ground Systems	
	30) Isolated ground systems may be required to meet special instrumentation or other equipment needs. Such ground systems shall be clearly identified, protected against improper usage, and installed in conformance with NFPA 70.	Compliance. Single lines to the Bailey system have an isolated ground. As the Bailey system continues to be expanded and upgraded, even to the point of becoming safety class at some locations, an isolated power ground system should be considered.
1660	SPECIAL SYSTEMS	
1660-99.0	Non-reactor Nuclear Facilities - General	
	Protection Systems and Instrumentation and Controls	
1660-99.0.2	31) Safety class instrumentation shall sense abnormal conditions effecting safety and subsequently provide an alarm, e.g., low dp between HVAC zones, criticality monitoring.	TBD. As safety class items are identified by WHC criteria (see Item 1), it is presumed that the criteria in Items 31-41 below will be properly implemented. Noncompliance. At this point, safety class systems are deficient with respect to operation during DBAs, redundancy, qualification, separation, test and calibration, UPS power.
	32) Safety class instrumentation and control systems shall provide audible and visual alarms so that the operation can take timely corrective actions to ensure the safety of operating personnel and the public.	TBD. See Item 31.
	33) The safety class instrumentation shall be designed to monitor safety related variables and safety class systems over expected ranges for normal operation, anticipated operational occurrences, DBA conditions, and for safe shutdown. Safety class controls shall be provided when they are necessary to control these variables.	TBD. See Item 31.

TABLE 8. B Plant Design Criteria Comparison to DOE 6430.1A General Design Criteria for Instrumentation and Control (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	34) The design of safety class instrumentation and controls shall provide suitable redundancy and diversity to ensure that safety functions can be completed, when required, and that no single failure will result in the loss of the protective functions.	TBD. See Item 31.
1660-99.0.3	Qualification	
	35) Protection systems and safety class instrumentation and control equipment shall be qualified to the environmental qualification requirements in Section 1300-3.4, Equipment Environment Considerations, and the seismic qualification requirements in Section 0111-99.0.4, Earthquakes.	TBD. See Item 31.
1660-99.0.4	Separation and Physical Protection	
	36) Redundant protection system and safety class instrument channels shall be physically protected or separated to prevent a common external event or failure of one channel from causing a failure in the redundant channel.	TBD. See Item 31.
	37) The safety class protection system and safety class instrumentation and control system shall be appropriately separated or isolated from other instrumentation and control systems to the extent that a failure (e.g. electrical, control air) in these other systems will not degrade the safety class systems to the extent that they are unable to perform their necessary safety functions.	TBD. See Item 31.
1660-99.0.5	Test and Calibration	
	38) The design of protection system and safety class instrumentation and control systems shall provide for the periodic in-place testing and calibration of instrument channels and interlocks.	TBD. See Item 31.

TABLE 8. B Plant Design Criteria Comparison to DOE 6430.1A General Design Criteria for Instrumentation and Control (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	39) The design shall permit periodic testing of protective functions to determine whether failure or loss of redundancy may have occurred.	TBD. See Item 31.
1660-99.0.6	Power Sources	
	40) The protection system and safety class instrumentation and control systems shall be provided with an uninterruptible power source.	TBD. See Item 31.
	41) Safety class electric power or a safety class control air system shall be provided unless adequate system performance including fail safe shutdown can be demonstrated when conventional power sources are used.	TBD. See Item 31.
1660-99.0.7	Control Areas	
	42) Control areas or a control room shall be designed to permit occupancy and actions to be taken to operate the facility safely under normal conditions, anticipated operational occurrences, and DBA conditions to achieve and maintain a safe shutdown condition including the remote manual initiation and control of safety functions, if used.	TBD. DBA conditions and OSR and Process Flow Sheet requirements must be determined as bases for compliance determination. It is then presumed that appropriate interfaces to safety class instrument systems will be provided at the dispatcher's office.
	43) In the event that a control area or control room is disabled, there shall be sufficient redundancy and capability to allow the facility to be placed in a safe shutdown condition.	TBD. See Item 42. It is anticpated that systems will be upgraded to fail safe with no need for operator action from a control room.

TABLE 8A. B Plant Comparison to CS&Rs: Instrumentation

Applicable Section	Design Criteria Summary	B Plant Implementation
DOE 5480.5, 11c (3)(g)	The criticality alarm system shall be installed in all locations where the quantities of fissionable material may exceed 700 grams of U-235, 520 grams of U-233, 450 grams of Pu, or 450 grams of any combination of these three nuclides.	Compliance for NCAW. It is presumed that there will be no location where these quantities will exist and that material balances will forewarn of any abnormal accumulations.
DOE 5480.4, Att. 2 f	The hardware oriented reactor safety and nuclear facility safety standards specified in this subparagraph shall be applied to DOE-owned nuclear reactors and facilities in either of the following cases: all new construction of facilities; or during nuclear facility modifications or repairs to safety or safety-related structures, systems, or components when the standard would be compatible with existing systems and would increase the level of safety. o ANSI/ANS-8.3-1979, "Criticality Accident Alarm System." o ANSI N16.1-1975, "Safety Standards for Operations with Fissionable Materials Outside Reactors" (Replaced by ANSI 8.1 - 1983).	Compliance for NCAW. Sampling and analyzing the incoming and outgoing solutions for Pu and performing flushes when a significant imbalance in Pu occurs has provided adequate control in the past. The NCAW flowsheet indicates no Pu holdup is expected in B Plant (Per Larry Gale, Process Engineer, WHC). When other feed sources are considered, viz., Plutonium Finishing Plant waste, a determination of the potential for accumulating Pu would be appropriate. This determination should be made based on criticality parameters presented in ANSI 8.1. ANSI-8.3 requires alarms based on the same quantities as DOE 5480.5, 11c. (see above) so such alarms are not required at this time.
5820.2A, I 3b(2)(h) High-Level Waste Storage and Transfer Operations	Engineered controls incorporated to provide inventory data and prevent spills, leaks, and overflows. HLW shall be stored at pressures lower than those of ancillary systems (e.g., cooling water).	Compliance. The volume of solution in process vessels is maintained less than 80% of capacity and level alarms are provided (Ref. B Plant SAR 6.8.10.3). Cooling water is pressurized with respect to the process vessel pressure (Ref. SAR 6.8.11.2).

TABLE 8A. B Plant Comparison to CS&Rs: Instrumentation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
5820.2A, I 3b(3) High-Level Waste Monitoring, Surveillance, And Leak Detection	(a) Monitoring and leak detection capability shall be incorporated in the engineering systems (e.g., liquid level sensing devices and alarms for high-level waste liquid systems) to provide rapid identification of failed containment, and measurement of abnormal temperatures. The following, at a minimum, shall be monitored: temperature, pressure, radioactivity in ventilation exhaust, and liquid effluent streams associated with high-level waste facilities. Where the possibility exists for the generation of flammable and explosive mixtures of gases, monitoring shall be conducted. For facilities storing liquid high-level waste, the following should also be monitored: liquid levels, sludge volume, tank chemistry, condensate, and cooling water.	Compliance. o Process temperatures and pressures are monitored as necessary (Ref. SAR 6.10). o Ventilation is monitored (Ref. FDC, CDR for B-432 project. o Liquid effluents (including condensate and cooling water) are monitored (Ref. SAR 6.7). o Buildup of explosive mixtures is mitigated by air purging in lieu of monitoring (Ref. SAR 6.8.1). o Sludge volume can be monitored by dip tube response and sampling. Agitation is supplied to prevent sludge buildup.
	(b) Leak detection systems (e.g., conductivity probes) shall be designed and operated so that they will detect the failure of the primary containment boundary, the occurrence of waste release, or accumulated liquid in the secondary containment system.	Noncompliance. Conductivity probes are in place, but not all are currently in use.
	(c) A method for periodically assessing waste storage system integrity (e.g., coupons for corrosion testing, photographic and periscopic inspections, leak detectors, liquid level devices) shall be established, documented, and reported as required in the Waste Management Plan.	Compliance. Integrity is checked using vessel inventory monitoring and periodic visual surveillance as practical. Historical experience with process vessels provides information on corrosion.

TABLE 8A. B Plant Comparison to CS&Rs: Instrumentation (Continued)

Applicable Section	Design Criteria Summary	B Plant Implementation
	(d) Electrical monitoring and leak detection devices essential to safe operations shall be provided with backup power, as appropriate, to ensure operability under emergency conditions.	Noncompliance. At this time, reliable backup power to process monitoring and leak detection systems is not provided.
	(e) Surface water associated with HLW storage shall be monitored per applicable Pollution Discharge Elimination System permits.	TBD. Discharges to the 216-B-3 Pond impoundment are monitored. RHO-SD-RE-ER-004, 7-14-82, "Liquid Effluent Sampler-Monitor Upgrade Plan," includes B Plant planned action; compliance to permit requirements is TBD.
40 CFR 264.193 Containment and Detection of Releases	Secondary containment systems must be provided with a leak detection system to detect the failure of either the primary or secondary containment structure within 24 hours.	Noncompliance. Conductivity probes are in place, but not all are in use. See 5480.2A I 3b(3) above.

APPENDIX B

B PLANT DOCUMENT LIST

B Plant Document List

File#	Document #	Title	Date	Author	Organization
B2-1	PFD-B-033-0001	Process Flowsheet, Demonstration of Neutralized Current Acid Waste Pretreatment at B Plant	Sept, 1987	Gibson, M.W.; Landeene, B. C.	Waste Management Separations Process Technology
B2-2	SD-4-1.HPS.1004	SDC-4.1, Standard Arch-Civil Design Criteria, Design Loads For Facilities	June, 1988	None	Hanford Plant Standards, U.S. Department of Energy, Richland, WA
B2-3	SD-WM-TA-015	Process and Facility Options for Pretreatment of Hanford Tank Waste	Sept, 1988	Kupfer, M. J.; Boldt, A. L.; Buelt, J.L.	Westinghouse Hanford Company, Richland, WA
B2-4	WHC-C -4-46	Non-Reactor Facility Safety Analysis Manual: Safety, Quality Assurance, and Security	Sept, 1988	None	Westinghouse Hanford Company, Richland, WA
B2-5	13530-88-225	Impact on Hanford Waste Vitrification Plant Design of Implementing 6430.1A	Oct, 1988	Engstom, S. L., et. al.	Westinghouse Hanford Company, Richland, WA
B2-6		USNRC Regulatory Guides Referenced in DOE/TIC 11603-Rev. 1	None	None	None
B2-7	None	Meeting Minutes: B-Plant Compliance to DOE Order 6430.1A	Dec, 1988	None	None
B2-8	SD-WM-TA-013	B-Plant Productivity Retention Study	Aug, 1987	Higley, B. A., et. al.	Westinghouse Hanford Company, Richland, WA
B2-9	SD-WM-SA-PP1, REV. 0	B Plant Structural Qualification Interim Report	Dec, 1988	Wagenblast, G. R.	
B2-10	JABE-VITRO-01	Earthquake Analysis of the Waste Encapsulation Facility - Hanford Atomic Energy Reservation	April, 1971	None	John A. Blume & Associates, Engineers, San Francisco, CA

File#	Document #	Title	Date	Author	Organization
B2-11	SD-432-CDR-001	Conceptual Design Report, Chemical Sewer Upgrade, B Plant Project B-357	Sept, 1982	Wood, R. J.	Kaiser Engineers Hanford Co., Richland, WA
B2-12	SD-356-CDR-001	Conceptual Design Report, Chemical Sewer Upgrade, B Plant Project B-356	March, 1982	McVey, C. B., Tanimoto, E. Y.	Kaiser Engineers Hanford Co., Richland, WA
B2-13	SD-WM-TA-002	B Plant Support Facilities Natural Forces Evaluation	Sept, 1983	Chen, W. W., et. al.	Rockwell Hanford Operations, Richland, WA
B2-14	RHO-R-34	Geologic and Seismic Investigation of the PUREX Building Site Near Richland, Washington	March, 1981		URS/John A. Blume & Associates, Engineers, San Francisco, CA
B2-15	SD-WM-ES-023	Evaluation of Process and Facility Options for Treatment of Double-Shell Tank Wastes	Dec, 1983	Schulz, W. W.; Kupfer, M. J.; Sloughter, J. P.	Rockwell Hanford Operations, Richland, WA
B2-16	W-059	Short Form Data Sheet - Fiscal Year 1992, B Plant Category I Vent Upgrades	None	None	Westinghouse Hanford Company, Richland, WA
B2-17	SD-W024-FDC-001	Functional Design Criteria, B Plant Environmental Compliance Upgrades, Project W-010	Nov, 1987	Hansen, G. E.	
B2-18	SD-W010-FDC-001	Functional Design Criteria, B Plant Environmental Compliance Upgrades Project W-010	Nov, 1987	Hansen, G. E.	
B2-19	RHO-CD-15828	Plant Natural Force Hazards Survey	Oct, 1981	Vollert, F. R.; Higgins, T. J.	Rockwell Hanford Operations, Richland, WA
B2-20	SD-RE-TI-213	Repair Procedure for Sealing and Structural Restoration of Cracks and Construction Joints for Bldg 221-B, Hanford Site, Richland, WA			
B2-21	SD-HWV-FDC-001	Engineering Change Notice: 6.0 General Criteria and Standards - FDC	Oct, 1988	None	Westinghouse Hanford Company, Richland, WA

File#	Document #	Title	Date	Author	Organization
B2-22	SD-428-CDR-001	Conceptual Design Report, B Plant Electrical Substation Upgrade, Project B-428	Dec, 1982	Wolfe, B. A.	Kaiser Engineers Hanford Co., Richland, WA
B2-23	None	For Waste Management Project Responsibility Assignments for Active Projects, B Plant Project Upgrades List	None	None	None
B2-24	SD-463-FDC-001	Functional Design Criteria, Project B-463, B Plant F Filter	May, 1983	Hummer, J. H.	Rockwell Hanford Operations, Richland, WA
B2-25	SD-602-FDC-001	Functional Design Criteria, B Plant Canyon Crane Replacement Project B-602	Feb, 1988	Janicek, G. P.	Rockwell Hanford Operations, Richland, WA
B2-27	SD-647-FDC-001	B Plant Process Condensate Treatment Facility, Project B-647	July, 1987	Pauly, T. R.	Rockwell Hanford Operations, Richland, WA
B2-28	SD-W010-FDC-001	Functional Design Criteria B Plant Environmental Compliance Upgrades, Project W-010	Nov, 1987	Hansen, G. E.	Westinghouse Hanford Company, Richland, WA
B2-29	SD-625-FDC-001	Functional Design Criteria, B Plant, Sand Filter Duct Upgrade Project B-625	May, 1986	Hansen, G. E.	Rockwell Hanford Operations, Richland, WA
B2-30	SD-660-FDC-001-ECN 101352	B Plant AMU Area Upgrades, Project W-004	Aug, 1988	None	None
B2-31	SD-W008-FDC-001	Functional Design Criteria, B Plant Chemical Sewer Neutralization System, Project W-008	Sept, 1987	Pauly, T. R.	Westinghouse Hanford Company, Richland, WA
B2-32	SD-W056-ES-001	Engineering Study, B Plant NCAW Process Jet Control Valve Upgrade	Nov, 1988	Baynes, P. A., Witherspoon, J. E.	Westinghouse Hanford Company, Richland, WA
B2-33	W-064	Engineering Study Plan Project W-064, B Plant Waste Minimization Upgrade	Feb, 1989	None	None
B2-34	SD-WM-TI-311	Preliminary Design of the Cell 18 Cesium/Nitric Acid Ion Exchange System	July, 1987	Gale, L. A.	Rockwell Hanford Operations, Richland, WA

File#	Document #	Title	Date	Author	Organization
B2-35	SD-WM-CR-024	B Plant Instrumentation Upgrade Design Criteria	Feb, 1986	Baynes, P. A., Witherspoon, J. E.	
B2-36	SD-WM-ES-068	B Plant Cell 23 Concentrator System, Instrumentation Upgrade	Sept, 1985	Baynes, P. A.	Rockwell Hanford Operations, Richland, WA
B2-37	SD-WM-ES-061	B Plant Dispatcher's Office Instrumentation Upgrade	Sept, 1985	Witherspoon, J. E.	Rockwell Hanford Operations, Richland, WA
B2-38	SD-WM-CDR-012	Conceptual Design Report, B Plant Instrumentation Upgrades, Dispatcher's Office, Cell 23 and Cell 24	Aug, 1988	Witherspoon, J. E.	Kaiser Engineers Hanford Co., Richland, WA
B2-39	SD-RE-CR-003	Seismic/Tornado Design Criteria for Evaluation of Existing Structures and Equipment, B Plant Facilities	Feb, 1988	Smith, W. F.	Rockwell Hanford Operations, Richland, WA
B2-40	RHO-CD-85	Operational Safety Analysis Report, Cross-Country Waste Transfer System	Aug, 1977	Entrop, G. E.	Rockwell Hanford Operations, Richland, WA
B2-41	NOT USED				
B2-42	NOT USED				
B2-43	SD-WM-SAR-013, REV. 1	B Plant Safety Analysis Report	July, 1985	Sewell, R. G.	Rockwell Hanford Operations, Richland, WA
B2-44	LETTER 65620-CDP-83-070	"Seismic Analysis and Evaluations, 221-B Canyon Structure."	Dec 13, 1983	Vollert, F. R., to R. G. Sewell	Rockwell Hanford Operations, Richland, WA
B2-45	LETTER 65431-81-121	"B Plant Natural Forces Hazards Survey."	Oct 27, 1981	Vollert, F. R., to R. J. Higgins	Rockwell Hanford Operations, Richland, WA
B2-46	LETTER 65620-DCP-84-119	"Earthquake Occurrence Probabilities."	May 10, 1984	Vollert, F. R., to R. G. Sewell	Rockwell Hanford Operations, Richland, WA
B2-46A	LETTER 72310-85-WG-130	"Calculations for the Seismic Scenario of the B Plant SAR."	Apr 15, 1985	Rittman, P. D., to R. G. Sewell	Rockwell Hanford Operations, Richland, WA
B2-47	CVI 17161	Project HAP-634, 8% NBS Filters	Jan 7, 1970	None	American Air Filter

File#	Document #	Title	Date	Author	Organization
B2-48	CVI 20140	Project B-112B, Intake Louver	Mar 5, 1976	None	Johnson Barrows Inc.
B2-49	CVI 14079	Project HAP-631, Centrifugal Fan	Feb 21, 1973	None	ES Constant Co.
B2-50	CVI 71752	Clarage Fan	Oct 14, 1943	None	Clarage Fan Company
B2-51	HPS-157, 158-, 159-, 161-, 162-163-M; DI-163-M	Standard Specification for Fire- and Moisture-Resistant Nuclear Grade HEPA Filters; and Instructions for Using HPS-158- and 161-M	May 15, 1984 and June 30, 1986	None	DOE, Richland, WA
B2-52	None	CVI Index, Bldg 221-B, 291-B	None	None	None
B2-53	SDC-5.1	Standard Design Criteria For Heating, Ventilating, and Air Conditioning	June 27, 1962	None	DOE, Richland, WA
B2-54	SDC-7.8	Standard Electrical Design Criteria for Fire Alarm Systems	None	None	None
B2-55	CVI 12149	Project HCP-670, Fire Damper Curtain	July 2, 1973	None	None
B2-56	CVI 12300	Proejct HCP-670, Fire Protection Improvements, Motor Operated Ball Valves	April 26, 1974	None	Jahn & Associates, Inc
B2-57	CVI 12154	Project HCP-780, Fire Alarm Station	April 16, 1974	None	Warren Cliver Co., Gamewell Distributor
B2-58	CVI 20154	Project B-114, Fire Dampers	Feb 20, 1976	None	Air Products, Inc.
B2-59	CVI 12150	Project HCP-670, Fire Protection Improvements	Aug 1, 1973	None	Cosco Fire Protection Co.
B2-60	E Index, I Index, MS Index, SDC Index	Hanford Plant Standards, Indices to the Electrical Standards Book, Instrumentation Standards/Design-Guide Book, Mechanical Standards Book, Design Criteria Book	Various	None	DOE, Richland, WA

File#	Document #	Title	Date	Author	Organization
B2-61	SD-410-FDC-001	Functional Design Criteria, 241-A-702 Vent Header Upgrade	Dec, 1981	Guenther, R.B.	Rockwell Hanford Operations, Richland, WA
B2-62	SD-419-CDR-001	Conceptual Design Report, 241-A-702 Vent Header Upgrade	Feb, 1982	Guenther, R. B.	Rockwell Hanford Operations, Richland, WA
B2-63	SD-WM-FDC-001	Exhaust Stack Upgrade - B Plant Project B-432	Mar 12, 1982	Cammann, J. W.	Rockwell Hanford Operations, Richland, WA
B2-64	SA: GRW: 87-171	"Assessment of Past Seismic Evaluations of 200 Area Canyon Facilities."	Oct 22, 1987	Structural Analysis to R. Marusich	Westinghouse Hanford Company, Richland, WA
B2-65	None	6430.1A Revised Structural Criteria, Solack Comments	None	Tim Solack	SAIC, Richland WA
B2-66	WHC-CM-6-3, DS-6.1	Drawing Index Numbering System, Hanford Site	Aug 31, 1988	None	Westinghouse Hanford Company, Richland, WA
B2-67	RLO-76-4	Evaluation of Impact of Potential Flooding Criteria on the Hanford Project	1976	None	DOE, Richland, WA
B2-68	SD-472-FDC-001	Miscellaneous Fire Doors and Life Safety Upgrade - Life Safety Upgrade	April, 1983	Romano, T.	Rockwell Hanford Operations, Richland, WA
B2-69	SD-RE-ES-001	Fire Suppression Needs in 200 Area Landlord Buildings	Dec 15, 1981	Caldwell, B. A.	Rockwell Hanford Operations
B2-70	SD-472-FDC-001	Miscellaneous Fire Doors and Life Safety Upgrade - Functional Design Criteria	Aug, 1983	Allison, M. P.	Rockwell Hanford Operations, Richland, WA
B2-71	SD-WM-ES-001	Engineering Study, 221T Fire Protection Upgrade	Aug, 1982	Caldwell, B. A.	Rockwell Hanford Operations, Richland, WA
B2-72	SD-472-CDR-001	Conceptual Design Report, Miscellaneous Fire Doors and Life Safety Upgrade, Project B-472	Oct, 1983	None	Kaiser Engineers Hanford
B2-73	None	221B Drawing List	Jan 13,1989	None	None

File#	Document #	Title	Date	Author	Organization
B2-74	SD-HWV-FDC-001	Project B-595 General Criteria and Standards	Oct 10, 1988	None	Westinghouse Hanford Company, Richland, WA
B2-75	SD-430-FDC-001	Project B-430 FDC Electrical Cable Replacement	July 22, 1982	Wolfe, B. A.	Rockwell Hanford Operations, Richland, WA
B2-76	SD-430-DCR-001	Project B430, Conceptual Design Report, B Plant Electrical Cable Replacement	Oct, 1982	None	Rockwell Hanford Operations, Richland, WA
B2-77	None	Modernization of Electrical Power Distribution in 221-B Building (B Plant)	July, 1981	Szilay, J. J.	Rockwell Hanford Operations, Richland, WA
B2-78	SD-428-FDC-001	Functional Design Criteria, B-428 Electrical Substation Upgrade/B-Plant	July 22, 1982	Wolfe, B. A.	Rockwell Hanford Operations, Richland, WA
B2-79	None	Project B-428 Construction Specification B-428-C1 (Rev. 1) for B Plant Electrical Substation Upgrade	Dec, 1983	None	Dhillon Engineers, Inc.
B2-80	SD-392-FDC-001	Project B-392, FDC Fire Alarm, Communication System	Sept 8, 1982	Wood, R. J.	Rockwell Hanford Operations
B2-81	SD-428-LL-001	Lessons Learned from B Plant Electrical Substation Upgrade	Aug 27, 1986	Witherspoon, J. E.	Rockwell Hanford Operations, Richland, WA
B2-82	None	Marusich's List of Safety-Related Equipment	Jan 17, 1989	Marusich, R.	Westinghouse Hanford Company, Richland, WA
B2-83	None	B Plant's 64301A Compliance	Jan 11, 1989	Washenfleder, D. J., to Donald E. Ball	None
B2-84	None	B Plant Viability	Jan 19, 1989	D. Ball	Westinghouse Hanford Company, Richland, WA
B2-85	ARH-2644 1	Design Criteria B Plant and 244-AR Vault Effluent Control	Oct 31, 1972	Yoder, R. A.	Atlantic Richfield Hanford Company, Richland, WA
B2-86	HW-77016	221-B Building, Phase I, Information Manual	March, 1963	None	

File#	Document #	Title	Date	Author	Organization
B2-87	ARH-2116	Design Criteria B Plant Filter Fire Improvements, 291-B Building	Jun 11, 1971	Tabasinske, R.E.	Atlantic Richfield Hanford Co., Richland, WA
B2-88	ARH-2141	Project Proposal, Improved Fire Protection B Plant Exhaust Filters	Aug 25, 1971	Braden, D.E.	Atlantic Richfield Hanford Co., Richland, WA
B2-89	ARH-2438	Design Criteria, Fire Protection Facilities, B Plant Peripheral Buildings	Apr 3, 1972	Tabasinske, R.E.	Atlantic Richfield Hanford Co., Richland, WA
B2-90	SA-584	Study to Evaluate the Hanford Site Fire Alarm System and Develop Upgrading Alternatives	Aug, 1982	None	Diliberto & Assoc.
B2-91	SD-WM-IT-201	B Plant Raw and Sanitary Water Supply Upgrade Assessment	Sep 9, 1985	Hummer, J.H.	Rockwell Hanford Operations, Richland, WA
B2-92	SD-392-CDR-001	CDR for Hanford Site Fire Alarm System Upgrade, Project B-392	July, 1983	None	Kaiser Engineers Hanford Co., Richland, WA
B2-93	B-392-DC1	Design/Construction Specification for Hanford Site Fire Alarm System Upgrade	July 15, 1985	None	Kaiser Engineers Hanford Co., Richland, WA
B2-94	003/RJ88	Letter, Meeting Minutes, Jan 4, 1989	Jan, 1989	Jackson, R. R., to T. Solack	SAIC, Richland, WA
B2-95	None	Statement of Work for Tank Farm Compliance	None	None	None
B2-96	CVI 20287	Project B-114, Supply Fans	Mar 4, 1977	None	Burgess Industries
B2-97	CVI 21778	Bldg 291-B Exhaust Fan	Feb 12, 1986	None	Buffalo Forge Co.
B2-98	CVI 20150	Project B-114, Exhaust Fans	Mar 17, 1976	None	Aladdin Heating Corp.
B2-99	CVI 20120	Project B-112B, Intake Louver	Jan 19, 1976	None	Johnson-Barrows, Inc.
B2-100	CVI 20101	Project HCP-682, Centrifugal Fan	Nov 11, 1975	None	Aladdin Company

File#	Document #	Title	Date	Author	Organization
B2-101	CVI 17154	Project HAP-634, Adjustable Louver	Jan 13, 1970	None	Carnes
B2-102	CVI 17151	Project HAP-634, Fan	Jan 8, 1970	None	Greenheck Fan Corp.
B2-103	CVI 17005	Project CAC-144, Change House Addition Air Filter System	Apr 29, 1969	None	Cambridge
B2-104	CVI 17006	Project CP-5119, Ventilation Equipment	Jan 13, 1969	None	Clarage Fan Co.
B2-105	SD-557-CDR-001 REV. 0	Conceptual Design Report, B Plant Ventilation Control System Upgrade, Project B-557	None	None	Rockwell Hanford Operations
B2-106	SD-WM-ES-072	B Plant Component Failure HVAC Analysis	Dec 31, 1985	Lee, H. A.	Rockwell Hanford Operations
B2-107	SD-557-ES-001	B Plant Ventilation Control System Upgrade, Engineering Study	Jan, 1985	Ferlan, K. B.	Rockwell Hanford Operations
B2-108	SD-557-FDC-001	Functional Design Criteria, Project B-557, B Plant Ventilation Control System Upgrade	Jun 18, 1985	Ferlan, K. B.	Rockwell Hanford Operations
B2-109	ISO-100	Waste Management Technical Manual	Aug, 1967	Buckingham, J. S., ed.	Waste Management Process Engineering, Research and Engineering, ISOCHEM, Inc., Richland, WA
B2-110	P6MITE-C-01	Construction Specification for B Plant Dispatcher's Office Instrumentation Upgrade, Work Order CK0070	Jan 23, 1989	Witherspoon, J. E.	Kaiser Engineers Hanford Co.
B2-111		Bibliography of B-Plant Upgrades and Assessments	Oct 22, 1988		Westinghouse Hanford Co., Richland, WA
B2-112	HW-31802	WAFRAX: Waste Fractionization Design Criteria, Waste Management	May 28, 1964	Caudill, H. L.	General Electric, Hanford Atomic Products Operation, Richland, WA
B2-113		Project Responsibility for Active Projects: B FILE LIST	Dec 1, 1988		