ATTACHMENT 1

ENGINEERING DATA TRANSMITTAL

1. EDT 152838

2. To: (Receiving Organization) Project W-011H Design Review Team	3. From: (Originating Organization) Effluent Treatment and Laboratory Projects	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: W-011H: Package 5/6	6. Cog. Engr.: JE Witherspoon	7. Purchase Order No.: N/A
8. Originator Remarks: This draft is sent for your prompt review. Please insure that it includes requirements for your area of interest. See accompanying DSI. Please insure that your accepted comments are included JEWitherspoon 7/2/92		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: 6265, 6265A, 6267, 6269, 6270
11. Receiver Remarks:		12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: ~~6/22/92~~ 7/3/92

OCT 1992

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Impact Level	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	W-011H-DC1	all	0	Design/Construct Specification for 6265, 6265A, 6267, 6269, 6270 Buildings	3	~~4~~ 1		

16. KEY

Impact Level (F)	Reason for Transmittal (G)	Disposition (H) & (I)
1, 2, 3, or 4 (see MRP 5.43)	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Impact Level for required signatures)

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1 ~~4~~		Cog.Eng. JE Witherspoon			R3-35	JN Papenfuss			L5-07	1 ~~4~~	
1 ~~4~~		Cog. Mgr. DP Hughes			R3-35	CB McVey			H1-61	1 ~~4~~	
1 ~~4~~		QA CT Norton			S1-54	LL Curfman			T6-12	1 ~~4~~	
1 ~~4~~		Safety DA Conners, IV			T6-10	EA Smith			L5-07	1 ~~4~~	
2 ~~4~~	1	Env. ~~ASSURANCE~~	Verle L. Hale	7/9/92	B2-16	DE Shafer			H1-62	1 ~~4~~	
1 ~~4~~		RA VanBaalen			S2-62	TL Sweet			S4-01	1 ~~4~~	
1 ~~4~~		TG Montgomery			T6-12	MS Collins			A5-18	1 ~~4~~	

18.	19.	20.	21. DOE APPROVAL (if required)
JEWitherspoon ~~4/5/92~~ 7/2/92 ORIGINATOR	JEWitherspoon 7/2/92		Ltr. No. TBD

Sta # 10 JUL 23 1992 (23)

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8. Originator Remarks: This draft is sent for your prompt review. Please insure that it includes requirements for your area of interest. See accompanying DSI. RELEASE FOR CONSTRUCTION		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: 6265, 6265A, 6267, 6269, 6270
11. Receiver Remarks:		12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: 6/22/92

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1	W-011H-DC1	~~all~~ Rev 4 7-22-92	0	Design/Construct Specification for 6265, 6265A, 6267, 6269, 6270 Buildings	3 ESQ	4		

16. KEY

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2A	1	Cog.Eng. JE Witherspoon		7/9/92	R3-35	JN Papenfuss	SEE ATT 3		L5-07	2A	1
2A	1	Cog. Mgr. DP Hughes		7/22/92	R3-35	CB McVey		7/9/92	H1-61	2A	1
2A	1	QA CT Norton		7-9-92	54	LL Curfman		7/22/92	T6-12	2A	1
2A	1	Safety DA Conners, IV			T6-10	EA Smith			L5-07	4	6
2A	1	Env. JI Gould	SEE ATT 1		B2-16	DE Shafer	SEE ATT 4		H1-62	2A	1
4A	6	RA VanBaalen			S2-62	TL Sweet			S4-01	4	
2A	1	TG Montgomery	SEE ATT 2		T6-12	MS Collins		21 Jul 92	A5-18	2A	1

18.	19.	20. COG/PROJ. ENG. MANAGER	21. DOE APPROVAL (if required)
6/15/92 ORIGINATOR	7/22/92	7/22/92 D.P. HUGHES	Ltr. No. TBD

ATTACHMENT 2

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2. To: (Receiving Organization) Project W-011H Design Review Team	3. From: (Originating Organization) Effluent Treatment and Laboratory Projects	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: W-011H: Package 5/6	6. Cog. Engr.: JE Witherspoon	7. Purchase Order No.: N/A
8. Originator Remarks: This draft is sent for your prompt review. Please insure that it includes requirements for your area of interest. See accompanying DSI. Please insure that your accepted comments are included. JEWitherspoon 7/2/92		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: 6265, 6265A, 6267, 6269, 6270
11. Receiver Remarks:		12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: ~~6/22/92~~ 7/8/92

15. DATA TRANSMITTED

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1	W-011H-DC1	all	0	Design/Construct Specification for 6265, 6265A, 6267, 6269, 6270 Buildings	3	4 / 1		

16. KEY

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1 4		Cog.Eng. JE Witherspoon			R3-35	JN Papenfuss			L5-07	1 4	
1 4		Cog. Mgr. DP Hughes			R3-35	CB McVey			H1-61	1 4	
1 4		QA CT Norton			S1-54	LL Curfman			T6-12	1 4	
1 4		Safety DA Conners, IV			T6-10	EA Smith			L5-07	1 4	
1 4		Env. JI Gould			B2-16	DE Shafer			H1-62	1 4	
1 4		RA VanBaalen			S2-62	TL Sweet			S4-01	1 4	
2 4	1	TG Montgomery	TGMontgomery	7/9/92	T6-12	MS Collins			A5-18	1 4	

18.	19.	20.	21. DOE APPROVAL (if required)
JEWitherspoon 7/2/92 ORIGINATOR	JEWitherspoon 7/2/92		Ltr. No. TBD

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8. Originator Remarks: This draft is sent for your prompt review. Please insure that it includes requirements for your area of interest. See accompanying DSI. Please insure that your accepted comments are included. JEWitherspoon 7/2/92		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: 6265, 6265A, 6267, 6269, 6270
11. Receiver Remarks:		12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: ~~6/22/92~~ 7/8/92

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1	W-011H-DC1	all	0	Design/Construct Specification for 6265, 6265A, 6267, 6269, 6270 Buildings	3	~~4~~ 1		

16. KEY

Impact Level (F)	Reason for Transmittal (G)		Disposition (H) & (I)	
1, 2, 3, or 4 (see MRP 5.43)	1. Approval	4. Review	1. Approved	4. Reviewed no/comment
	2. Release	5. Post-Review	2. Approved w/comment	5. Reviewed w/comment
	3. Information	6. Dist. (Receipt Acknow. Required)	3. Disapproved w/comment	6. Receipt acknowledged

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1 ~~4~~		Cog.Eng. JE Witherspoon			R3-35	JN Papenfuss		7-10-92	L5-07	2 ~~4~~	2
1 ~~4~~		Cog. Mgr. DP Hughes			R3-35	CB McVey			H1-61	1 ~~4~~	
1 ~~4~~		QA CT Norton			S1-54	LL Curfman			T6-12	1 ~~4~~	
1 ~~4~~		Safety DA Conners, IV			T6-10	EA Smith			L5-07	1 ~~4~~	
1 ~~4~~		Env. JI Gould			B2-16	DE Shafer			H1-62	1 ~~4~~	
1 ~~4~~		RA VanBaalen			S2-62	TL Sweet			S4-01	1 ~~4~~	
1 ~~4~~		TG Montgomery			T6-12	MS Collins			A5-18	1 ~~4~~	

18.	19.	20.	21. DOE APPROVAL (if required)
JEWitherspoon 7/2/92 ORIGINATOR	JEWitherspoon 7/2/92		Ltr. No. TBD

ATTACHMENT 4

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5. Proj./Prog./Dept./Div.: W-011H: Package 5/6	6. Cog. Engr.: JE Witherspoon	7. Purchase Order No.: N/A
8. Originator Remarks: This draft is sent for your prompt review. Please insure that it includes requirements for your area of interest. See accompanying DSI.		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: 6265, 6265A, 6267, 6269, 6270
11. Receiver Remarks:		12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: 6/22/92

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Impact Level	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	W-011H-DC1	all	0	Design/Construct Specification for 6265, 6265A, 6267, 6269, 6270 Buildings	3	4		

16. KEY

Impact Level (F)	Reason for Transmittal (G)	Disposition (H) & (I)
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4		Cog.Eng. JE Witherspoon			R3-35	JN Papenfuss			L5-07	4	
4		Cog. Mgr. DP Hughes			R3-35	CB McVey			H1-61	4	
4		QA CT Norton			S1-54	LL Curfman			T6-12	4	
4		Safety DA Conners, IV			T6-10	EA Smith			L5-07	4	
4		Env. JI Gould			B2-16	DE Shafer	Don Shafer	7/20/92	H1-62	~~2~~ 4	1
4		RA VanBaalen			S2-62	TL Sweet			S4-01	4	
4		TG Montgomery			T6-12	MS Collins			A5-18	4	

18.	19.	20.	21. DOE APPROVAL (if required)
JE Witherspoon 6/15/92 ORIGINATOR	JE Witherspoon		Ltr. No. TBD

W-011H-DC1
Revision 0

DESIGN/CONSTRUCT SPECIFICATION FOR

BUILDINGS 6265, 6265A, 6267, 6269, and 6270

Work Order CR9497

OFFICIAL RELEASE BY WHC 23
DATE JUL 23 1992
Sta # 10 EDT-15283

Prepared By:

Kaiser Engineers Hanford Company
Richland, Washington

For the U.S. Department of Energy

Contract DE-AC06-87RL10900

APPROVED
Kaiser Engineers Hanford Company (KEH)

Design Engineering	7-17-92 Date	Technical Documents	7-17-92 Date
Safety	7/20/92 Date	Environmental	7-20-92 Date
Quality Engineering	7/20/92 Date	Construction	7/21/92 Date
Project Management	7.22.92 Date		

Westinghouse Hanford Company

Projects Department	7/22/92 Date

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SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 INTRODUCTION

1.1.1 Project W-011H provides for the construction of the Waste Sampling and Characterization Facility (WSCF) Complex in the 600 Area within the Controlled Access Area of the Hanford Site. The project site location is approximately 28 road miles northwest of Richland, Washington as shown on Figure 1, Hanford Area Map, Appendix A.

1.1.2 This Specification is for the design and construction of five auxiliary structures that are part of the WSCF complex.

1.2 STATEMENT OF WORK

1.2.1 Scope: The Contractor shall design and construct the required structures.

1.2.1.1 The design shall be in accordance with this Specification and shall include the Drawings, Specifications, and Test Procedures that are required to construct the structures and to perform the required acceptance testing.

1.2.1.2 Construction shall be in accordance with the approved Detailed Design Package.

1.2.2 Work Included: The Contractor is responsible for providing complete structures ready for occupancy. The location of each structure listed below is shown on Figure 2, WSCF Site Plan, Appendix A. The structures shall include the following:

a. Building 6265, Utility Building (UB)

b. Building 6265A, Solid Waste Storage Building (SWS)

c. Building 6267, Environmental Sample Archive Facility (ESA)

d. Building 6269, Mobile Laboratory Storage Facility (MLS).

e. Building 6270, Environmental Data Remedial Tracking System Facility (EDRTS)

1.2.3 Work Not Included: The following items are not included in this Contract.

1.2.3.1 Roadwork, parking areas, sidewalks, and landscaping.

1.2.3.2 Wiring connections in the radio fire alarm reporter (RFAR) box.

1.2.3.3 Furnishings and appliances.

1.2.3.4 Interior and exterior signage except safety signage identified for Building 6265 (UB) and emergency exit signs.

1.2.3.5 Window treatments.

1.3 SUBMITTALS

1.3.1 Preliminary Design Review Package: Submit in accordance with components identified in subparagraph 1.6.1.3.a.

1.3.2 Final Design Review Package: Submit in accordance with components identified in subparagraph 1.6.1.3.b.

1.3.3 Detailed Design Package: Submit completed design documents including construction drawings, construction specifications, design calculations, and product information as approved by KEH through Final Design Review.

1.3.4 Acceptance Test Procedures: Submit in accordance with Paragraph 1.6.3.

1.3.5 Product Equipment Manuals: Submit in accordance with Paragraph 1.6.4.

1.3.6 As-Built Drawings and Specifications: Submit completed as-built drawings and specifications as identified in Paragraph 1.6.5.

1.4 DESIGN CRITERIA

1.4.1 General Requirements

1.4.1.1 Design and construction shall be in accordance with DOE Order 6430.1A - Department of Energy General Design Criteria as outlined in subparagraph 1.4.2.1; DOE-RL Order 6430.1C, Hanford Plant Standard Design Criteria as outlined in subparagraph 1.4.2.2, and Hanford Plant Standard Design Guides as outlined in subparagraph 1.4.2.3; and additional Codes, Standards, and DOE orders, outlined in Section 01090 - References. Products and materials shall meet or exceed the requirements of referenced applicable standards.

1.4.1.2 The buildings shall be designed for a useful life of 30 years with normal maintenance. The facility design shall provide ease of maintenance and minimize the amount of maintenance. Items to consider include:

a. Provide for visual inspection where possible.

b. Use interchangable parts.

c. Provide access for disassembly.

d. Allow maintenance with standard tools.

e. Provide access for maintenance of gas, electric, heating, ventilating, and air conditioning (HVAC), and water utilities.

1.4.1.3 Provision for the physically handicapped is required for Building 6270 (EDRTS).

1.4.2 Site Specific Requirements

1.4.2.1 The DOE Order 6430.1A and applicable documents referenced therein shall apply to this project. In general parts outlined within Division 1 below, Division 13 - Special Facilities, and all 99 sections described in 0101-3.4.-Special Facilities excluding 99.8-Telecommunications, Alarm, and ADP Centers and Radio Repeater Stations will not apply to this project.

a. Division 1, General Requirements, with the exception of following parts:

- 0101-3.4 Special Facilities
- 0110-1.1.2 Programming
- 0110-5.2 Safety Analysis
- 0110-5.3 Emergency Preparedness Training
- 0110-5.4 Asbestos-Containing Materials
- 0110-6.2 Fire Protection Design Analysis
- 0110-6.3 Fire Resistance Ratings
- 0110-10 Fallout Shelters
- 0110-12.8 Energy Conservation Report Requirements
- 0110-13 Physical Protection
- 0111-4 Structural Systems for Highway and Railroad Structures

1.4.2.2 The current revisions of the following Hanford Plant Standard Design Criteria (Appendix D) shall apply to this project as applicable to Safety Class 3 facilities.

a. SDC-1.2, Hanford Plant Standards and National Codes and Standards.

b. SDC-1.3, Preparation and Control of Engineering and Architectural Drawings.

c. SDC-3.2, Minimum Depth of Underground Water Lines.

d. SDC-4.1, Design Loads for Facilities.

e. SDC-5.1, Heating, Ventilating and Air Conditioning.

f. SDC-7.2, Outside Lighting and Aerial Distribution.

g. SDC-7.4, Underground Power Distribution.

h. SDC-7.5, Interior Power and Lighting.

i. SDC-7.7, Communication, Signaling and Low Voltage Control Systems.

j. SDC-7.8, Fire Alarm Systems.

1.4.2.3 The current revision of Hanford Plant Standard Design Guide (Appendix D), E-12-1, Typical Electrical System Grounding for Buildings shall apply to this project.

1.4.2.4 Emergency egress requirements shall be in accordance with NFPA 101, Life Safety Code.

1.4.2.5 Foundation and earthwork construction and design shall be based on the Report of Geotechnical Investigation to Kaiser Engineers Hanford Company Richland, Washington, W011-H WCSF dated May 1990. Contractor's Design Engineers shall confer with Contractor's Soils Engineer in accordance with DOE Order 6430.1A to determine adequacy of available subsurface data. Any additional subsurface investigation will be Contractor's responsibility.

1.4.3 Building Classification

1.4.3.1 Occupancy types are classified in accordance with NFPA 101 as follows.

a. Building 6265 (UB) - Special Structure, Storage, ordinary hazard.

b. Building 6265A (SWS) - Special Structure, Storage, ordinary hazard.

c. Building 6267 (ESA) - Storage, ordinary hazard.

d. Building 6269 (MLS) - New business.

e. Building 6270 (EDRTS) - New business.

1.4.3.2 Type of construction is classified in accordance with NFPA 220 as Type II, 000 minimum.

1.4.4 Fire Protection and Alarm

1.4.4.1 The fire protection systems shall be designed in accordance with Paragraph 1.4.2. The fire protection systems shall also comply with the requirements of DOE Order 5480.7 and Richland Field Office Implementing Procedure (RLIP), RLIP 5480.7. Backflow prevention shall be provided in accordance with the Pacific Northwest Section of American Water Works Association, "Accepted Procedure and Practice in Cross-Connection Control Manual" and Washington Administrative Code (WAC) 246-290-490. The sprinkler systems shall be designed to meet Ordinary Hazard Group II Occupancy Classification in accordance with NFPA 13.

1.4.5 HVAC

1.4.5.1 Provide facilities with independent HVAC systems designed in accordance with Paragraph 1.4.2 and following.

a. Design ductwork systems in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible. Pressure class shall be not less than 2 inches wg. Size ductwork using the "Equal Friction Method" and low air velocities.

b. Size outside air intakes for 300 fpm maximum face velocity.

c. Design, installation, testing, and examination of piping systems for R-22 refrigerant shall be in accordance with ANSI B 31.5. Design parameters shall be as follows.

Design temperature range: 70 to 150°F.

	Max Operating Pressure	Max Operating Temperature	Test Pressure
High Side:	250 psig	150°F	350 psig
Low Side:	90 psig	70°F	125 psig

1.4.6 Plumbing

1.4.6.1 The WSCF auxiliary facilities shall be furnished with their respective and individual plumbing systems, designed in accordance with Paragraph 1.4.2 and the Uniform Plumbing Code. Size piping using the equal friction method.

1.4.6.2 Backflow prevention shall be provided and tested as required in accordance with the requirements of the Pacific Northwest Section of the American Water Works Association, "Accepted Procedure and Practice in Cross-Connection Control Manual," and WAC 246-290-490.

1.4.7 Electrical

1.4.7.1 Design electrical and lighting systems in accordance with Paragraph 1.4.2.

1.4.8 Communication Systems

1.4.8.1 Design and install telecommunication systems including telephone, Hanford Local Area Network (HLAN), and paging in accordance with Paragraph 1.4.2 and ANSI EIA/TIA 568 and 569.

1.4.9 Environmental

1.4.9.1 Select construction materials that minimize generation of hazardous waste or byproducts.

1.4.9.2 Fume hood function is for the comfort and safety of facility personnel. Administrative controls will be employed to limit facility

inventory to materials not requiring emissions monitoring or controls under the Federal and State Clean Air Acts.

1.4.9.3 Design of the SWS shall comply with applicable sections of WAC Chapter 173-303, in particular WAC 173-303-630, "Use and Management of Containers."

1.5 BUILDING DESCRIPTIONS

1.5.1 Subparagraphs 1.5.1.1 through 1.5.1.8 set forth baseline/minimum requirements applicable to all buildings:

1.5.1.1 General
1.5.1.2 Improvement to land
1.5.1.3 Architectural
1.5.1.4 Fire protection and alarm
1.5.1.5 HVAC
1.5.1.6 Plumbing
1.5.1.7 Electrical
1.5.1.8 Communications

Paragraphs 1.5.2 through 1.5.6 set forth additional requirements applicable to each building:

1.5.2 Building 6265, Utility Building (UB)
1.5.3 Building 6265A, Solid Waste Storage Building (SWS)
1.5.4 Building 6267, Environmental Sample Archive Facility (ESA)
1.5.5 Building 6269, Mobile Laboratory Storage Facility (MLS)
1.5.6 Building 6270, Environmental Data Remedial Tracking System Facility (EDRTS)

1.5.1.1 General

a. Design and construction of the facilities shall incorporate standard materials and practices that are appropriate for the building types.

b. The buildings shall be steel frame and/or masonry structures constructed on a reinforced concrete slab-on-grade. The roof, facia and overall design character shall be coordinated with the WSCF.

c. The design, structural system, and location of the buildings on the site shall accommodate flexibility and future expansion. Figures identifying location, site utilities and constraints, and functional floor plan of the buildings are included in Figures 3 through 7, Appendix A.

d. Building design and selection of equipment and materials shall consider maintenance. Wherever possible, design shall reflect the following order of preference in performing maintenance.

1) Adjust unit in place.

2) Repair unit by contact maintenance.

3) Replace with spare units unless it is more economical to remove, repair, and return unit to service.

e. Materials and equipment shall be new, of standard quality for industrial and office buildings, and meet the requirements of DOE Order 6430.1A.

1.5.1.2 Improvements to land

a. Sanitary water, fire water, sanitary sewer, underground electrical power supply, and underground communication systems shall be extended to the WSCF utility service locations. Service tie in locations are identified on Figures 3 through 7, Appendix A, and in this Specification.

b. Final site grading shall be provided. Final grade shall be 6 inches below floor elevation directly adjacent to the building. Final grade shall slope away from the building in a uniform manner so as to blend with existing grade approximately 25 feet from the building or closer if required by planned improvements such as future sidewalk or curb construction. If there is insufficient excess soil available to meet the above requirement, the slope may intersect existing grade no closer than 10 feet from the building provided the slope is uniform for the full length of the slope toe.

c. Personnel and vehicle accesses or other appurtances shall be provided as indicated on figures in Appendix A.

d. Final cleanup shall consist of removal of all construction debris, extraneous materials, and excess excavated spoils. Excess spoils shall be removed to a designated site. All other materials and debris shall be Contractor's responsibility.

1.5.1.3 Architectural

a. The design of the facilities shall reflect the developed WSCF Complex design characteristics for a unified campus. Design elements coordinating the facilities within the complex shall be incorporated in the design of all structures. These elements include:

1. Single slope shed roof with a 1 inch per foot slope or double slope ridge with a 2-1/2 inches per foot slope. Shed roof design shall be incorporated on Buildings 6265 (UB), 6265A (SWS), and 6269 (MLS). Gable roof design shall be incorporated on Buildings 6267 (ESA) and 6270 (EDRTS). Ridge direction and slope shall be as indicated on Figure 2, Appendix A, to facilitate future expansion. The roofing material shall be standing seam metal matching style and color of the WSCF roofs. Bottom of eave height shall be 8 feet above finish floor with a 4 foot minimum facia above. Facias shall be of same material as roof.

2. Exterior siding shall be sand color matching WSCF exteriors.

3. Window and glazing type and color shall match those selected for WSCF exteriors. Window size shall be 24 square feet minimum total with center mullion with pattern and placement similar to existing WSCF facilities.

b. Exterior walls, roofs, and perimeter foundations of Buildings 6267 (ESA), 6269 (MLS), and 6270 (EDRTS) shall be fully insulated. Vapor barriers shall be installed on all insulated exterior wall and roof areas.

c. Fire extinguisher cabinets shall be provided within all buildings of quantities and locations required by NFPA 10.

d. Materials

1. Metal roof and facia: 0.0276-inch (24 gage) minimum galvanized sheet metal, concealed fastening, standing seam type, similar to Butler VSR Roof System. Panels shall have 2-inch deep interlocking male and female ribs at 16 inches on center with stiffening corrections at 4 inches on center. Panels shall be installed on expanded polystyrene thermal spacers. Panels shall be prefinished similar to Butler-Cote 500 Premium Finish. Color shall match "Fluropon Aged Copper" by Valspar Corporation, No. 4498-105/J-2535.

2. Gutters: 0.0276-inch (24 gage) galvanized sheet metal same color as roof. Downspouts shall be of same material with color to match adjacent exterior walls.

3. Exterior siding: 0.0276-inch (24 gage) minimum galvanized sheet metal with corrugations similar to Butler Shadowrib Wall System. Color to be similar to Butler "white sand" or match existing, factory finished.

4. Main entrance of Buildings 6269 (MLS) and 6270 (EDRTS) shall be aluminum framed door and frame with insulated glazing, lockable entrance hardware, weatherstripping, door sweep, threshold and closer. Aluminum finish and color shall be similar to Kawneer Fluropon Architectural Coating with color to be PPG5MG95059 "aged copper" color or similar.

5. Exterior doors: Flush face 1-3/4-inch insulated hollow metal. Size to be 3'0" x 7'0" unless otherwise indicated. Frames will be 0.0516-inch (18 gage) hollow metal. Doors shall be provided with lockable entrance hardware, weatherstripping, door sweep, threshold and closer.

6. Overhead doors: Sectional type with weatherstripping, door bottom and motorized operation.

7. Interior doors: Flush face 1-3/4-inch insulated hollow metal with 0.0516-inch (18 gage) hollow metal frames, fire rated where required. Door size to be 3'-0" by 7'-0" unless otherwise indicated. Doors shall be provided with appropriate hardware. Doors, indicated in specific building requirement sections to receive view lites shall be provided with a

6- by 24-inch wire glazed view lite or smaller, if required by code, with metal frame.

8. Door hardware: Meet ANSI A156 series with brushed chrome finish. Locksets and latchsets to have lever handles and meeting ANSI A156.13, Series 1000, Grade 1. Locksets to be mortise type with removable core. Furnish 6 pin tumbler cylinders with Corbin 59C2-6 keyway for each lockset. Key locks to match existing WSCF master-key system. Furnish 2 keys with each lock cylinder. Hardware shall be UL approved for fire rated doors.

9. Exterior windows: Fixed aluminum frame meeting the requirements for entrance door.

10. Exterior glazing: Insulating type, tempered where required with 2 lites separated by 1/2-inch hermetically sealed dehydrated air space. Interior lite shall be 1/4-inch clear float. Exterior lite shall be 1/4-inch tinted similar to PPG Graylite tint, No. 14.

11. Interior glazing: 1/4-inch thick wire, clear, rolled flat, UL approved for fire rated doors and windows.

12. Interior fixed partitioning and gypsum board suspended ceilings: 5/8-inch thick gypsum wall board, Type X or water resistant where required, over 3-5/8-inch thick metal studs minimum or hat channel ceiling suspension system.

13. Suspended acoustical ceilings: 2 by 4 foot lay in panel type with suspension grid and ties. Panels to be fissure type with factory-applied washable paint, light reflectance of over 75 percent, and noise reduction coefficient (NRC) range of 50-60. Suspension system to be exposed 2-way tee grid, intermediate duty.

14. Resilient flooring: Commercial grade vinyl sheet or tile with a critical radiant flux of 0.45 W/cm^2 or more. Rubber base shall be 4 inch high, 1/8 inch thick cove type. Vinyl reducer strips will be provided at transitions.

15. Interior and exterior nonfactory finish surfaces shall be painted or sealed. In general exterior surfaces will be painted with semi-gloss enamel, interior surfaces with semi-gloss latex enamel. Concrete floors and concrete masonry walls shall be sealed. Additional concrete floor finishes shall be as identified in specific building sections.

16. Metal toilet compartments: Overhead braced type with baked enamel finish. Provide with door, coat hook, and bumper.

17. Toilet accessories provided in each restroom include a soap dispenser, toilet paper holder, and toilet seat cover holder. A sanitary napkin holder shall be provided in each women's restroom. A paper towel dispenser shall be provided in each restroom and at lunch area sinks. Accessories will be provided by KEH as indicated in Section 01019.

18. Casework: Plastic laminate faced wood or metal with baked enamel finish. Base cabinet shall provide shelving units with doors and drawer unit minimum of 24 inches in width.

19. Fire extinguisher cabinets: Semi-recessed type with 180 degree protruding clear acrylic bubble within plastic metal framed nonlockable doors. Cabinets shall be sized to accommodate one 10 pound dry chemical fire extinguisher.

20. Emergency exit signs: Self-illuminating type.

1.5.1.4 Fire protection

a. Fire sprinkler system: Provide underground sprinkler system supply mains to each building requiring fire sprinkler systems. Service tie-in locations are identified on Figures 3 through 7, Appendix A. A calculated wet pipe sprinkler system shall be installed throughout all areas of the indicated buildings. The hydraulic designs for the systems shall include a 10% cushion below the water supply curve for both flow and pressure.

1) Backflow prevention assembly: Located at the base of the fire sprinkler system riser.

2) Alarm check valve with standard trim and retard chamber.

3) Flow alarm pressure switch: Pressure operated with a built-in adjustable time retard feature which may be set from zero seconds to a minimum of one minute. Retard feature shall recycle automatically with no build up.

4) Weatherproof water motor alarm gong complete with drain and interconnecting piping.

5) Fire department connection: Brass finish, self closing double clappers, plugs and chains, automatic ball drip valve, escutcheon plate, a 4-inch IP by 2-1/2-inch HT by 2-1/2-inch HT and National Fire Hose Threads of 7-1/2 TPI.

6) Inspectors test connection.

7) Two inch system main drain valve.

8) Sprinkler heads: Nominal 1/2-inch diameter, orificed, rated for ordinary temperature.

9) Piping: Schedule 40 steel with threaded or grooved type rubber gasketed fittings.

10) Appropriate sway bracing and flex couplings.

11) Outside screw and yoke (OS&Y) gate valve supervisory switch: Alarms when cover is removed. Alarms during first 2 revolutions of

valve hand wheel in closing direction. Shall be single-pole, double throw, 120 V ac, rated for pilot duty.

12) Flow switches: Install directly on sprinkler system piping for zones or alarm annunciation. Switches shall be flexible vane type, with normally open contacts and instantaneous recycling retard adjustable 15 seconds to 60 seconds, and/or pressure type.

13) Sprinkler systems having air or other gases in the piping (dry, pre-action, deluge) shall be designed using galvanized pipe (inside and out). A "C" factor of 120 shall be used in the calculations.

b. Fire alarm system: The fire alarm system shall provide alarms throughout indicated buildings and notify the Hanford Fire Department via radio signals.

1) Fire alarm control panel (FACP): Low voltage, local energy, battery standby capability, surface mounted.

2) Batteries: Rechargeable and sized to operate the system for a minimum of 60 hours and sound alarm strobes or single stroke gongs for a minimum of 5 minutes after a loss of normal 120 V ac. Batteries shall recharge to 80 percent within 48 hours of complete discharge.

3) Manual pull stations: Surface mounted.

4) Signaling devices: Strobe chimes or single stroke gongs, low voltage.

5) Smoke detectors: Photoelectric type if required for indicated building.

6) Duct smoke detectors: Keep to absolute minimum in quantity if required.

7) RFAR box: Supplied by KEH and installed by contractor. RFAR box code numbering and final wiring connections within RFAR enclosures will be made by others. The RFAR box can be provided in 8, 16, 24, 32, 40, and 48 zones for connecting to a single local FACP. The RFAR shall be used only to report fire alarm signals. Upon request KEH will provide engineering data of the RFAR, manufactured by G.H. Harlow Company.

8) Alarm signal silencing: Provide bell bypass switch.

9) Wiring and equipment arrangement: Arrange within panel(s) so that individual sub-panels or components are readily accessible for adjustment or maintenance.

10) The use of automatic fire detectors along with the automatic sprinkler system is not recommended unless codes specify.

11) The following zone arrangement depending on the specific devices shall be used in the design:

First	Water Flow Switch (FS, vane type; FAS, pressure type) (each switch shall be on a separate zone)
Second	Manual Stations (MS)
Third	Other Suppression Systems, ie, Deluge, Carbon dioxide, foam, etc (if applicable)
Fourth	Detectors (SD, Smoke; HD, Thermal; etc)
Fifth	Spare zones provided, for future expansion
Last	Trouble Devices (TS, Tamper Switch; LP, Low Pressure Switch) (Work backwards from last zone on the panel)

A one-to-one correspondence between the zone arrangement of the FACP and the RFAR should exist. The FACP system trouble signals shall be interfaced to the RFAR trouble contacts, TR terminals.

12) Operation of any remote function (such as HVAC or computer shutdown) in response to an alarm condition shall be processed by the FACP. The remote function initiation circuit shall include a function bypass switch which shall initiate a trouble condition when activated.

13) FACP design shall include spare alarm/supervisory zones whose number shall be one, or 20 percent of existing zones, whichever is greater.

14) Underground conduit routed to existing PIV shall be 3/4-inch PVC coated rigid steel. Provide tamper switch at PIV and connect to FACP.

1.5.1.5 HVAC

a. The HVAC systems shall maintain and promote the effectiveness of the engineered physical barriers of the facilities to ensure confinement of process inside the facility and prevent uncontrolled ingress of outside air into the facilities.

b. Instrumentation and automatic controls (I&C) for the HVAC systems shall be provided with local direct digital control panels (DDCP) and capability for remote monitoring and control of equipment to the Control Room S-32 located in the Waste Sampling and Characterization Facility (WSCF) Administration Area.

c. All HVAC systems, equipment, individual units, and components will be properly positioned square to the building walls, floors, and grid lines and level with provisions to allow for daily inspections and maintenance to be performed with ease and safety.

d. Materials, equipment, and components.

1) Equipment Nameplates shall be made of laminated plastic, 1/16 inch thick with white surface and black core. Edges beveled and smooth. Engraved nomenclature sharp and clear. Lettering: 1/4 inch high minimum. Nameplates shall be permanently attached to each item of equipment which requires maintenance, adjustment, or replacement of parts and show as minimum following information.

(a) Equipment tag number of nine digits. The first three digits to identify symbol of facility where equipment, systems, and components are located (example: ESA for HVAC equipment located in the ESA, etc). The second three digits to identify symbol for equipment (example: AHU for air handling unit, PMP for pumps, etc). The third 3 digits to identify unique number for particular equipment (example: ESA-AHU-001).

(b) Manufacturer's name and address.

(c) Manufacturer's serial number.

(d) Equipment ratings and operating data.

(e) Applicable codes.

(f) Date of manufacture.

2) Outside air intakes shall be located at roof level and oriented in such a way as to assist in preventing the introduction of airborne particulates, rain, or snow into the HVAC systems and the facility they serve.

3) Plastic flexible ductwork shall not be used.

4) Ductwork located indoors shall be thermally insulated with 2 inch thick minimum 3 pcf density with foil reinforced draft facing vapor barrier. Thermal insulation shall be fireproof and resistant to rot, mildew, moisture, vermin, decay, fungi, bacteria, and settling. Semi-rigid insulation for indoor ductwork shall be similar to Owens-Corning Fiberglass Industrial Insulation 700 Series Type 703FRK. In addition, duct exposed to weather shall have total of 4-inch thick insulation and be covered with 2 wet coats of weatherproofing reinforced with white membrane similar to Foster Mast-A-Fab.

5) Supply and return air ductwork shall be lined with 1-inch thick rigid acoustic duct insulation similar to Fiberglass Aeroflex Duct Liner Type 150, with vinyl face on airstream for distance of 25 feet on discharge side of supply air fans and upstream of return air fans. Duct carrying contaminated air ie, fumehood exhaust shall not be internally insulated.

6) Electric heating coils and unit heaters shall meet the requirements of UL 1096 for zero clearance application. Coils shall be constructed in accordance with applicable requirements of NEC and UL 1096. Internal wiring shall be factory installed and terminated at conveniently located terminal blocks. Heater power and control terminals shall be

clearly marked. Other switches, controls, contactors, control transformers, thermostats, relays, etc shall be provided integral to unit.

7) Packaged air conditioning equipment shall be able to operate under low outdoor ambient temperatures, and be from one manufacturing source with factory matched components and controls, and compatible with refrigerants that will not promote ozone depletion. Air cooled equipment shall have refrigerant low heat pressure control to maintain satisfactory operation during light loading, and be located away from noise-sensitive and vibration-sensitive areas.

8) Indoor piping insulation for refrigerant and water piping with operating temperatures below 200°F shall be foamed plastic of closed cell structure, k value at 75°F, maximum 0.28 Btu·in/hr·ft^2·°F, maximum water vapor transmission rating of 0.1 perms, similar to Aerotube manufactured by Manville. Piping with operating temperatures between 200 and 450°F shall be insulated with rigid glass fiber insulation, k value at 75°F maximum 0.24 Btu·in/hr·ft^2·°F. Foil scrim kraft jacket with pressure sensitive closure system similar to Flame-Safe AP-T manufactured by Manville.

9) Exterior piping insulation shall be same as indoor piping and provided with metal jacket made with 0.016-inch aluminum with snap fastening closure system with joint band strap containing sealing compound for waterproofing. Longitudinal seams shall be positioned to shed water.

1.5.1.6 Plumbing

a. Cold water services shall be connected to the WSCF sanitary water main services at locations indicated on respective building figures (Appendix A). Each building requiring sanitary water service shall be provided in the building with a main shut-off valve and backflow preventor.

b. Sanitary sewer shall be connected to the WSCF sanitary sewer main at locations indicated on respective building figures (Appendix A).

c. Wall hydrant hose bibbs shall be provided for Buildings 6267, 6269, and 6270 with one bibb located at the approximate center on each side of building.

d. Provide plumbing fixtures that meet the following minimum requirements.

1) Water Closets: Floor mounted vitreous china elongated siphon jet action bowls, similar to American Standard, Inc, "Afton" No. 2206.027 with No. 5320.114 white open front seat and Sloan "Royal" No. 110 flush valve.

2) Lavatories: Similar to American Standard, Inc, 20 by 18 inches "Roxylyn" No. 0195.073 flat slab lavatory for concealed arm support, with center set supply fitting with spray face nozzle and integral flow restrictor, PO plug with perforated grid strainer, 1-1/4-inch cast body adjustable "P" trap with cast escutcheon with set screw, angle supplies with

wheel handle stops with stuffing box and flexible risers, and floor mounted fixture support with concealed arms.

3) Urinals: Wall mounted vitreous china flushing rim siphon jet, similar to American Standard, Inc, "Jetbrook" No. 6570.014, with Sloan "Royal" No. 180 flush valve.

4) Mop Sink: Similar to American Standard Model "Florwell" service sink, enameled cast iron, nominal size 28 by 28 inches, acid resisting and with rimguard. Faucet: Model No. 8344-111 with top brace, stops and vacuum breaker. Drain: Model No. 7721.038 with strainer and socket for 3-inch outlet.

5) Electric Water Cooler: Wall mounted air cooled self contained refrigerated type with a one piece stainless steel top, bubbler, adjustable temperature control, and automatic steam regulator. Capacity 8 gph of 50°F water from 80°F entering water and an ambient of 90°F. Unit suitable for 120 volt, single-phase, 60-cycle electric power; similar to Elkay Manufacturing Company Model No. EWA-8. Where required provide water cooler capable to dispense both cooled and hot water with glass filler, 14 gph capacity, similar to Elkay Model EFH-14.

6) Electric Water Cooler for Handicapped: Wall mounted air cooled self contained refrigerated type with a one piece stainless steel top, a bubbler with two wrist blade operating handles, adjustable temperature control, and automatic steam regulator. Capacity 8 gph of 50°F water from 80°F entering water and in ambient of 90°F. Unit suitable for 120 volt, single-phase, 60-cycle electric power; similar to Elkay Manufacturing Company Model No. EHL-8.

7) Water Pressure Regulator: Bronze body, spring loaded, adjustable valve assembly with integral strainer. Regulator suitable for 100-psig cold water inlet pressure, and set for 45-psig delivery pressure.

8) Floor Drains: Similar to JR Smith Manufacturing Company Figure 2010-A for inside calk, size 2 inch with 5-inch polished bronze strainer. Provide floor drains with trap and trap primer.

9) Backflow Prevention Device: Employing reduced pressure principle, consisting of two shut-off valves and incorporating two check valves and relief valve to automatically maintain zone between check valves at pressure less than supply pressure. Failure of any working part shall result in continuous discharge. Device shall be of a current model approved for installation in Washington State.

10) Wall Hydrant Hose Bibb: Nonfreeze type, similar to JR Smith 5610, 3/4 inch with loose key, with 3/4-inch hose threads, chrome face.

e. Materials and equipment.

1) Indoor water piping with operating temperatures between 80°F to 200°F shall be insulated with foamed plastic of closed cell structure, k value at 75°F, maximum 0.28 Btu·in/hr·ft^2·°F, maximum water

vapor transmission rating of 0.1 perms, similar to Aerotube manufactured by Manville. Minimum thickness: 1 inch. Jacketing shall be of white kraft and foil reinforced laminate with glass and applied to insulation at factory. Jackets shall have minimum 1-1/2-inch longitudinal sealing lap. Butt joints sealed with 3-inch wide strip of jacket material. Longitudinal jacket laps and butt strips secured with adhesive recommended by insulation manufacturer.

2) Fittings and valves shall be insulated with same type used for pipe. Open weave fiberglass tape or cloth used where necessary to hold insulation in place and to fair-in fittings and valves.

1.5.1.7 Electrical

a. Permanent building power services shall be provided from site utility transformers at locations shown on Figures 2 through 7, Appendix A. Buildings 6267 and 6269 shall receive power from pad vault (PV) 4. Building 6270 shall receive power from PV 3. Buildings 6265 and 6265A shall receive power from PV 1. Provide underground conduit, meter at building, wiring and connections. Service voltage shall be 480Y/277 V ac, 3-phase, 4-wire. Metering shall measure total building consumption.

b. Provide service, panels, and all necessary power supply and interior lighting to meet functional and referenced requirement needs. Provide low pressure sodium exterior lighting at all exterior doors as a minimum.

c. Breaker panels and service shall be sized to allow for future expansion at a 25 percent growth factor as a minimum, not inclusive of anticipated facility expansion.

d. Ground fault circuit interrupters shall be provided in panels for all receptacles requiring protection.

e. Emergency lighting shall be provided with battery packs.

1.5.1.8 Communications

a. Provide gas type lightning arrestor protection for incoming copper lines.

1.5.2 Building 6265, Utility Building (UB)

1.5.2.1 General

a. The UB shall provide a covered single-story storage area of approximately 3600 square feet. The UB shall be a nonenclosed structure with a sealed reinforced concrete slab and masonry divider walls. The building shall be located and functions arranged similar to Figure 3, Appendix A.

b. The UB design shall readily accommodate future expansion of 3600 square feet to the south (see Figure 2, Appendix A). The building

addition will accommodate offices, lunchroom, restrooms, miscellaneous shops, and chemical storage. Design accommodations, including location and sizing of services, shall be made for ease of building access, structural system extension, utility connections, electrical system extension, and addition of exterior walls around the general storage of the UB constructed under this Specification.

1.5.2.2 Improvements to land: Required, except no water or sewer service connections shall be made.

1.5.2.3 Architectural

a. The UB will consist of two 1800 square foot storage areas, one for gas bottles and the other for unassigned storage. The storage areas shall be open to roof structure. The minimum eave height shall be 10'-0" floor to bottom of eave to facilitate movement of bottles. The storage areas shall be separated by a full height concrete masonry unit wall meeting the requirements for cutoff storage of NFPA 43C.

b. The gas bottle storage area will provide 5 separate multiple gas bottle rack areas meeting the requirements of NFPA 43C for compressed gas. Appropriate identifying signs for segregation of gases meeting the requirements of NFPA 43C. The storage area shall also be provided with the following.

1) Gas bottle storage for approximately 150 full and empty bottles. Types and quantity of gases stored are identified in Appendix B.

2) Separate multiple gas bottle rack areas with 6 foot 6 inch high minimum 8-inch concrete masonry unit partition walls. Multiple bottle gas rack areas shall be further divided with 36-inch high steel pipe racks with securing chains.

3) Access to storage area and adequate space between racks for movement of gas bottles by hand truck or cart.

c. The unassigned storage area will provide an open area for miscellaneous storage. A ramp shall be provided to finish slab for forklift access.

1.5.2.4 Fire protection

a. Fire sprinkler system: Not required.

b. Fire alarm system: Required. See subparagraph 1.5.1.4b.

1.5.2.5 HVAC: Not required.

1.5.2.6 Plumbing: Not required.

1.5.2.7 Electrical: Required. See subparagraph 1.5.1.7.

1.5.2.8 Communication

a. Provide, install, and connect an external weatherproof telephone that will be compatible with the existing Private Automatic Exchange (PABX). This telephone will be wall mounted in the gas bottle storage area.

b. Provide, install, and connect a speaker numbered ES-301 and signals through a 3-zone controller not in contract (NIC), mounted in a waterproof enclosure. Use the Valcom paging system to calculate speaker placement. This system shall be dc powered and have a battery backup. A signal shall be returned to the telecommunications room in Building 6266 over existing telephone lines, to indicate low battery status. This indicator shall be labeled and mounted on the existing backboard in Building 6266.

c. Provide underground raceway from the existing handhole HH-T1 (indicated on Figure 3, Appendix A) to the inside of the building. Continue the FODUCT as it is in the ducts that enter the handhole. Stub up duct in accordance with EIA/TIA standard. Mount a 4 by 4 foot by 3/4-inch fire retardant backboard in the general storage area. Install raceway from this area out to the wall mounted outlet.

1.5.3 Building 6265A Solid Waste Storage Building (SWS)

1.5.3.1 General

a. The SWS shall be a covered single-story solid waste storage area of approximately 750 square feet. The building will be used for temporary, less than 90 days, storage of 55-gallon drums containing hazardous and possible radioactive industrial waste as defined in WAC-173-303-090. The SWS shall be a nonenclosed structure with a reinforced concrete containment pad and masonry end walls. Building shall be designed as outdoor storage, meeting the requirements of UFC 80.301 (aa). The building shall be located and functions arranged similar to Figure 4, Appendix A.

b. Provisions for future expansion is not required.

1.5.3.2 Improvements to land: Required, except no water or sewer service connections shall be made.

1.5.3.3 Architectural

a. The SWS will consist of 3 separate storage areas sized for 16 drums each. The areas shall be separated by full height concrete masonry partition walls. The building shall have concrete masonry end walls parallel to the partition walls. Minimum height to top of eave shall be 8'-0" with a clear 7'-6" opening below. Eave facia is not required.

b. The SWS storage areas shall be open to the roof structure. Access to and design of the separate storage areas shall facilitate ease of individual drum movement by hand truck. The open sides shall be enclosed

with 6-foot high chain link security fencing with a 6 foot total width access on each side of each area secured with 2 swinging gates.

c. Provide grating inside the 8-inch deep containment storage areas. The containment shall be as indicated on Figure 4, Appendix A below all drum storage, the full length of each storage area and provided with access for containment retrieval. The recessed area shall be sealed with materials compatible to the waste materials to be stored. A listing of potential waste materials will be provided by KEH.

1.5.3.4 Fire protection

a. Fire sprinkler system: Not required.

b. Fire alarm system: Required. See subparagraph 1.5.1.4b.

1.5.3.5 HVAC: Not required.

1.5.3.6 Plumbing: Not required.

1.5.3.7 Electrical: Required. See subparagraph 1.5.1.7.

1.5.3.8 Communications

a. Provide underground duct from existing pedestal T-1 to Building 6265A, location indicated on Figure 4, Appendix A. Provide a 50-pair telephone cable from the existing T-1 pedestal cabinet (to be terminated by others) to the 6265A Building in said duct. Terminate the other end of this cable on a 110 type terminal block mounted in a weatherproof enclosure. Provide, install, and wire in a weatherproof telephone that shall be compatible with the existing PABX system. This telephone shall be mounted on the outside of the building.

b. Provide, install, and connect speakers numbered ES-701 and ES-702 through a one-zone controller using the Valcom paging system mounted in a weatherproof enclosure. The paging signal will arrive on the above telephone lines. This system shall be dc powered and have a battery backup. A signal shall be returned to the telecommunications room in the 6266 Building over existing telephone lines to indicate low battery status. This indicator shall be labeled and mounted on the existing backboard in Building 6266.

1.5.4 Building 6267, Environmental Sample Archive Facility (ESA)

1.5.4.1 General

a. The ESA shall be a single-story enclosed structure with a sealed reinforced concrete slab of approximately 1800 square feet. The facility will provide ambient and refrigerated storage for WSCF samples. The facility shall be located and functions arranged similar to Figure 5, Appendix A.

b. The ESA design shall accommodate facility expansion of 1800 square feet to the north (see Figure 2, Appendix A). The building

addition will provide space for additional ambient and refrigerated sample storage, and support office.

1.5.4.2 Improvements to land

a. See subparagraph 1.5.1.2.

b. No sanitary water service connections shall be made for this building.

c. Concrete mechanical equipment pads and entrance landings shall be provided as shown in Figure 5, Appendix A.

1.5.4.3 Architectural

a. The ESA will be comprised of two storage areas (ambient and refrigerated) and a work area. The facility shall provide adequate area for storage for up to 14,000 samples previously characterized in the WSCF. This storage will consist of 11,500 samples at ambient temperature and 2500 samples at a refrigerated temperature requiring stringent tolerances. A sample consists of two 250-milliliter jars 3 inches in diameter by 4 inches high and a one liter jar 5 inches in diameter by 9 inches high.

b. Noncombustible open shelving systems shall be incorporated in the storage area design and installed for storing samples. The shelving system shall provide for indexing and categorizing and be designed and positioned to allow easy access and retrieval of samples. Each storage area shall be provided with the following:

1) Ambient temperature storage: A mechanically-assisted mobile high density (MAMHD) storage system shall be installed consisting of shelving unit carriages with mechanically assisted movement along a raised track. A minimum 42-inch aisleway shall be provided between carriages to be accessed. Finish floor shall be raised to track level in shelving area. The shelving carriages shall be provided with variable shelving sized to accommodate samples with a cupped edge to retain samples. Anticipated accessories NIC which the MAMHD shall accommodate include storage bins for three samples each, mobile ladders for reaching upper tiers, and a labeling system with necessary equipment. The MAMHD shall be similar to Space Saver Storage Systems Model CT-3MA/Mechanically Assisted System in design and operation suggested layout is shown on Figure 5, Appendix A.

2) Refrigerated storage: Two refrigerative cooler units shall be installed. The units shall be sized to accommodate 1,250 samples each on mobile free standing shelving with adequate area for cart access and egress along full length of shelving. Each unit will be self-supporting with R 38 insulated metal skin core panels on floor, ceiling, and sides. The panel skins shall be aluminum except floor panels which shall be stainless steel. The floor shall be recessed in the slab to provide a flush floor transition from the main facility. Unit interiors shall be provided with sprinkler protection. Refrigeration temperature shall be 40 ±2°F, and shall be monitored and recorded continuously. The refrigeration units shall be similar to Bally 250 Series Walk-in Coolers in design and function with the following accessories:

- 34-inch wide door with observation window
- floor treadles
- mortise look door hardware
- door strip curtains
- pressure relief port
- interior lighting
- digital thermometer and recorder
- out-of-range temperature alarm
- manufacturer supplied coil support
- condenser winterization
- mobile (castored) free standing shelving
- dry pendant automatic sprinkler heads

c. A work area shall be provided sized to accommodate a desk, chair, and computer station.

d. A 6-foot wide access aisle shall be provided connecting all areas to 2 double 3 ft by 7 ft exterior doors. The aisle shall be provided along the access side of the MAHMD and refrigerated storage units as a minimum. Refer to Figure 5, Appendix A.

e. The facility shall be provided with the following as a minimum.

1) Open to roof structure.

2) Securable exterior doors.

3) View lites in exterior doors.

1.5.4.4 Fire protection

a. Fire sprinkler system: Required. See subparagraph 1.5.1.4a.

b. Fire alarm system: Required. See subparagraph 1.5.1.4b.

1.5.4.5 HVAC

a. The HVAC system shall provide an ambient environment with ventilation and filtration. Include manufacturer-specified ventilation units in the roofing package to provide a nonconditioned flow of air throughout the ambient storage area. Space heaters will be required to maintain a minimum 50°F ambient temperature in ambient storage area.

1.5.4.6 Plumbing

a. Sanitary water is not required.

b. The special equipment required for refrigeration of the samples will require the condensate piping to be connected to the plumbing drainage system. Other drainage systems may be required.

1.5.4.7 Electrical: Required. See subparagraph 1.5.1.7.

1.5.4.8 Communication

a. Provide underground duct from existing handhole HH-T4, location indicated on Figure 5, Appendix A, to the inside of the east wall of the building. Continue the FODUCT as it is in the ducts that enter the handhole. This area shall be designated as the main telephone and data distribution point. Provide a 4- by 5-foot by 3/4-inch thick fire retardant backboard and mount it to the east wall. Provide raceway from the backboard to an area near the door where the wall mounted telephone and the data outlet are to be located.

b. Provide, install, and connect speakers numbered IS-401 through IS-406 and signals through a one-zone controller (NIC) using the Valcom paging system. This system shall be powered from a Uninteruptible Power Supply (UPS). The paging signal will arrive on telephone lines.

1.5.5 Building 6269, Mobile Laboratory Storage Facility (MLS)

1.5.5.1 General

a. The MLS shall be a single-story structure of approximately 6800 square feet. The facility will provide protective storage for 5 mobile laboratories, required support spaces for personnel, and servicing of sampling and analytical equipment. The MLS shall include block heater outlets within the mobile laboratory parking area. Reference Figure 6, Appendix A.

b. Design consideration for future expansion is not required.

1.5.5.2 Improvements to land (civil)

a. See subparagraph 1.5.1.2.

b. Reinforced concrete vehicle apron designed for laboratory vehicle loads along the full width of the mobile laboratory bay area with one 6-inch diameter concrete filled painted steel pipe bollard at each bay door jamb. Concrete landings at each entrance as shown in Figure 6, Appendix A shall also be provided.

c. Ten block heater outlet supports at the vehicle parking area as located on Figure 6, Appendix A with associated underground electrical power supply from the MLS. Supports shall be constructed of steel pipe bollards as previously described with conduits and outlet mounted on side opposite traffic.

1.5.5.3 Architectural

a. The MLS will consist of two separate functional areas, the mobile laboratory bay area and an office/support work area. These areas will be physically separated with a 2-hour fire rated partition constructed to meet a Sound Transmission Coefficient (STC) of 50. A continuous slab construction joint along the separation will be provided for additional vibration transmission control with fibrous joint and topping sealant. Two fire rated doors between the areas will be provided, one for personnel

access located near the office area, and one for personnel and equipment access near the equipment support area. This door will be a minimum of 4 foot wide. Doors will be provided with weatherstripping for reduced sound transmission.

b. The mobile laboratory bay area will provide protective storage for 5 mobile laboratory units, space for work benches, approximately 36 inches wide by 30 inches high (NIC), and an ice machine (NIC). The area shall be approximately 4000 square feet sized to provide adequate working area around and space for 5 laboratory units. Laboratory units will be either motorized van or trailer type with a maximum size of 35 feet long, 8 feet wide, and 13 feet 5 inches high each weighing approximately 8000 pounds. Each bay will provide a 20-foot wide by 40-foot clear dimension with a 16-foot clear minimum height. Interior wall surfaces will be of painted gypsum wallboard or steel liner panel. Ceilings may be open to structure. Each vehicle bay floor shall be sloped to a central point for collection and easy removal of accumulated liquids. Provide a personnel door to the exterior at each end of the bay area and a 14-foot wide by 16-foot high overhead sectional door for each of 5 bays. (See Figure 6, Appendix A.) Exterior doors shall be properly weatherstripped to facilitate required positive static air pressure.

c. The office/support area will provide support spaces required for the facility operation. Spaces will be enclosed with painted gypsum board partitioning and doors. Ceiling heights will be 8'-0" minimum. The spaces in this area shall provide the following. Square footages indicated are approximate.

1. Three separate offices for scientists, 200 square feet each. Offices to have exterior light and view.

2. An office bay area of 400 square feet. The area shall be designed to accommodate 3 workstations shared by technicians. Each workstation will have a desk, table, chair and file cabinet (NIC). Office bay to have exterior light and view.

3. A lunch area sized to accommodate an 8-foot long counter with lower casework, backsplash and sink; and space for a refrigerator (NIC). A microwave oven (NIC) will be located on counter.

4. A calibration room of 290 square feet. Space and services are required to accommodate a 6-foot long exhaust fume hood with base cabinet (in project), work benches and metal storage cabinet (NIC). The door shall be 4 foot wide to accommodate equipment access.

5. An instrument storage room of 135 square feet. The room shall be proportioned to maximize storage and facilitate easy access to stored items. These items will be storable on standard shelving. Shelving shall not be provided by contract.

6. A sampling storage room of 250 square feet. This space shall be proportioned to easily store and access miscellaneous cleaned reusable sample collection apparatus. The access door shall be lockable.

7. A men's and women's restroom sized to accommodate use. The men's restroom shall be provided with a minimum of one water closet with metal toilet partitioning, a urinal, a lavatory, and all necessary accessories. The women's restroom shall be provided with a minimum of one water closet with metal toilet partitioning, a lavatory, and all necessary accessories. Toilet accessories shall be provided as indicated in subparagraph 1.5.1.3.d(17) of this Section. A drinking fountain will be provided in this area accessible to all personnel.

8. A janitor closet sized to accommodate one janitor mop sink and minimal janitorial supplies with mop/broom racks and shelving.

9. A telecommunications room in accordance with ANSI EIA/TIA-569 to accommodate required equipment.

10. Space shall be provided for mechanical equipment including a sprinkler system riser and a water heater.

11. A central circulation spine connecting the main entrance and service entrance providing easy access between the main areas of the facility. Circulation corridors will have a minimum width of 60 inches. The main entry door shall be 3-foot wide by 7-foot high with a 1 foot full height side light.

d. Relationships of functional spaces shall be divided into four distinct areas. These include the mobile laboratory bay area, the equipment support area (sampling supply storage, calibration and instrument storage rooms), office area, and facility support area (restrooms, lunch area, janitor, telecommunications, mechanical). The following spacial relationships are required for the MLS. Reference Figure 6, Appendix A.

1. The office area shall be directly adjacent to the main entrance with the scientist offices nearest the entrance. The technician office bay shall be accessible to the mobile laboratory bay. Strong relationship to the equipment support area is not required.

2. The equipment support area shall have a strong relationship to the mobile laboratory bay area and service entrance. Most daily activity will be between these areas. The sampling supply storage shall be directly adjacent to the service entrance. The calibration room requires easy access to the mobile laboratory bay area to facilitate direct movement of equipment and carts between the 2 areas. The instrument storage room shall be accessed through the calibration room only.

3. The facility support area shall be centrally located between the office area and equipment support area. The telecommunications closet shall be centrally located with preferable access from a main corridor.

4. The mobile laboratory bay area shall have direct access to the exterior for all bays accommodating easy vehicle entrance. All 5 vehicle bays shall be within the same open area.

e. The MLS shall be provided with the following as a minimum.

1. View lites in doors to all offices, calibration room, and the service entry door.

2. Suspended gypsum board ceilings in restrooms, janitor closet, storage room, and calibration room.

3. Suspended acoustical tile ceilings in all areas except those receiving gypsum board ceilings and the mobile laboratory bay area. A suspended ceiling is not required in the telecommunications closet.

4. Resilient flooring with rubber base in all areas of the MLS except the mobile laboratory bay area. The concrete floor of the mobile laboratory bay area shall be coated with a coating system capable of resisting attack by anticipated material spillage. All cracks, crevices, and joints shall be calked or sealed and finished smooth to prevent contaminated material accumulation in inaccessible areas.

5. Securable exterior doors and windows.

6. A 6-foot, stainless steel, Class C fume hood with manual operation switch and 120 V electrical receptacle.

1.5.5.4 Fire protection

a. Fire sprinkler system: Required. See subparagraph 1.5.1.4a.

b. Fire alarm system: Required. See subparagraph 1.5.1.4b.

1.5.5.5 HVAC

a. The office and garage bay areas shall be on separate HVAC systems.

b. The HVAC system in the garage bay area shall maintain a positive air pressure when the bay doors are closed to help maintain mobile laboratory cleanliness and equipment integrity. Indoor temperatures shall be maintained by using evaporative coolers and electric space heaters. Throw-away air filters shall be used.

c. The Calibration Room shall be provided with hood exhaust vented to the outside via a stainless steel ductwork, all-welded construction. During fume hood operations, makeup air shall be delivered to the Calibration Room from a conditioned source to maintain system and room air balance.

d. Outside air shall be passed through a filter system ASHRAE rated at 35 percent dust spot efficiency. Temperature for the mobile laboratory vehicle bays shall be maintained at 21.1°C (70°F) plus or minus 8°C (15°F). The remainder of the complex shall be maintained at temperatures for personnel comfort with a minimum of four air changes per hour. Air supply to the calibration room shall assure proper hood face velocity. Fume hood face velocity will be in accordance with DOE Order 6430.1A, Section 1161-4. Supply air shall enter the Calibration Room at half the fume face velocity or less, and not more than 50 fpm.

1.5.5.6 Plumbing

a. The restrooms, lunchrooms, and janitor closet shall be provided with the required plumbing fixtures and associated plumbing piping services. A domestic hot water heater shall be provided with the related components for hot water supply to the plumbing fixtures. A water cooler shall also be provided.

b. The sanitary waste system shall collect liquid sanitary waste from the building restrooms, lunchrooms, and air conditioner condensate.

1.5.5.7 Electrical

a. Provide ceiling mounted retractable power cords for attachment to the mobile equipment while parked in each of their respective parking bays.

b. Provide 10 outdoor weatherproof electrical outlets for mobile unit engine block heaters with underground service location as indicated on Figure 6, Appendix A.

c. Provide wall receptacles in the mobile laboratory parking bays mounted at a height above the work benches, and incorporate GFCI as required by code.

d. Provide both 120 and 208 V ac outlets in the calibration room.

1.5.5.8 Communications

a. Provide underground duct from existing handhole HH-T3 location (reference on Figure 6, Appendix A) to the telecommunications room. Continue the FODUCT as it is in the ducts that enter the handhold.

b. Provide raceway and wiring from the telecommunications room to each room/area that will require telephone and HLAN. These telephones and service lines shall be installed in each office, in the calibration room, and in the mobile laboratory bay. The mobile laboratory bay shall have 2 telephones and 2 HLAN outlets centrally located. Both the telephone and the data connector shall be in the same flush mounted wall box with the exception of the mobile laboratory bay which shall have wall mounted telephones. Provide telephones compatible with the existing PABX. Leave 20 feet of spare cable in the telecommunication room.

c. Provide, install, and connect speakers numbered IS-601 through IS-612 and signals through a 3-zone controller (NIC) the Valcom paging system. This system shall be powered from a UPS.

d. Provide an HLAN outlet in each office, one in the calibration room, and two in the garage.

1.5.6 Building 6270 - Environmental Data Remedial Tracking System Facility (EDRTS)

1.5.6.1 General

a. The EDRTS shall be a single-story structure of approximately 4,600 square feet. The building shall provide accommodations for laboratory automated data processing (ADP) and supporting services. Reference Figure 7, Appendix A. The ADP systems will support WSCF sample handling, records management, data repository, and communications.

b. The EDRTS design shall readily accommodate future expansion of 4600 square feet to the east. The addition will include office and related spaces, lunchroom, and restrooms. Design accommodations of the EDRTS including location and sizing of services shall be made for ease of circulation, structural system continuity, and utility, mechanical system, and electrical/communication system connections and extensions.

1.5.6.2 Improvements to land

a. See subparagraph 1.5.1.2.

b. Concrete mechanical equipment pads and entrance landings shall be provided as shown in Figure 7, Appendix A.

1.5.6.3 Architectural

a. The EDRTS shall be comprised of 2 main areas and a mechanical equipment room. The main areas include a computer core area and an administrative support area. Reference Figure 7, Appendix A.

b. All spaces within the EDRTS shall be enclosed with painted gypsum board walls, appropriate view windows and doors. Ceiling heights shall be 8'-0" minimum.

c. The computer core area shall provide space for automatic data processing supporting the WSCF and its immediate support functions. The area shall be designed in accordance with DOE/EP-0108 and NFPA 75. A 1-hour fire separation shall be provided between the computer data center/ communication room/printer room, and the remainder of the facility. The spaces within the computer core area shall provide the following. Square footages indicated are approximate.

1) A computer data center of 1500 square feet designed to accommodate automated data processing equipment (NIC), support equipment (NIC), air conditioning systems, and data cabling (NIC) between equipment and to other support areas. The center shall be designed to provide flexibility to accommodate changing equipment. The center entry shall accommodate a 4'-0"-wide equipment access. Type and quantity of NIC equipment will be provided by KEH for facility design.

2) A communication room of 340 square feet designed to accommodate required communication equipment (NIC), electrical support equipment (NIC), air conditioning systems, and data cabling (NIC) between

equipment and a computer data center. The room shall be designed to provide flexibility to accommodate changing equipment. Type and quantity of NIC equipment will be provided by KEH for facility design.

3) A printer room of 190 square feet designed to accommodate printer equipment (NIC) and paper storage cabinets (NIC), and data cabling (NIC) to computer equipment. Vision between the computer data center and printer shall be provided through a minimum of 2 windows, 2'-6" by 4'-0" in size.

4) A computer equipment/operator office area of 300 square feet. The area will provide work space for 2 operators with storage area for minor equipment.

5) A temporary file storage room of 300 square feet. The room will provide space for file cabinets (NIC) and other storage. The storage room will be accessible from the computer equipment/operator office. Complete closure between the 2 areas is not required.

d. The administrative support area shall provide support spaces required for the EDRTS operation which do not require direct adjacency to the computer data center. The spaces within this area shall provide the following: (Square footages indicated are approximate.)

1) A sample data quality center of 500 square feet shall be designed to accommodate independent work terminals with associated equipment and cabling (NIC) to the computer center. A 4-foot wide by 4-foot high glazing area will be provided to facilitate viewing of visitors into the space. This viewing area shall be located directly adjacent to the main entry circulation pathway.

2) A sample records workroom with reference area of 430 square feet provided with exterior light and view. The workroom will contain test sample results, laboratory notebooks, selected hard copy quality originals of documents, microfilm, photographs, and selected training records which shall be protected against damage, deterioration or loss.

3) A clerk office of 140 square feet provided with exterior light and view.

4) A janitor closet sized to accommodate one janitor's sink and minimal janitor's supplies with mop/broom rack and shelving.

5) A 10- by 5-foot minimum area for the fire sprinkler system riser shall be provided at a location to easily accommodate future expansion.

6) Circulation shall be provided to directly connect the main entry of the EDRTS with Building 6266-WSCF. The internal circulation will provide direct access to future expansion from the main entry. Circulation corridors shall have a minimum width of 7'-0" to the computer data center and 5'-0" elsewhere. The main entry door shall provide a

minimum 4'-0" equipment access. Removable mullion or other mechanical means to achieve width are acceptable.

e. The mechanical equipment room shall be provided sized to accommodate mechanical and electrical equipment, serving equipment, and spaces which require special air quality ie, computer data center.

f. Relationships of functional spaces shall be as follows:

1) The communication room and printer room shall be directly adjacent to the computer data center. Strong relationships are also required of the computer equipment and operator office, temporary file storage room, and the sample data quality center.

2) The sample data quality center shall be directly adjacent to the printer room and have a strong relationship to the entry corridor for visitor viewing.

3) The clerk office shall have a strong relationship to the main entry and sample records workroom.

4) The janitor closet shall be accessible to the entire EDRTS and located to provide access after expansion.

g. The EDRTS shall be provided with the following as a minimum.

1) View lites in doors to all spaces except the janitor closet, sample records workroom, and exterior doors not associated with circulation corridors.

2) Suspended gypsum board ceiling in janitor closet. The mechanical equipment room shall have a sound separation barrier in the ceiling consisting of 2 layers of 5/8-inch gypsum wallboard.

3) Suspended acoustical tile ceiling in all areas except janitor closet and mechanical equipment room.

4) Access flooring shall:

(a) Be steel, minimum 14 inches high; 24 by 24 inch removable, interchangeable panels, with adjustable pedestals.

(b) Be factory finished 0.060-inch thick high pressure plastic laminate, high wear type, Grade H W 62, conforming to NEMA LD3, color - misty with integral panel trim.

(c) Provide static electric resistance from 5.0×10^5 (minimum) to 2.0×10^{10} (maximum) ohms measured from covering to pedestal. Resistance shall remain stable over life expectancy of system. If anti-static agent is used in the manufacturing process, it shall be an integral part of the material.

(d) Have load resistance capable of sustaining 500 pound rolling load with deflection less than 0.035 inch; with 1250 pound

concentrated load on one square inch of surface, deflection shall not exceed 0.080 inch and leave no permanent surface indentation; and a safety factor of 2.

(e) Be provided with 40 spare floor panels and 10 spare air flow panels.

(f) Have access from corridor via ramp with handrails on each side.

5) Resilient flooring with rubber base in all areas of the EDRTS except spaces receiving access flooring, janitor closet, and mechanical room. Seal all exposed concrete floors.

6) Securable interior and exterior doors and windows.

1.5.6.4 Fire protection

a. Fire sprinkler systems: Required. Provide as described in subparagraph 1.5.1.4.a, with "on-off" sprinkler heads in computer data center.

b. Fire alarm systems: Required. Provide as described in subparagraph 1.5.1.4.b with smoke detectors installed under the access floor in the computer area.

1.5.6.5 HVAC

a. Provide a separate stand-alone system for the spaces requiring special temperature and humidity control. This system shall have two dual-compressor HVAC units in the computer area. Size equipment to allow 3 compressors to operate simultaneously during full-load operation. The fourth compressor will be on standby. Humidity will be controlled by accessory humidifiers with reheat capacity provided as required. Circulating fans will deliver air to the raised floor area; air will be returned through high-wall grilles. Two air cooled condensers will reject system heat. The two HVAC systems will be controlled by a manufacturer-supplied central control panel, with capability for future monitoring and control of the equipment to the Control Room S-32 located in the WSCF Building.

b. The computer data center, printer room, communication room, temporary file storage room, and sample data quality center shall be air conditioned with humidity control. The temperature under normal conditions shall be maintained between 21.1 and 23.3°C (70 and 74°F) and a relative humidity between 45 and 55 percent.

c. Occupancy requirements for HVAC calculations: Computer core area to have occupancy of 3, sample data quality center to have 12, and clerk's office to be 1.

d. Sensible equipment loads: Sample data quality center has 10,000 Btu/h and computer core area has 293,000 Btu/h.

1.5.6.6 Plumbing

a. Provide a mop sink in the janitor closet. Provide a domestic hot water heater for hot water supply to the mop sink. A water cooler with hot water supply shall also be provided.

b. Functional spaces requiring access flooring shall be provided with trapped floor drains with trap primer connected to sanitary water.

c. The sanitary waste system shall collect liquid sanitary waste from the janitor closet, air conditioner condensate, and floor drains.

1.5.6.7 Electrical

a. Provide future remote monitoring capability from building electrical meter.

b. Provide dedicated power to the computer data center.

1.5.6.8 Communications

a. Continue the underground duct from handhole T-2 to the telecommunications room of the 6270 Building (see Figure 7, Appendix A). Continue the FODUCT as it is in the ducts that enter the handhole.

b. Provide raceway and utility boxes as shown on Figure 8, Appendix A. Provide 3/4-inch conduit from the raceway to each speaker location. Provide an electronic UPS system that provides a minimum of 4 hours steady power to support the communication equipment after normal power failure. Should the building be reconfigured, use Valcom's methods to calculate the number of speakers required.

1.6 DESIGN SERVICES

1.6.1 General

1.6.1.1 Design of Buildings 6265, 6265A, 6267, 6269, and 6270 shall be performed by licensed architect(s) and engineer(s) experienced in building type and proposed construction who shall be in responsible charge for the preparation of the detailed design package. The detailed design package shall be in accordance with this Design Construction Specification.

1.6.1.2 Detailed design shall be prepared under the supervision of architects and engineers licensed in the State of Washington and experienced in each applicable discipline. All components of the Detailed Design Package shall be stamped by the applicable discipline architect or engineer certifying compliance of the design to the requirements of this section. The sprinkler system, its supply main, and the fire alarm system design and drawings shall be prepared under the supervision of and stamped by a registered fire protection engineer.

1.6.1.3 Design reviews shall be as indicated in Section 01200. The following are minimum design packages. Completed construction drawing sets

and related construction specifications may be submitted at an earlier time to meet project schedule if preliminary design review is complete and prior approval, including package content, has been made by KEH.

a. Preliminary Design Review

1) Preliminary drawings in accordance with Paragraph 1.7.2.

2) Outline specifications in accordance with Paragraph 1.8.3.

3) Product information in accordance with subparagraph 1.8.3.2.

b. Final Design Review

1) Construction drawings in accordance with Paragraph 1.7.3.

2) Construction Specification in accordance with Paragraph 1.8.4.

3) Nonstructural Systems Seismic Design calculations in accordance with Paragraph 1.9.3.

4) Structural Systems Design calculations in accordance with Paragraphs 1.9.4.

5) Mechanical/Electrical System Design calculations in accordance with Paragraph 1.9.5.

6) Product information in accordance with Paragraph 1.8.5.

1.6.2 Detailed Design Package: Prepare documents which include the following.

1.6.2.1 Construction drawings: Prepare construction drawings for the work meeting the requirements specified in Articles 1.3, 1.4, and 1.7.

1.6.2.2 Construction specifications: Prepare construction specifications for the work meeting the requirements specified in Articles 1.3, 1.4, and 1.8.

1.6.2.3 Design Calculations: Prepare calculation package from the work meeting the requirements specified in Articles 1.4 and 1.9.

1.6.3 Acceptance Test Procedure: Prepare an ATP for testing of each system specified in Article 1.10.

1.6.4 Product and Equipment Manuals: Prepare manuals for the work meeting the requirements specified in Article 1.11.

1.6.5 As-built Drawings and Specifications: Prepare as-built drawings and specifications incorporating approved changes to detailed design

package. Prepare drawings on mylars and CAD generated media with program files. As-built Drawings shall be designated H-6-XXXX, Rev 0.

1.6.6 Participate in the timely resolution of field problems.

1.7 DRAWING REQUIREMENTS

1.7.1 General

1.7.1.1 Prepare preliminary and construction drawings to scale and dimensioned on preprinted mylars, supplied by KEH. Drawings may be produced by CAD with titleblock facsimile. A block of drawing numbers (H-6-XXXX-A) will be provided at preconstruction meeting. Drawing revisions shall be indicated by alpha indicator.

1.7.1.2 Construction drawings shall be in accordance with SDC-1.3.

1.7.2 Preliminary Design Review Drawings: Prepare necessary Drawings to indicate overall design direction, type of structure, method of construction, materials used, and extent of work.

1.7.2.1 Civil: Site Plan indicating site layout showing building location and extent of existing and contract road, walkway, and parking interfaces; materials; and existing and new utilities.

1.7.2.2 Architectural/Structural

a. Floor plan indicating layout of spaces and locations of major equipment.

b. Reflected ceiling plan indicating materials, lighting, and location of electrical/communication supply in bay area.

c. Building elevations and sections indicating structural systems, material types, door and window sizes, and locations.

d. Door/window schedule indicating type and size.

e. Finish schedule indicating interior and exterior finish materials proposed for use including location, type, and colors.

1.7.2.3 Fire Protection: Indicate riser location, backflow prevention, and other major components on floor and site plans. Provide fire alarm/detection system design including location and type of initiating devices, indicating appliances and system functional design.

1.7.2.4 HVAC and Plumbing: Indicate equipment, ductwork, piping, and plumbing locations on floor plans, sections; provide air flow and piping diagrams, and instrument control diagrams.

1.7.2.5 Electrical: Indicate major equipment (ie, MCC, switchgear, transformers), site and building lighting, and power distribution concept on plans.

1.7.2.6 Communications

a. Communications infrastructure: Provide proposed telecommunications room floor layout and raceway/conduit cable distribution drawings.

b. Telephone: Provide telephone specific drawings detailing cable distribution and outlet locations, and termination arrangements.

c. HLAN: Provide HLAN specific drawings detailing cable distribution and outlet locations.

d. Paging: Provide paging specific drawings detailing cable distribution and speaker locations.

1.7.3 Construction Drawings: Prepare necessary instructions/drawings to erect building and install components. Submit design/fabrication/ installation drawings as follows.

1.7.3.1 Civil: Site plan and details.

1.7.3.2 Architectural/structural

a. Foundation plan.

b. Floor plan.

c. Reflected ceiling plan.

d. Building elevations and sections.

e. Wall sections and details.

f. Window, door and hardware schedule.

g. Roofing, siding, and soffit details.

h. Structural framing plan.

i. Miscellaneous details including nonstructural system seismic connection details.

j. Finish schedule: Include materials, finish and color for interior and exterior finished items.

1.7.3.3 Fire Protection

a. Underground fire main and PIV conduit: Include plans and details including pipe, fittings, material, methods of thrust restraint, location and burial depth.

b. Sprinkler system: Include reflected ceiling plan, sections, elevations, and details indicating system sizing, arrangement, and support.

c. Fire alarm system: Include floor plan, details, and other drawings indicating equipment and component location and arrangement, and diagrams and schematics showing intervals and point to point wiring.

1.7.3.4 HVAC

a. Drawings shall indicate HVAC systems, (airside and waterside), equipment, components, air outlets, air intakes, ducts, etc and identify their respective tag number.

b. Drawings shall include floor plans, elevations, and details indicating duct and equipment size, locations, elevations, automatic controls and instrument diagrams, thermostat locations, control locations, damper locations, HVAC equipment and component schedules. Grilles and registers shall show location, size, air flow direction, flow in cubic feet per minute, neck sizes, and noise criteria.

1.7.3.5 Plumbing

a. Drawings shall indicate plumbing systems, equipment, components, fixtures, drainage systems, sanitary piping, sewers, potable water, vent lines, etc, and identify their respective tag number.

b. Drawings shall include site plan showing water/sewer connections, underground plumbing plan, building floor plan indicating piping locations and elevations, fixture locations, pipe sizes, slopes, applicable inverts, clean-out locations, vent through roof locations, shut-off valve locations, water hammer arrestor locations, access door locations. Provide sanitary and water drainage riser diagrams, hot and cold water, and recirculating hot water riser diagrams. Provide plumbing fixtures and equipment schedules on drawings.

1.7.3.6 Electrical

a. Site plans indicating tie-ins to power and communications pull boxes and any outside lighting.

b. One-line diagram.

c. Power and Lighting Plans indicating lighting fixture layout and schedule, light switches, location of electrical distribution equipment, receptacles, equipment hookups, and conduit routing.

d. Panelboard schedules.

e. Conduit/wire run list.

f. Building grounding plan and details.

1.7.3.7 Communications

a. Site plans indicating underground service.

b. Telecommunication duct and outlet plan.

c. Cable tray and equipment plans.

d. Speaker, telephone, and data outlet location plan.

e. Telephone/data details and diagrams.

f. Telecommunications elevations and details.

1.8 SPECIFICATION REQUIREMENTS

1.8.1 General

1.8.1.1 The Contractor shall prepare a Construction Specification, based on this Design Construction Specification and meeting its requirements. The approved Contractor prepared Construction Specification and design drawings will be the basis for final inspection by KEH. Include references, codes, and standards, submittals, installation, inspection, testing, acceptance criteria, and documentation.

1.8.1.2 The construction specification shall contain all Sections required to define materials and products intended for use.

1.8.2 Specification Format

1.8.2.1 The construction specification shall be prepared using the Construction Specification Institute (CSI) division and section numbering.

1.8.2.2 Individual sections shall be prepared in the CSI 3-part format. Each part, as applicable, shall be divided into articles and paragraphs.

1.8.2.3 The specification shall contain a table of contents preceded by a specification cover and sign-off review page.

1.8.2.4 The page size shall be 8-1/2 by 11 inches.

1.8.3 Outline Specifications

1.8.3.1 An outline specification identifying and describing all materials and products proposed for use will be required at Preliminary Design Review. Specification will indicate compliance to this Document.

1.8.3.2 Information of proposed products shall be submitted for review with the outline specification. Submittal shall include the following.

a. Metal roofing: Product data, color sample.

b. Exterior siding: Product data, color sample.

c. Aluminum entrance door: Color sample.

d. Aluminum windows: Color sample.

e. Glazing: Color sample.

f. Resilient flooring and base: Color samples.

g. Paint: Color chips.

h. Metal toilet compartments: Color sample.

i. Casework: Color samples of casework and counter top/splash.

j. Fire extinguisher cabinets: Product data.

k. Mechanically assisted high-density storage system: Product data.

l. Refrigerated storage units: Product data.

m. Exhaust fume hood: Product data.

n. HVAC equipment/component selections: Product data.

o. Plumbing fixtures: Product data.

1.8.3.3 Required color samples proposed for use shall be submitted on "color board" format indicating proposed color scheme.

1.8.4 Construction Specification

1.8.4.1 The construction specification shall list all products and materials to be used for each section. The products and materials shall meet the Referenced Standards and Specifications set forth in this Design-Construct Specification.

1.8.4.2 Specific product and material requirements identified in Article 1.5 shall be included in the Construction Specification.

1.8.4.3 The Construction Specification shall describe the fabrication and/or installation procedures to be followed for each product and/or material.

1.8.4.4 The Construction Specification shall contain the requirements outlined in Section 01100.

1.8.5 Product Submittals: The following products and materials will require submittal for information and record indicating compliance to the requirements of this Section and items to be installed/furnished. This list is not intended to be complete, only an outline of standard items that would possibly be used in design. Other materials and products specific to design not outlined in this paragraph may require submittal as determined at Preliminary Design Review. Some materials may include:

1.8.5.1 Metal roofing.

1.8.5.2 Exterior siding.

1.8.5.3 Refrigerated storage units.

1.8.5.4 Mechanically assisted high-density storage system.

1.8.5.5 Exhaust fume hood.

1.8.5.6 FACP.

1.8.5.7 HVAC systems equipment and components.

1.8.5.8 Instrumentation and controls equipment and components.

1.8.5.9 Plumbing fixtures.

1.8.5.10 Plumbing equipment and components.

1.9 CALCULATION REQUIREMENTS

1.9.1 General: The contractor shall prepare a Design Calculation package including calculations and associated detail sketches for nonstructural system seismic design, structural design, and mechanical/electrical systems design.

1.9.2 Calculation Format

1.9.2.1 The design calculation package shall be prepared in a design report format with the seismic design and each system design as separate sets.

1.9.2.2 Each set of calculations shall be identified by a unique calculation number, be provided with a typed calculation identification and index cover sheet, and be paginated. Sets shall be combined into a single design calculation package hard cover with a typed coversheet, table of contents, tabbed dividers between each calculation set and bound in 3-ring binder.

1.9.2.3 Each set of calculations shall be referenced to detail construction drawings, if applicable, which show completed design.

1.9.3 Nonstructural Systems Seismic Design: Prepare calculations and details for system and equipment and building component installation connections to resist seismic forces. The work shall include all items required by the UBC and other criteria documents, codes, and standards referenced in Article 1.4.

1.9.4 Structural System Design: Prepare calculations and details for building structural design indicating compliance to UBC and SDC-4.1. The work shall include but not be limited to foundation and footing design, concrete slab design, and design criteria and stress analysis of structural numbers.

1.9.5 Mechanical/Electrical Systems Design: Prepare calculation and appropriate details for building mechanical and electrical systems design indicating compliance to referenced requirements. The work shall include but not be limited to the following:

1.9.5.1 Fire sprinkler system hydraulic calculations.

1.9.5.2 HVAC equipment sizing with accompanying Life Cycle Cost Analysis.

1.9.5.3 HVAC system design descriptions.

1.9.5.4 Lighting system design using the Zonal Cavity method. Calculation shall state inputs, assumptions, and results for each area designated.

1.9.5.5 Power system design in a report format listing loads, assumptions, and results. Calculations should include loads, equipment sizing, fault, voltage drop, and load and fault coordination assumptions.

1.10 ACCEPTANCE TEST PROCEDURE (ATP) REQUIREMENTS

1.10.1 Prepare ATP for the following systems: Use Guide ATP, covered by Section 01655, as an example in preparing format and content of system ATP.

1.10.2 Fire Alarm System

1.10.2.1 A written ATP for testing fire alarm system components and installation shall be prepared in accordance with NFPA 72, Paragraph 2-5.1. Contractor shall be responsible for performance of the ATP, and functionality of system and equipment in verifying operability of components and circuits. Perform the ATP in presence of KEH.

1.10.2.2 The ATP shall include, but not be limited to, the testing of the following fire alarm system components and installation.

a. Proper wiring.

b. Alarm sounds upon operation of each alarm initiating device.

c. Alarm sounds upon operation of each waterflow switch.

d. Trouble annunciation upon operation of each supervisory switch.

e. Trouble annunciation upon open circuit, grounded circuit, and loss of power from building panel.

f. Alarms are transmitted and received correctly, including trouble signals.

g. Batteries supply power sufficient to operate the entire system as required in this Section.

1.10.3 HVAC Systems

1.10.3.1 A written ATP for HVAC systems shall be prepared. Contractor shall be responsible for performance of the ATP, and functionality of systems and equipment in verifying operability of components. Perform ATP in presence of KEH.

1.10.3.2 The ATP shall include, but not be limited to, balancing, system operation, duct fabrication, water side, air side, and refrigerant side testing.

1.10.4 Plumbing Systems

1.10.4.1 A written ATP for plumbing systems shall be prepared. Contractor shall be responsible for performance of the ATP, and functionality of systems and equipment in verifying operability of components. Perform ATP in presence of KEH.

1.10.4.2 The ATP shall include, but not be limited to, system operation, piping system integrity, and sanitation of potable water supply.

1.11 PRODUCT AND EQUIPMENT MANUALS

1.11.1 Provide product and equipment manuals as follows:

1.11.1.1 One complete manual shall be provided for KEH review 4 weeks before completion of construction.

1.11.1.2 KEH will review, note corrections and return to Contractor. Corrections shall be made and 3 final manuals shall be delivered to KEH within 14 days.

1.11.2 Copies shall be bound in hard cover 3-ring binders. Each copy shall have a typewritten index and tabbed dividers between each product or equipment category.

1.11.3 These manuals shall contain product and equipment information; specifications, illustrative cuts, colors, parts lists, spare parts lists, operating and maintenance instructions, as applicable for each specific product or equipment. Where an equipment item requires special and unique maintenance tool(s), the tools(s) and instructions for use shall be provided. Information shall be provided for all equipment and components as a minimum for the following:

1.11.3.1 Mechanically assisted high-density storage system.

1.11.3.2 Refrigerated storage units.

1.11.3.3 Exhaust fume hood.

1.11.3.4 Fire protection sprinkler system.

1.11.3.5 Evacuation alarm equipment.

1.11.3.6 Fire alarm system and equipment.

1.11.3.7 Emergency batteries.

1.11.3.8 HVAC equipment.

1.11.3.9 HVAC controls.

1.11.3.10 Plumbing equipment.

a. Fixtures.

b. Water heaters.

c. Pumps.

d. Valves.

e. Water heaters and tanks.

1.11.3.11 Electrical equipment.

a. Panelboards (including breaker AIC, time-current-coordination curves, panelboard AIC, and other pertinent technical data).

b. Dry type transformers (including temperature rating, impedance, full/no-load loss information and other pertinent technical information.

c. Light fixtures (include power requirements for ballast and lamps, and IES data).

1.11.3.12 Communication Systems equipment.

a. Krone, Lsa-Plus quick connection system.

b. Valcom paging/speaker system.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01019

ITEMS FURNISHED FOR CONSTRUCTION

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 Code of Federal Regulations (CFR)

Title 30, Mineral Resources

Part 56	Safety and Health Standards--Surface Metal Nonmetal Mines

1.2 SUBMITTALS: Not Used

1.3 GENERAL

1.3.1 Material and equipment furnished or made available for incorporation into the Work are identified in this Section. Other services and utilities provided are covered in other sections of this Specification.

1.3.2 Meet the provisions of Section 9 of the Contract General Conditions for items furnished for construction.

1.3.3 Provide KEH access to premises where items furnished for construction are stored before incorporation into the Work.

1.4 GRAVEL AND SAND

1.4.1 Unmined natural deposits are available at no cost from sites designated by KEH within 10 miles of Project site. KEH makes no representation that materials will meet physical properties required in this Specification.

1.4.2 If Contractor elects to utilize available gravel sites he shall furnish equipment and labor required to excavate, process, load, transport, and place material.

1.4.3 Material shall be used only for the Work covered by this Specification and no gravel or sand, processed or unprocessed, or concrete manufactured therefrom shall be transported off the Hanford Site.

1.4.4 Access to gravel sites and travel between gravel and construction sites shall be on roads designated by KEH and use shall be in accordance with Section 01500.

1.4.5 Operations of gravel sites shall meet the following requirements.

1.4.5.1 Confine removal of overburden and top soil to areas designated by KEH. Stabilize blow sand areas after surface has been disturbed, with ballast or other approved method to prevent wind erosion.

1.4.5.2 Make no excavation or bank cut within 100 feet of power lines, paved roads, railroads, security fences, or other permanent structures.

1.4.5.3 Excavating and processing shall be in accordance with 30CFR56. Correct operations identified by KEH to be hazardous to life or property.

1.4.5.4 Explosives are prohibited articles described in Section 56 of the Contract General Conditions and shall not be brought to the Hanford Site or proposed for use without written KEH approval.

1.4.5.5 Temporary structures are permitted at gravel site for offices, storage, or repair facilities necessary for gravel removal and processing. No facility for habitation will be permitted.

1.4.5.6 Use of gravel sites is nonexclusive. Others may also enter to excavate material required for other work.

1.4.5.7 Upon completion of operations clear gravel site of debris, temporary structures, and equipment. Grade, properly slope banks, and stabilize excavated area to prevent wind erosion. Conditions identified by KEH as not meeting these requirements shall be corrected before final acceptance of the Work.

1.4.5.8 Right to use gravel sites may be terminated by KEH for failure to meet the requirements set forth or for abandonment of operations under this Contract. Right to use gravel will terminate without notice upon acceptance of Work under this Contract.

1.5 EQUIPMENT

1.5.1 Items listed below will be furnished by KEH for incorporation into the Work.

1.5.1.1 Radio Fire Alarm Reporter (RFAR) box and antenna.

1.5.1.2 Soap dispensers.

1.5.1.3 Sanitary napkin holders.

1.5.1.4 Paper towel dispensers.

1.5.1.5 Toilet seat cover holders.

1.5.1.6 Fire extinguishers.

1.5.2 Items noted in subparagraphs 1.5.1.1 through 1.5.1.6 are on hand and presently stored in the 3000 Area approximately 25 miles from Project site. Notify KEH 2 working days before need date to arrange for pick-up.

1.5.3 Furnish equipment and labor for uncrating or unpacking, handling, and transporting KEH furnished equipment.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01027

APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 FORMAT

1.3.1 Complete Form KEH-1026, Progress Estimate Backup, sample included. Contractor developed substitute for form may be used with prior approval of KEH.

1.3.2 Complete Form KEH-0959, Monthly Estimate of Work Completed, sample included, or include following in letter requesting payment.

Subtotal Value of All Pay Items Completed to date (Include modifications)		$X,XXX.XX
Allowance for Material Stored on Site:		
Previous Net Allowance	$X,XXX.XX	
Minus Materials Placed	$X,XXX.XX	
Plus Materials Stored	$X,XXX.XX	
Net Allowance		$X,XXX.XX
Subtotal Value Completed to Date		$X,XXX.XX
Less Previous Payments	$X,XXX.XX	
Less Other Charges from KEH	$X,XXX.XX	
Subtotal Deductions		$X,XXX.XX
Total Payment Requested		$X,XXX.XX
Less Retainage at ___%		$X,XXX.XX
Total Payment Allowed		$X,XXX.XX

1.4 APPLICATION PROCEDURE

1.4.1 Payments to Contractor specified in Section 15 of Contract General Conditions are initiated by Contractor making application as follows.

1.4.1.1 Begin application by completing Form KEH-1026. For lump sum contracts, each application shall include, as minimum, breakdown of Contract price for items listed in Section 01310 and percent complete for each item.

1.4.1.2 Review backup sheets with KEH approximately 5 days before end of pay period and adjust data if required by KEH.

1.4.1.3 Finalize application by meeting requirements of Paragraph 1.3.2.

1.5 PAYMENT PROCEDURE

1.5.1 Upon receipt of application, KEH will audit data and check for compliance with requirements of Section 01720. When satisfied that Contract requirements are up-to-date, Form KEH-0959 will be signed by KEH.

1.5.2 Copy of signed Form KEH-0959 showing amount of payment to be made will be furnished to Contractor.

1.5.3 KEH will mail check to Contractor's designated address.

1.6 ADDITIONAL DATA REQUIRED

1.6.1 When processing applications for payment and preparing payment documents, KEH may require data to substantiate and justify amounts requested. Processing of payment documents may be delayed if data is not forwarded expeditiously to KEH.

1.6.2 Requests for payment for equipment or material which Contractor has received, but has not installed, shall be accompanied by invoice or other data to provide evidence that title to equipment or material is held by Contractor.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

KAISER ENGINEERS
HANFORD

PROGRESS ESTIMATE BACKUP

Sheet____ of ____

Contractor:	Contract No.:
Subject:	
Backup For Progress Estimate No.:	Dated:

Item	Description	Estimated Cost	Weighted Percent	Percent Complete to Date	W'T'D % Complete to Date	Total $ to Date

SAMPLE

KEH-1026 00 (03-87)

KAISER ENGINEERS HANFORD	MONTHLY ESTIMATE OF WORK COMPLETED	
Contract or P.O. No	Estimate No.	Date
Name of Contractor		
Address		
Nature of Work		

Initial Amount of Contract	Total Amount of Modifications to Date	Total Adjusted Contract Amount
$	$	$

Description			Amount	
Estimated Work Completed to (Date)				
Less: Previous Payments	$			
Other Charges (Explain Below)	$			
Total Deductions			($	)
Adjusted Payment Requested			$	
Less Retainage @ _____%			$	
Total Payment Allowed			$	

SAMPLE

I certify that I have verified this periodical estimate dated _____ for $ _____ and that to the best of my knowledge and belief it is a true and correct statement of work performed and that the contractor's statement of his account and amount due him is correct and just, and the quantities included in this estimate have been performed in full accordance with the terms and conditions of the corresponding construction documents

FOR THE CONTRACTOR

By _____

KAISER ENGINEERS HANFORD COMPANY

By _____
Project Manager

By _____
Field Contract Engineer

KEH-0959 00 (02/90)

END OF SECTION

SECTION 01036

ENGINEERING CHANGE PROCEDURE

PART 1 - GENERAL

1.1 SUMMARY

1.1.1 This Section covers the preparation of Contractor originated Engineering Change Notices (ECNs). ECN forms (sample included) will be provided by KEH. Completed ECNs shall be forwarded to KEH. The Contractor shall not proceed with a change without ECN approval by KEH.

1.1.2 Design changes to the approved design, as shown on the Drawings or described in this Specification, may be initiated at any time. Completed ECNs shall contain sufficient engineering data, and cost and schedule analysis, for a complete evaluation. Each design change shall be identified on a separate, sequentially numbered ECN. ECNs will be reviewed and approved by design disciplines responsible for the original design.

1.1.3 Contractor originated ECNs for minor field changes will be approved by KEH at the project site. These are typically no-cost corrections or deviations that do not change the intent of the approved design.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PREPARATION

3.1.1 Prepare ECN(s) using the following instructions for the sample ECN for each block number/title. Make the following entries on ECNs with black ink, or type.

3.1.1.1 (Block 1) ECN: Sequentially number ECNs W-011-___, etc.

3.1.1.2 (Block 2) ECN Category: Leave blank.

3.1.1.3 (Block 3) Originator's Name, Organization, and Telephone No.: Name of originator organization and contract number.

3.1.1.4 (Block 4) Date: Date the ECN was originated.

3.1.1.5 (Block 5) Project Title/No./Work Order No.: WSCF Support Buidings (W-011H) CR9452.

3.1.1.6 (Block 6) Bldg./System/Fac. No.: 6265, 6265A, 6267, 6269 or 6270.

3.1.1.7 (Block 7) Impact Level: Leave Blank.

3.1.1.8 (Block 8) Document(s) Number Affected: Identifying number, revision number, and sheet number (if applicable) of the engineering document (e.g., drawing, specification) being revised. If more than one document is changed, enter "See Block (12)" and there list all engineering documents (including revision numbers/sheet numbers) revised by this ECN.

NOTE: When more than one document is affected, list the documents with appropriate revision and/or sheet number independent of the narrative description of the change (this is to permit identification of the documents affected without reading the narrative section).

3.1.1.9 (Block 9) Related ECN No.: (Applicable only when a previous ECN is affected). Place the number of the original ECN in Block (9). If more than one ECN is affected, enter in Block (9) "See Block (12)". In Block (12), list all affected ECNs and preface list with "Related ECNs".

Describe the required change in Block (12) and indicate which parts of the original ECN(s) are changed. Special instructions shall also be included in Block (12) of the new ECN.

When new changes (not affecting a previous ECN) are being added, list the documents separately from the "Related ECNs" and preface list with "Additional Documents Affected".

3.1.1.10 (Block 10) Related P.O. Number: N/A.

3.1.1.11a (Block 11a) Modification Work: N/A.

3.1.1.11b (Block 11b) Work Package Doc. No.: N/A.

3.1.1.11c (Block 11c) Complete Installation Work: N/A.

3.1.1.11d (Block 11d) Complete Restoration (Temp. ECN only): N/A.

3.1.1.12 (Block 12) Description of Change: Detailed description of the change. Provide sketches, changed drawing sections, catalog cuts, text changes, etc. as required to implement the change. Use an ECN sketch if needed, and indicate ECN No., reference drawing and revision, preparer signature, checker signature, page no.

Provide sufficient detail of the change to allow implementation or construction including drawing zones, applicable paragraphs, and other references as required to allow as-builting of the design documents.

If Block (12) has insufficient space, the description is to be continued on the Engineering Change Notice Continuation Sheet (sample appended).

3.1.1.13a (Block 13a) Justification: Single applicable justification block to support the need for change. Justifications are as follows:

<u>Criteria Change</u>: To accommodate a change in criteria or requirement.

Design Improvement: To propose a change to make a part, component, system, etc. more efficient.

Environmental: To accommodate federal, state, and local environmental standards/requirements.

As-Found: To revise the approved design to reflect a condition discovered in the field/hardware.

Facilitate Construction: To accommodate variations in construction practices.

Construction Error/Omission: To correct a constructor error or omission.

Design Error/Omission: To correct a design error or omission.

3.1.1.13b (Block 13b) Justification Detail: Engineering justification for change. Reference to appropriate technical documents, calculations or other criteria shall be stated. Technical justification shall be in sufficient detail to permit an assessment of change.

3.1.1.14 (Block 14) Distribution: Leave blank. (KEH responsibility.)

3.1.1.15 (Block 15) Design Verification Required: "No."

3.1.1.16 (Block 16) Cost Impact: Estimated cost impact to engineering and construction.

3.1.1.17 (Block 17) Schedule Impact: Estimated schedule impact. Provide back-up based on approved schedule.

3.1.1.18 (Block 18) Change Impact Review: Leave blank.

3.1.1.19 (Block 19) Other Affected Documents: Leave blank.

3.1.1.20 (Block 20) Approvals

a. Sign and date the appropriate signature line under Architect-Engineer. Contractor's quality assurance procedure controlling design activity shall indicate minimum required signatures. As a minimum, licensed engineer in appropriate discipline, independent checker, and contractor project lead personnel shall sign.

b. Minor field changes need only be signed by Contractor Project Engineer (PE).

c. Other blocks under Operations and Engineering, Department of Energy and additional shall be left blank. KEH will indicate approval of each change by a single approval signature under "Additional" block.

ENGINEERING CHANGE NOTICE

Page 1 of _____

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.		4. Date
Supplemental ☐ Direct Revision ☐ Change ECN ☐ Temporary ☐ Supersedure ☐ Discovery ☐ Cancel/Void ☐	5. Project Title/No./Work Order No.	6. Bldg./Sys./Fac. No.	7. Impact Level
	8. Document Number Affected (include rev. and sheet no.)	9. Related ECN No(s).	10. Related PO No.

11a. Modification Work	11b. Work Package Doc. No.	11c. Complete Installation Work	11d. Complete Restoration (Temp. ECN only)
☐ Yes (fill out Blk. 11b) ☐ No (NA Blks. 11b, 11c, 11d)		Cog. Engineer Signature & Date	Cog. Engineer Signature & Date

12. Description of Change

SAMPLE

13a. Justification (mark one)	13b. Justification Details
Criteria Change ☐ Design Improvement ☐ Environmental ☐ As-Found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐	

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

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ENGINEERING CHANGE NOTICE

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

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

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

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

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

Document Number/Revision	Document Number/Revision	Document Number/Revision
_____	_____	_____
_____	_____	_____
_____	_____	_____

20. Approvals

OPERATIONS AND ENGINEERING	Signature	Date	ARCHITECT-ENGINEER	Signature	Date
Cog./Project Engineer			PE		
Cog./Project Engr. Mgr.			QA		
QA			Safety		
Safety			Design		
Security			Other		
Proj.Prog./Dept. Mgr.					
Def. React. Div.					
Chem. Proc. Div.					
Def. Wst. Mgmt. Div.			DEPARTMENT OF ENERGY		
Adv. React. Dev. Div.					
Proj. Dept.					
Environ. Div.			ADDITIONAL		
IRM Dept.					
Facility Rep. (Ops)					
Other					

SAMPLE

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END OF SECTION

SECTION 01040

COORDINATION

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 CONSTRUCTION ACTIVITIES

1.3.1 Coordinate construction activities to ensure efficient and orderly sequence of work, with provisions for accommodating items to be installed later.

1.3.2 As noted in Section 29 of the Contract General Conditions, other contracts may be under construction concurrently with the Work included in this Specification. Coordinate activities with other contractors for mutual benefit. Coordination meetings may be required in addition to progress meetings to keep parties informed of scheduled activities at interface points.

1.3.3 Certain onsite work related to Project will be performed by others. Cooperate and coordinate work to eliminate interferences and delays. Removal of contaminated soil if encountered will be responsibility of others. Assistance may be required during removal to expedite work and minimize downtime.

1.4 CONNECTIONS TO EXISTING SYSTEMS

1.4.1 Advance notice of work that will affect existing systems shall be given to KEH. Careful planning and scheduling of work is required to coordinate operations of existing systems to keep disruptions at minimum.

1.4.2 As required in subsection 50.8 of the Contract General Conditions, connections to existing systems shall be scheduled well in advance for work to be done. KEH will coordinate schedule with Contractor and other contractors.

1.4.3 All connections shall be accomplished within 4 hours.

1.5 ACCESS TO WORK AFTER POSSESSION

1.5.1 Access to warranty work as specified in Section 24 of the Contract General Conditions or access to work after possession as specified in Section 20 of the Contract General Conditions will be coordinated by KEH with other contractors, and users of facility. Notify KEH in advance of proposed work to minimize disruptions.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01043

JOB SITE ADMINISTRATION

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American National Standards Institute (ANSI)

Z41-1983	Personnel Protection - Protective Footwear
Z87.1-1989	Practice for Occupational and Educational Eye and Face Protection

1.2 SUBMITTALS: Not Used

1.3 WORKING HOURS

1.3.1 Regular day shift working hours are from 7:30 am to 4:00 pm, Monday through Friday, excluding holidays.

1.3.2 For other than regular day shift work refer to Section 51 of Contract General Conditions.

1.4 BADGE, DOSIMETER, AND ORIENTATION

1.4.1 For work within the Controlled Access Area of Hanford Site, but outside Limited Areas, badge and orientation requirements will be in accordance with Section 56 of Contract General Conditions. Basic dosimeters will not be required.

1.4.2 Badges will not be provided until notice to proceed letter has been signed and returned to KEH, supervisors have attended KEH safety training course, requirements of Section 55 of Contract General Conditions have been received and approved by KEH, and site labor conference and preconstruction meeting specified in Section 01200 have been completed.

1.5 EMERGENCY RESPONSE DRILLS

1.5.1 Personnel working on Hanford Site shall participate in emergency response drills held approximately once each calendar quarter and lasting approximately one hour.

1.5.2 Maintain daily log or other suitable record of personnel, including subcontractors, working on Hanford Site.

1.6 SAFETY REQUIREMENTS

1.6.1 Fire Safety

1.6.1.1 Address fire safety as part of construction safety plan required by Section 55 of the Contract General Conditions. Incorporate following requirements into plan:

a. Utilize portable shields wherever welding, cutting, or grinding.

b. Maintain fire watch minimum 1/2 hour after welding, cutting, or grinding.

c. Have fully charged fire extinguisher available whenever welding, cutting, or grinding.

d. Develop method to prevent ignition of brush fires.

1.6.1.2 See Section 01500 for off-road driving and grass fire prevention requirements.

1.6.2 Safety Apparel

1.6.2.1 Personnel shall not be allowed in construction areas without approved safety apparel. Personnel are required to wear the following in construction areas, and KEH's shops and yards: steel-toed type shoes meeting the requirements of ANSI Z41; eye protection with eye shield devices meeting the requirements of ANSI Z87.1; hardhats, and clothing that prevents direct exposure to the construction environment. Steel-toed shoes shall be constructed of substantial material, preferably leather. Steel-toed shoes shall be in good condition; damaged footwear, impaired in the performance of its protective function, is not acceptable. Tennis shoes, canvas type shoes, or other athletic type shoes, including those with steel toe protection, are not acceptable. Tank-top type shirts, sleeveless shirts, dresses, or other than full length pants are not allowed. Exceptions to these requirements, for specific work tasks, require advance KEH approval.

1.6.3 Core Drilling: Equip core drill with kill switch to stop drill upon hitting metal. Demonstrate that switch is operational before drilling.

1.6.4 Job safety analysis required in subsection 55.2 of the Contract General Conditions shall address following work items as minimum.

1.6.4.1 Excavations.

1.6.4.2 Fall protection.

1.6.4.3 Hazardous materials.

1.6.4.4 Lockout and tagout procedures.

1.6.4.5 Shoring.

1.6.4.6 Welding or cutting.

1.6.4.7 Confined spaces.

1.6.4.8 Paint/coatings.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01050

FIELD ENGINEERING

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 QUALITY CONTROL

1.3.1 Establishing alignment, support location, and grades shall be the responsibility of a Land Surveyor registered in the State of Washington and acceptable to KEH.

1.3.2 Deliver field notes, records, and documentation to KEH to review and verify procedures used and accuracy of work.

1.4 SURVEY DATA

1.4.1 Basic reference points with coordinate descriptions and bench mark with elevation identified will be located at the 4 corners of the fenced-in WSCF site.

1.4.2 Preserve bench marks and reference points, including stakes or other markers established, until removal is authorized by KEH.

1.4.3 From information and dimensions shown on the Drawings, perform survey/layout required by the Work.

1.5 PROCEDURES

1.5.1 Before initial layout, field verify horizontal and vertical data. Report discrepancies to KEH before proceeding.

1.5.2 Establish adequate permanent reference points to be used during construction, referenced to original control points. Record locations with horizontal and vertical data on Project record documents.

1.5.3 Protect and preserve control and reference points until Work is complete. Report loss or destruction of control points to KEH. Report relocation or change in data affecting reference points.

1.5.4 Periodically verify data for control and reference points, and construction stakes to maintain construction accuracy.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01065

PERMITS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 FEDERAL, STATE, AND MUNICIPAL LAWS, CODES, AND REGULATIONS

1.3.1 Required permits or licenses to do business are responsibility of Contractor as specified in Section 6 of the Contract General Conditions.

1.4 HANFORD SITE PERMITS

1.4.1 General: Before certain types of work can be done at Hanford, Contractor is required to have a permit. Permits are provided by KEH at no cost; however, furnish information required and notify KEH in advance of work requiring permit. Meet the requirements and restrictions set forth in each permit. Keep permits posted in visible location at site of work being performed.

1.4.2 Excavation Permit: Do not excavate without the permit specified in subsection 50.10 of the Contract General Conditions. Permit will be issued before start of construction and will be for duration of the Work.

1.4.3 Backfill Permit: Each element of fill and backfill requires a permit. Permits are good for 5 days, or duration of work element provided Work does not stop for 5 consecutive days. Complete permit form, furnished by KEH, and return to KEH for approval before starting work.

1.4.4 Tie-in Permit: Each utility tie-in requires a permit. Permits are valid until tie-in is complete. Permits furnished by KEH with 5 days notice.

1.4.5 Hazardous Work Permit: Start no work without permit. Permit will provide personnel protection requirements and restrictions for work involving welding and cutting, confined spaces, hazardous materials, or other hazardous working conditions. Permit is good for duration of Contract.

1.4.6 Solid Waste Disposal Permit: See Section 01500, Paragraph 1.3.3. This permit is required for disposal of nonhazardous waste on the Hanford Site. Obtain form from KEH, complete, and return to KEH for approval before moving waste to the disposal site.

1.4.7 Oversize Load Permit: In addition to Washington State permit, obtain permits for each movement of each oversize vehicle or load within the Hanford Site. Permits will be furnished by KEH with 48 hour notice of width, height, and length of oversized load and proposed route of travel. Verify proposed route has been traveled and limitations have been identified. See Section 01500 for additional requirements.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01090

REFERENCES

PART 1 - GENERAL

1.1 CODES, STANDARDS, AND SPECIFICATIONS

1.1.1 The following codes, standards, and specifications, including documents referenced therein, shall govern the design and construction in addition to those designated in Section 01010.

1.1.1.1 American Concrete Institute (ACI)

301-89	Specification for Concrete for Buildings
302.1R-89	Guide for Concrete Floor and Slab Construction

1.1.1.2 American Institute of Steel Construction, Inc (AISC)

M016-1989	Allowable Stress Design (ASD) Manual of Steel Construction, 9th Edition

1.1.1.3 American National Standards Institute (ANSI)

B31.5-1987	Refrigeration Piping
EIA/TIA-569	Commercial Building Wiring Standard for Telecommunication's Pathways and Spaces
EIA/TIA-568	Commercial Building Wiring Standard

1.1.1.4 American Water Works Association (AWWA)

M14 (1990)	Recommended Practice for Backflow Prevention and Cross-Connection Control
Cross Connection Control Manual	Accepted Precedure and Practice (1990) (PNW Section)

1.1.1.5 Code of Federal Regulations (CFR)

10 CFR, Part 435, Energy Conservation Voluntary Performance Standards for New Buildings; Mandatory for Federal Buildings

Subpart A	Voluntary Performance Standards for New Commercial and Multi-Family High Rise Residential Buildings; Mandatory for Federal Buildings

1.1.1.6 International Conference of Building Officials (ICBO)

UPC (1991)	Uniform Plumbing Code
UFC (1991)	Uniform Fire Code

1.1.1.7 National Fire Protection Association (NFPA)

43 C (1986)	Storage of Gaseous Oxidizing Materials
72 (1990)	Standard for the Installation, Maintenance and Use of Protective Signaling Systems
220 (1992)	Types of Building Construction

1.1.1.8 Underwriters Laboratories, Inc. (UL)

1991	Electrical Construction Materials
1991	Electrical Appliance and Utilization Equipment
1096-1988	Electrical Central Air Heating Equipment

1.1.1.9 Washington Administrative Code (WAC)

Title 173, Department of Ecology

Chapter 173-303	Dangerous Waste Regulations

Title 246, Department of Health

Chapter 246-290-490	Cross-Connection Control

1.1.2 The following U.S. Department of Energy orders and procedures shall apply to the design and construction. Additional Hanford Site specific orders and criteria are referenced in Section 01010.

1.1.2.1 DOE Orders and implementing procedures

DOE-RL Order 5480.7A	Fire Protection
RLIP 5480.7	Fire Protection
DOE-RL Order 6430.1A	General Design Criteria
DOE/EP-0108	Standard for Fire Protection of DOE Electronic Computer/Data Processing Systems

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01100

SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 Code of Federal Regulations (CFR)

Title 29	Labor
Part 1910	Occupational Safety and Health Standards

1.1.1.2 Federal Standards (FED STD)

FED-STD-313C	Material Safety Data, Transportation Data, And Disposal Data For Hazardous Materials Furnished To Government Activities

1.1.1.3 Washington Administrative Code (WAC)

Title 173	Department of Ecology
Chapter 173-303	Dangerous Waste Regulations

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Hazardous Materials: Submit a list of hazardous materials to be used. Include their current Material Safety Data Sheets.

1.2.2 Hazardous Material Storage: Submit a proposed method for storage of hazardous materials.

1.2.3 Control of Hazardous Energy: Submit lockout/tagout procedures and training certifications for employees.

1.3 HAZARDOUS MATERIAL REQUIREMENTS

1.3.1 Hazardous products, defined in Section 111 of the Contract General Conditions, whether specified, recommended, or voluntarily requisitioned by Contractor, shall be governed by requirements of FED-STD-313 and Section 111 of the Contract General Conditions.

1.4 DANGEROUS WASTE HANDLING REQUIREMENTS

1.4.1 Dangerous waste, defined in WAC 173-303, generated by Contractor at Project shall be turned over to KEH for disposal.

1.4.2 Contractor designated personnel who handle, transfer, accumulate, or otherwise work with dangerous waste shall be trained by KEH (4 hours per person) and adhere to the requirements of WAC 173-303-330. Other waste management requirements, covered in the KEH training, that shall be followed include:

1.4.2.1 Select compatible waste containers. Container integrity is, in part, dependent upon waste physical and chemical properties.

1.4.2.2 Contractor personnel shall call the KEH Hazardous Waste Coordinator (HWC) to receive container numbers which will be permanently marked on containers for tracking purposes.

1.4.2.3 Contractor personnel shall contact KEH HWC for specific instructions on completing Hazardous Waste labels, and attaching them to containers.

1.4.2.4 Weekly inspections of the satellite accumulation area, by the Contractor's trained waste handler, are required. A report of the inspection on Form KEH-2035 (sample included) shall be forwarded to KEH within 3 working days after the inspection. Forms will be provided by KEH.

1.4.2.5 As waste is accumulated in a container, a Waste Container Log, Form KEH-0844 (sample included) shall be filled out. Forms will be provided by KEH.

1.4.2.6 A full container date shall be recorded when accumulated waste reaches 55 gallons for solids, and 50 gallons for liquids. The container shall be sealed at that time. The Contractor shall notify KEH by forwarding the waste container log within 4 hours after a waste container is full.

1.4.3 Report dangerous waste or hazardous material spills to KEH immediately.

1.4.4 After identification of dangerous waste to be generated, a satellite accumulation area will be designated for Contractor to deposit waste.

1.4.5 Identify and package dangerous wastes as approved or directed by KEH.

1.4.6 Prepare a plan indicating how dangerous waste generated at the project site will be minimized during construction, in accordance with WAC 173-303. Other waste minimization requirements that shall be included are:

1.4.6.1 Material substitution: Replacement of hazardous materials with nonhazardous or less hazardous materials.

1.4.6.2 Inventory reduction: Minimization of chemical inventory on hand, which in turn reduces the undue accumulation of partially used or unused materials requiring disposal upon expiration.

1.4.6.3 Procurement modifications: Minimization of the variety of chemicals used to perform the same or similar processes, and incorporation into procurement specifications of provisions for the return of unused chemical stock and empty, unrinsed containers.

1.4.6.4 Waste segregation: Separation of hazardous and nonhazardous materials to avoid creating additional hazardous waste, and to avoid creating mixtures for which recycling may not be practical.

1.4.6.5 Recycling: Extension of the useful life of materials to delay final disposition as waste.

1.4.6.6 Process modification: Streamlining of processes for more efficient operation and less waste generation.

1.4.6.7 Reuse: Reusing material such as plastic drop cloths, application tools, and rags as much as possible to reduce the volume of waste generated.

1.4.7 Inspections: Provision for KEH inspections of the Contractor's waste management practices and waste minimization efforts.

1.5 CONTROL OF HAZARDOUS ENERGY

1.5.1 Conform to lockout/tagout requirements of 29 CFR 1910.147.

1.5.2 Establish an energy procedure and training plan with provisions for the following.

1.5.2.1 Isolation or inactivation of hazardous energy sources before performing work thereon. A hazardous energy source is defined as a machine or equipment item with the potential for causing injury by unexpected energizing, startup, or stored energy release.

1.5.2.2 Certification of the accomplishment and currency of appropriate training. Certification shall include employees' names and training completion dates.

1.5.3 Coordinate lockout/tagout operations with KEH.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

WEEKLY WASTE STORAGE FACILITY INSPECTION REPORT

Date:	Time:	Location:

	Yes	No	N/A	Corrective Action	Completed	
					Date	Initial
Emergency Equipment (In good condition?)						
Fire Extinguisher						
Spill X Gun						
Chemical Resistant Suit						
Goggles						
Chemical Gloves						
Respirator (up-to-date)						
Boots						
Non-sparking Shovel						
Absorbent						
Eye Wash Station						
Broom						
Barricade Tape						
Housekeeping good?						
Handling equipment in good condition?						
Contingency Plan						
Dangerous Waste Procedure						
Other						

SAMPLE

CONTAINER STATUS

Hazardous Waste Container Number	Condition Good?		Labelled - Include Haz. Class		Accumulation Start Date		Current Log Sheet		Corrective Action	Completion	
	Yes	No	Yes	No	Yes	No	Yes	No		Date	Initial

Comments

Print Name: _____ Signature and Payroll No. _____

DISTRIBUTION: White & Yellow - Environmental Restoration Pink - Waste Storage Facility KEH-2035.00 (01/91)

WASTE CONTAINER LOG

Barrel Number: _____ Area: _____ Location: _____ Full Container Date: _____

Container Type:

Provide all information requested including MSDS Number and exact waste description including manufacturer, product name, number, color and other applicable information. If MSDS Number is not available include a copy of the MSDS with completed log sheet.

Date	Amount	MSDS Number	Waste Description, Manufacturer, Product Name and Number, Color and other Applicable Information	Name and Pay Number

SAMPLE

KEH-0844 00 (10 89)

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 PROCEDURES

1.3.1 Representatives from KEH, Contractor, and major subcontractors shall participate in project meetings. Representatives from Operating Contractor and DOE may attend as required by items to be discussed.

1.3.2 Meeting times and locations shall be mutually agreed to by Contractor and KEH and will be held at the Hanford Site in Richland, Washington, except informal design reviews. KEH will issue notices of meetings and prepare meeting minutes which will be distributed to project participants.

1.4 DESIGN REVIEW

1.4.1 The work will be reviewed at informal and formal meetings to ensure that work is proceeding to approved schedule and is meeting the requirements of this Specification.

1.4.2 Informal Meetings: The Contractor and applicable architects and engineers shall participate in informal meetings held at Contractor's place of business three times during design as determined by KEH. Purpose of Informal Meetings shall be to review progress of design and resolve problems to ensure that design is proceeding in accordance with these documents and approved schedule. Five days before each meeting, Contractor shall provide 5 sets of "in progress" copies of detailed design for information to KEH. Copies will not be returned unless specifically requested by Contractor.

1.4.3 Formal Meetings: Two design review meetings will be held for Contractor and his architect and engineers to present the design to project representatives of the Operating Contractor, KEH, and DOE. Five days before formal meeting, Contractor shall provide 10 sets of design media identified in Section 01010 for information to KEH. Copies will not be returned unless specifically requested by Contractor. Design review meetings will be held at Hanford Site and will be as follows:

1.4.3.1 Preliminary Design Review shall be conducted approximately 45 days after notice of award. The review shall include items outlined in Section 01010 as a minimum.

1.4.3.2 Final Design Review shall be conducted after documents are completed and checked by Contractor and his architect and engineers, 120 days after notice of award. The review shall include items outlines in Section 01010 as a minimum.

1.4.4 Design Review Comments: Review comments will be transmitted, resolved, and incorporated as follows.

1.4.4.1 Comments generated during informal design review meetings will be documented by KEH on meeting minutes and distributed to Contractor within 5 days of meeting. Contractor and his architect and engineers shall provide explanation or justification of the design to resolve comments. The unresolved comments will be included with the minutes of the review meeting prepared by KEH for additional explanation or action by Contractor. Contractor shall prepare and return his proposed resolutions of the comments within 5 days after receiving meeting minutes. Contractor's proposed resolutions will be reviewed and KEH shall notify Contractor of the acceptance or rejection of his proposed resolutions. Contractor shall incorporate the agreed upon final resolutions into the design documents.

1.4.4.2 Comments generated during the formal design review meetings will be documented, resolved, and incorporated within the contract documents in accordance with submittal requirements described in Section 01300.

1.5 SITE LABOR CONFERENCE

1.5.1 Before starting construction onsite, conduct informational conference on Hanford Site labor requirements applicable to Project. KEH will provide meeting notice to representatives from labor organizations, identified by Contractor, whose members may be utilized in construction and are to attend conference. Contractor shall present proposed work plan and craft utilization, and review Contract General Conditions relating to labor.

1.6 PRECONSTRUCTION

1.6.1 Meeting will be scheduled by KEH before start of onsite work. Authorized representatives of Contractor and major subcontractors shall attend and KEH will advise others having interest in Work. Meeting will be chaired by KEH.

1.6.2 Following items, as minimum, will be incorporated into agenda for meeting:

1.6.2.1 Point of contact and key personnel representing Operating Contractor, Safety, QA/QC, Acceptance Inspectors, and Construction Engineers.

1.6.2.2 Schedule requirements and restraints, submittals, and work limitations.

1.6.2.3 Safety, construction progress meetings and frequency, and certified payrolls.

1.6.2.4 Report requirements and frequency.

1.6.2.5 Quality requirements.

1.6.2.6 Major material and equipment lists.

1.6.2.7 Other pertinent items.

1.7 CONSTRUCTION PROGRESS

1.7.1 Meetings held weekly at time and location determined at preconstruction meeting will be approximately one hour long.

1.7.2 KEH will chair meeting and request attendance of key personnel required. Authorized representatives of Contractor and pertinent subcontractors shall attend.

1.7.3 Purpose of meetings is to monitor status and provide forum for exchange of pertinent information related to the Work. Major topics may include the following:

1.7.3.1 Schedule, cost, and construction status.

1.7.3.2 Design and scope changes.

1.7.3.3 Submittal status, key material, and equipment delivery status.

1.7.3.4 Potential problem areas.

1.7.3.5 Inspection and testing status.

1.7.3.6 Action item status, goals for next meeting.

1.7.3.7 Other appropriate items.

1.7.4 Meeting minutes will be issued by KEH as promptly as possible following meeting. Action items will be identified with assigned follow-up. Issues resolved will be reported in minutes, as well as closed action items.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.1 DESCRIPTION

1.1.1 This Section summarizes submittals required in Contract General Conditions and Part 1, Article 1.2 of each section of this Specification. It explains type of submittals required, and describes procedures for submission and review.

1.1.2 Submittals required are summarized in Article 1.3 of this Section. Each submittal is identified by General Conditions and Specifications Section/Paragraph Number and Title. Submittals are required for either "Review and Approval" or "Review for Record".

1.1.2.1 Submittals requiring review and approval are to receive approval before procurement, fabrication, or construction is started.

1.1.2.2 Submittals requiring review for record are those on which procurement, fabrication, construction, or acceptance testing may proceed, but acceptance is contingent upon compliance with Drawings and Specifications.

1.2 SUBMITTAL PROCEDURES

1.2.1 Transmit submittals to KEH by Data Transmittal form.

1.2.2 Identify each submittal by Section/Paragraph Number and Submittal Title noted in Article 1.3. Number of copies required for retention by KEH are shown in Summary and include 2 copies to be returned to Contractor. Additional copies required for Contractor uses shall be added.

1.2.3 Review each submittal for completeness, compliance with Contract Documents, and proper identification before sending to KEH. Submittal data shall either be stamped showing review process has taken place or Data Transmittal form may be signed with statement of "Reviewed for Compliance." Submittals not stamped or signed to show review will be returned without consideration.

1.2.4 Submittals requiring review and approval will be stamped by KEH and marked "Approved", "Approved with Exception" or "Not Approved, Revise and Resubmit." Approval of submittals does not relieve Contractor of responsibility for errors contained therein.

1.2.4.1 Approved submittals are identified by submittal stamp with "Approved" or "Approved with Exception" box checked. "Approved" signifies general concurrence to achieve conformance with design concept of Project and compliance with requirements of Contract Documents. "Approved with Exception" signifies general concurrence with noteworthy comments or clarifications. Approval of specific item shall not be construed as approval of system or assembly of which item is a component.

1.2.4.2 A submittal which is not approved is identified as "Not Approved, Revise and Resubmit." Submittal is considered by KEH to be technically deficient or incomplete and therefore, unacceptable. Resubmittal is required, hence fabrication, procurement, or performance of procedures shall not proceed.

1.2.4.3 Upon receipt of deficient submittal data, make corrections noted on transmittal and resubmit data to KEH within 10 calendar days.

1.2.5 Materials and equipment fabricated or installed without required approved submittals, or those which differ from approved Drawings or vendor data, are subject to rejection and replacement at Contractor's expense.

1.2.6 Delays arising from failure to submit, in timely manner, required Drawings, and other related data described in Contract Documents, shall not constitute excusable delays for extensions, unless excusable under other provisions of Contract. Allow 15 calendar days for KEH review and disposition of submittals, including shop drawings and vendor information, required to be furnished. Time period will be measured from date of receipt of submittal in KEH's office to date of return mailing.

1.2.7 Contractor is responsible for dimensions to be confirmed and correlated at Project site.

1.2.8 Submittals for review and record will be reviewed and filed. Incomplete or inaccurate data will be returned marked "Resubmit" with appropriate comments, and items procured or work performed shall be corrected. Payment for equipment will not be made unless required vendor information has been furnished.

1.2.9 Procedures for performing certain items of work are required to be submitted for review and approval before work is commenced. Those work procedures which have been approved by KEH for work similar to that to be accomplished on Project may not need to be reapproved. Forward 1 copy of previously approved procedure to KEH by Data Transmittal form and identify by Section/Paragraph Number, Title, and either procedure number or project number for which procedure was approved. Submittal will be reviewed by KEH and if acceptable retained for record. If previously approved procedure is not acceptable submittal will be returned with requirements for resubmittal.

1.3 SUMMARY OF SUBMITTALS

CONTRACT GENERAL CONDITIONS					
No.	Section/ Paragraph Number	Section/ Submittal Title	Quantity	Review and Approval	Review for Record
	55	**HEALTH AND SAFETY REQUIREMENTS**			
	55.1	Certificates of First Aid Training (WISHA Requirements)	5	Before badging	
	55.2	Safety Program and Job Safety Analysis	5	Before badging	
	55.3	Industrial Injury/Illness Experience	5	Before badging	
	55.5.1	OSHA Form No. 200 Report	5		5th working day, each month
	55.6	Equipment Certification	5	Before badging	

SPECIFICATION					
No.	Section/ Paragraph Number	Section/ Submittal Title	Quantity	Review and Approval	Review for Record
	01010	**SUMMARY OF WORK**			
	1.3.1	Preliminary Design Review	5	5 days before formal review	
	1.3.2	Final Design Review	5	5 days before formal review	
	1.3.3	Detailed Design Package	5		5 days before start of work
	1.3.4	Acceptance Test Procedures	5		5 days before test
	1.3.5	Product Equipment Manuals	5		14 days after completion of construction
	1.3.6	As-Built Drawings and Specifications	5		14 days after completion of construction

No.	Section/ Paragraph Number	Section/ Submittal Title	Quantity	Review and Approval	Review for Record
		SPECIFICATION			
	01100	**SPECIAL PROJECT PROCEDURES**			
	1.2.1	Hazardous Materials	5		5 days before material delivery
	1.2.2	Hazardous Materials Storage	5	5 days before material delivery	
	1.2.3	Control of Hazardous Energy	5	5 days before start of work	
	01310	**PROGRESS SCHEDULES**			
	1.2.1	Progress Schedule for duration of Contract	5	30 days after notice of award	
	1.2.2	CPM Project Schedule	5	30 days after notice of award	
	01400	**QUALITY ASSURANCE**			
	1.2.1	Quality Assurance/Quality Control System	5	Before design work	

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01310

PROGRESS SCHEDULES

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Progress Schedules: Submit schedule as described in Article 1.3.

1.2.2 CPM Project Schedule: Submit schedule required in Article 1.4.

1.3 PROGRESS SCHEDULES

1.3.1 Schedules identified in Section 5 of the Contract General Conditions shall be in accordance with following:

1.3.1.1 Show order Contractor proposes to carry on the Work, starting dates of the several salient features of the Work including procurement of materials and equipment, and contemplated dates for completion. Each schedule shall be in form of bar chart of suitable scale to show percentage of Work scheduled for completion at any time with separate bar for each activity. At end of each week or at end of other periods of time specified in Contract, prepare and submit one copy of chart showing actual progress at end of period.

1.3.2 Organize schedule to show activities relative to each major subcontractor and supplier. Provide subschedule to define critical portions of entire schedule.

1.3.3 Schedule shall include for each building the design activities and milestones, delivery date of design documents, progress milestones, and the following activities:

1.3.3.1 Bond and insurance.

1.3.3.2 Submittal schedule.

1.3.3.3 Mobilization.

1.3.3.4 Survey.

1.3.3.5 Earthwork.

1.3.3.6 Concrete work.

1.3.3.7 Building erection.

1.3.3.8 Structural steel.

1.3.3.9 Piping.

1.3.3.10 Equipment.

1.3.3.11 Instrumentation.

1.3.3.12 Electrical conduit and wiring.

1.3.3.13 Telecommunications wireways, panels, and conduit.

1.3.3.14 Testing.

1.3.3.15 Stabilization.

1.3.3.16 Painting.

1.3.3.17 Tie-in to existing systems.

1.3.3.18 Start-up.

1.3.3.19 Deliver record documents.

1.3.3.20 Contract closeout.

1.3.3.21 Demobilize.

1.3.4 Schedule shall show, as minimum, accumulated percentage of completion of each activity and total percentage of work completed as of last work day of each month.

1.3.4.1 Develop an "S" curve from percentage of total work figures and superimpose on schedule.

1.3.4.2 Show dollar value or percentage of total next to each activity shown on schedule. Figures will be basis for determining progress payments described in Section 01027.

1.4 CPM PROJECT SCHEDULE

1.4.1 Prepare schedule identifying critical path activities which include logical sequence and relationship of activities for engineering, design, submittals, procurement, fabrication, delivery, erection, installation, and testing of work covered by Contract.

1.4.2 Activity durations shall be working days. Subdivide activities exceeding 20 working days by identifying logical subactivities. Activity titles shall be self-explanatory with abbreviations shown in legend on document. Show early start, early finish, late start, late finish, restraining activities, and total float for activities. Highlight critical path activities to identify Project's critical path.

1.4.3 Schedule shall include the following:

1.4.3.1 Significant engineering functions performed before fabrication, such as preparation of specific procedures, and shop and field drawings to be submitted for approval. Include necessary approval dates.

1.4.3.2 Major material acquisitions and delivery dates.

1.4.3.3 Offsite fabrication schedules and delivery dates.

1.4.3.4 Subcontractor activities.

1.4.3.5 Field installation and nondestructive examination activities.

1.4.3.6 Identification of activities requiring work performed outside of the regular day shift hours specified in Section 01043. Indicate if the work will require second or third shifts, or 6 or 7 day work weeks.

1.4.3.7 Identification of inspection hold points.

1.4.3.8 Manpower loading and leveling.

1.4.3.9 Milestones indicating interface requirements with construction activities performed by others.

1.5 REVISIONS TO SCHEDULES

1.5.1 Whenever KEH determines there are significant variances between actual and scheduled progress, endangering completion within Contract completion time, Contractor may be required to prepare and submit revised schedules.

1.5.2 Show progress to date of submittal and projected completion date of each activity. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.

1.5.3 Provide narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken, or proposed, and its effect, including changes on schedules of separate contractors.

1.5.4 Distribute copies of revised schedules to KEH Project file, subcontractors, suppliers, and other concerned entities. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in revised schedules.

1.5.5 If Contractor fails to submit progress schedule specified in Paragraph 1.3.1 within prescribed time, or revised schedules specified in Paragraph 1.5.1, within requested time, KEH may withhold approval of progress payments until time Contractor submits required schedules.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01400

QUALITY ASSURANCE

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American Society of Mechanical Engineers (ASME)

NQA-1-1989 w/Addenda a & b	Quality Assurance Program Requirements for Nuclear Facilities

1.1.1.2 Environmental Protection Agency (EPA)

EPA/530-SW-86-031	Technical Guidance Document: Construction Quality Assurance for Hazardous Waste Land Disposal Facilities

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Quality Assurance/Quality Control System: Submit a quality assurance plan (QAP) meeting the requirements of Section 14 of the Contract General Conditions, and specific Contractor QAP requirements contained herein.

1.3 SPECIFIC CONTRACTOR QAP REQUIREMENTS

1.3.1 Requirements apply to the following Contract work elements.

1.3.1.1 Design activities for 5 structures forming parts of the WSCF Complex including drawings, specifications, and test procedures.

1.3.2 Provide a documented QAP which satisfies the following criteria. If the QAP is based on a national standard, furnish a matrix which cross-references the plan with corresponding requirements listed.

1.3.2.1 Organization: The identity, authority, and functions of the individual(s) responsible for contractor design activities shall be documented.

1.3.2.2 Design control: Define and control Contractor design activities to include the following.

a. Use of qualified personnel.

b. Identification of sources of inputs for design (and changes to design), including procurement document technical requirements, codes, standards, and KEH authorized changes.

c. Checking of design documents (including design changes) by qualified personnel, not responsible for performing the design, to assure that design inputs are correctly incorporated into final design documents.

1.3.2.3 Document control: Ensure that the latest approved issue of procurement documents and design media are used for design activities. Such documents including changes thereto, shall be reviewed for adequacy and approved for release by authorized personnel. Records shall be legible, identifiable, and retrievable.

1.3.2.4 Inspection and Testing:

a. Perform inspections and tests specifically required by contract documents, including minimum code and standard requirements.

b. Inspection and testing requirements shall be described by clear, complete, and current procedures and instructions. Test procedures shall include reference test objectives and provisions for ensuring that prerequisites for inspections and tests have been met.

1.3.2.5 Control of Measurement and Test Equipment (M&TE):

a. Testing shall be performed using calibrated equipment when required by the design document. Equipment shall be calibrated at established intervals to ensure continued accuracy. Calibrations shall use certified measurement standards which have known, valid relationships to national standards.

b. Maintain records and mark equipment to show calibration status.

c. Notify KEH when M&TE is found to be out of calibration.

1.3.2.6 Inspection and Test Status:

a. The supplier shall maintain a positive system for identifying inspection and testing status of items or systems.

1.3.2.7 Control of Nonconforming Items:

a. Provide a method of notification for all construction items and activities which do not conform to requirements. Notification shall be given to KEH.

1.3.3 KEH may review/audit Contractor compliance with the QAP and Contract Documents.

1.4 In accordance with Section 19 of the Contract General Conditions, KEH will perform the following tests and inspections.

1.4.1 Soils sampling and compaction tests.

1.4.2 Concrete sampling and compressive strength tests.

1.4.3 Perform random overview of the Contractors activities to ensure compliance with Contract requirements.

1.4.4 Witness specific inspection and witness points.

1.4.5 Perform final acceptance inspection.

1.5 SPECIFIC INSPECTION POINTS

1.5.1 Adhere to inspection points. Ensure that personnel have completed inspections of, and approved portions of work in accordance with Contract requirements before notifying KEH.

a. Specific inspection points are defined as follows.

1) Construction inspection (H): Required for witnessing of specific construction features, before further construction is allowed to proceed.

2) Witness (W): Selected for inspection at the option of KEH. Work may proceed upon verbal release by KEH or upon expiration of one hour beyond scheduled time of witnessing.

b. H and W points apply to onsite work. Except where a longer period is specified, notify KEH at least four working hours before each point for onsite work.

1.5.2 H and W points are listed in Article 1.7.

1.6 OPEN ITEM AND NONCONFORMANCE REPORTING

1.6.1 KEH utilizes Open Item Reports and Nonconformance Reports (NCRs) to document deviations from Contract requirements.

1.6.1.1 Open Item Reporting: Documented on the Open Items List available from KEH. Items shall be corrected by the Contractor without additional direction. Correction shall bring item into compliance with Contract requirements, using approved rework procedures or standards, without violating Contract requirements.

1.6.1.2 Nonconformance report: Documented on nonconformance report (NCR) forms. NCRs document deviations from Contract requirements when characteristic, documentation, or procedure renders quality of an item or activity unacceptable, or indeterminate. Nonconformances are identified by a red construction hold tag, or blue NCR tag. A hold tag prohibits movement, installation, processing, or further fabrication of nonconforming items pending approval of the NCR disposition. An NCR tag identifies a

nonconformance, but allows work to proceed based on an approved NCR disposition. No action shall be taken to correct or alter an actual condition before receipt of an approved disposition. Tags are not to be removed by anyone other than the agency who applied the tag.

1.6.2 The Contractor shall ensure its organization is represented by individuals with sufficient authority to commit the Contractor to corrective action requirements identified by KEH.

1.6.3 Open items and nonconformances reported during performance of the Contract require resolution before completion and final payment.

1.7 SCHEDULE FOR H AND W POINTS

H - Compaction Procedure Demonstration
W - Structural Backfill Placement
H - Concrete Placement
H - Leak/Pressure Testing
H - Initial Erection of Buildings
H - HVAC Testing
W - Sanitizing of Water Lines
W - Backflow Preventor Testing
W - Electrical Testing
H - Acceptance Test Procedure

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 National Fire Protection Association (NFPA)

701	Fire Tests for Flame-Resistant Textiles and Films, 1989 Edition

1.1.1.2 Washington State Department of Transportation (WSDOT)

M41-10-91	Road, Bridge, and Municipal Construction

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Anchoring and Enclosure Methods: Submit methods proposed for anchoring portable structures and enclosing underfloor area to meet the requirements of this Section.

1.3 CONSTRUCTION FACILITIES

1.3.1 First Aid: Facilities are available at Building 2719WA in the 200 West Area to provide first line medical attention.

1.3.2 Operation and Storage Areas: Confine onsite operations, including storage of materials, to area northeast of Building 6270 site.

1.3.3 Waste Disposal

1.3.3.1 Disposal site: Dispose of construction debris (excess excavation, broken asphalt, and broken concrete) at the Hanford Site Central Landfill, approximately 10 road miles from the project. A Solid Waste Disposal Request shall be completed by the Contractor, and KEH representative. Forms are available from KEH. The site is open between 8:30 a.m. and 2:30 p.m.

1.4 TEMPORARY UTILITIES

1.4.1 Water

1.4.1.1 Construction: Available from existing hydrant in vicinity of Project site. Connect 4-1/2 inch, National Standard Thread, 1/4 turn ball valve with female swivel to 4-inch sexless "Snap-Tite/Storz" quick connect coupling to 4-1/2 inch port for fire department use. Install reduced

pressure backflow preventer, similar to BEECO-AERGAP Model 6CM, and slow-opening 2-1/2-inch gate valve to prevent water hammer on each hydrant port intended for construction use. Furnish hydrant wrench, backflow preventers and valves. Wrench shall remain on hydrant at all times. When used, turn hydrant "Full-on" or "Full-off". Partial opening causes damage to hydrant. Turn hydrant off at end of each work day. Provide freeze protection for hydrant and temporary piping or hoses. Fittings provided by Contractor for connection to water source shall be approved by KEH before installation. Remove temporary piping, hoses, fittings, and valves before final acceptance of the Work.

1.4.1.2 Drinking: Available within jobsite boundary. Furnish adequate drinking water, that meets health and safety requirements, to employees.

1.4.2 Electric Power: 480/208 3-phase and 120 V ac power will be made available at a power panel near site assigned for field office. Furnish power lines or cable extensions, including transformers, protective equipment, switches, and fixtures beyond point of supply. Remove temporary installations upon completion of construction.

1.4.3 Telephone

1.4.3.1 Telephone system is operated by General Telephone Company of the Northwest, Inc (GTE). Upon written request, KEH will arrange for telephone service at field offices of Contractor and subcontractors, if facilities are available. Allow at least 4 weeks for installation. KEH will charge Contractor for installation and services in accordance with charge assessed by GTE. Charges will be determined on basis of published tariffs. Information on tariffs may be obtained from DOE's Site Services Contractor, office of the Manager of the Plant Telephone and Radio, Telephone 376-6322.

1.4.3.2 Charges will be deducted from payments due Contractor. Contractor and subcontractors may use provided telephones for long distance calls necessary to the Work. Calls shall be made by valid credit card and cost shall not be charged to Site Services Contractor or KEH.

1.4.4 Sanitary Facilities: Furnish and service chemical or other approved sanitary toilets for employee use. Facilities shall meet requirements of KEH which are available upon request.

1.5 TEMPORARY CONTROLS

1.5.1 Dust Control: Maintain work areas to prevent hazard or nuisance to others. Accomplish dust control by sprinkling or other methods approved by KEH. Repeat sprinkling at necessary intervals to keep disturbed area damp at all times. Keep sufficient equipment on Project to accomplish dust control as work proceeds and whenever dust nuisance or hazard occurs. No separate or direct payment will be made for dust control and cost shall be considered incidental to and included in Contract price.

1.5.2 Temporary Enclosures: Plastic sheeting materials used to form enclosures shall be minimum 6 mils thick and have fire retardant properties meeting the requirements of NFPA 701. Acceptable manufacturers are Winman

Corp (Plastic Division), St. Cloud, Minnesota; Lancs Industries, Kirkland, Washington; and Protective Plastics, Inc, Greer, South Carolina.

1.5.3 Traffic Control: Temporary traffic control and barricades in accordance with WSDOT M41-10, Section 1-07.23(3).

1.5.3.1 Vehicle and equipment movement

a. Slow moving vehicles and equipment shall not travel on Hanford Site roads during heavy traffic periods between 6:30 and 8:00 am, and 3:30 and 5:30 pm.

b. Do not block existing roads.

c. Do not park on roadway shoulders.

1.5.3.2 Oversized vehicles and loads

a. Permits specified in Section 01065 are required for vehicles or loads exceeding following dimensions.

1) Width: 8'-6".

2) Height: 14 feet.

3) Length: Single unit, 40 feet.
Single trailing unit, 48 feet.

b. Additional requirements for vehicles and loads exceeding 8'-6" width.

1) Display oversize load sign on front of towing vehicle and rear of trailing unit.

2) Attach red flags to each corner.

3) Notify KEH 5 days before moving loads.

4) Travel between 9:00 am and 2:30 pm unless special arrangements are made.

c. Escort vehicle requirements.

1) Equip with oversize load signs and amber lights.

2) Vehicles or loads over 10 feet wide: Provide escort cars in front and rear on 2 lane highways.

3) Vehicles or loads over 14 feet wide: Provide escort car in rear on multiple lane highways.

4) Vehicles or loads over 20 feet wide: Provide escort cars in front and rear on multiple lane highways.

d. Electrical escort requirements: KEH will provide qualified electrical escorts, at no cost to Contractor, when load reaches height of 14 feet or more from road surface, or when clearance of at least 6 feet cannot be maintained from overhead electrical or signal lines. Notify KEH at least 3 working days before escort is required.

1.6 FIELD OFFICE

1.6.1 Establish a field office equipped and staffed to conduct the Work. Keep copies of Drawings, Specifications, and other information pertinent to the Work at office. KEH shall have access to documents at all times. Telephone service will be made available at field office as specified in Paragraph 1.4.3 providing service is available. Contractor may utilize existing telephones, at buildings designated by KEH, for local calls.

1.6.2 Anchor or tie down portable or relocatable structures, including trailers for field offices and storage, to prevent overturning or lateral movement in winds up to 70 mph. Enclose or skirt underfloor area with material that will not burn or support combustion to prevent accumulation of wind-blown debris and use of underfloor space for material storage. Complete anchoring and enclosing, within 14 days of arrival onsite.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01655

STARTING OF SYSTEMS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 ITEM DESCRIPTION

1.3.1 This Section covers the preparation of an Acceptance Test Procedure (ATP).

1.3.2 An ATP is performed after Inspection has verified that the system has been constructed in accordance with the Drawings and Specification.

1.3.3 An ATP is a functional demonstration that a system operates in accordance with design requirements. It includes provisions for recording test results (test reporting).

1.3.4 As a "procedure," the ATP requires KEH approval before running tests. As a "report," the ATP requires KEH approval/acceptance after testing has been accomplished.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PREPARATION

3.1.1 Prepare the ATP using the Guide ATP (Appendix C) for format and organization. Tailor the Guide ATP to the particular job by deleting unneeded material and adding job-specific requirements and procedure steps. Include acceptance criteria, data sheets, and tables as required.

3.1.2 Obtain document number, witness organization titles, and approval organization titles from KEH.

3.1.3 Submit for KEH approval as specified in related section.

3.2 FORMAT

3.2.1 List the sections of the procedure in the Table of Contents, as shown in the Guide ATP. On most projects, this simple list of section titles is sufficient. However, on large and complex ATPs, subsection headings may be listed as well.

3.2.2 Use decimal numbering for sections, subsections, and paragraphs/steps in ATPs. Start steps for signoff at the third level and indent. If more than four levels are required, use lower-case letters.

3.2.3 When a test is repeated, or the same data is acquired at intervals, use a data sheet. Prepare the data sheet listing the steps, paraphrasing the operation, and labelling required columns. Data sheets may be placed on the same page as the text. Data sheets are given the same number as the test to which they apply. Place the data sheet at the end of the last step. When a test consists of only a few steps that are repeated no more than three times, the steps may be repeated in the text and no data sheet is used.

3.2.4 Use a table when presenting data necessary for running the test. Identify tables with upper-case letters.

3.2.5 Number pages consecutively using Arabic numerals.

3.2.6 Start each test procedure section on a new page (8, 9, etc).

3.2.7 Each step, if it requires verification or recording, is normally listed separately; however, simple steps may be grouped for verification. For example, "Turn on power. Verify power is ON."

3.2.8 Provide space next to the step number or on a data sheet for the initials of the Recorder and the date the step was performed/verified.

3.3 LANGUAGE

3.3.1 Write ATPs in the imperative mood. For example, "Turn switch to AUTO."

3.3.2 Use care in selecting words to describe the condition of devices and indicators at various points in the test. In general, use words to describe the condition that will actually be observed. For example, an indicator light is described as ON, OFF, or FLASHING, rather than ENERGIZED. Valve positions are described as OPEN or CLOSED, but valve operators may be described as ENERGIZED or DE-ENERGIZED when the determination is made by a circuit check. Underlines are not used in ATPs. Use upper case for emphasis, as in the indicator descriptions above. Use quotation marks for long descriptions where all upper case is inappropriate.

3.3.3 Use names to identify components consistently throughout the ATP, and that agree with the nomenclature used on the drawings and on name tags installed in the field. Refer to tag numbers when available, to eliminate any possible ambiguity. Specific components have the first letter capitalized: for example, Fire Alarm Panel 31, Selector Switch SS-1.

3.4 CONTENT

3.4.1 Provide a brief description of the test purpose in the lead paragraph for each system or subsystem test.

3.4.2 Establish the system conditions at the start of the procedure; for example, valve positions, switch positions, power status.

3.4.3 Give definite instructions for returning each system and subsystem to a safe condition following the test.

3.4.4 Specify required calibrated equipment and testing devices. When the accuracy of results is important to the design, include the tolerance and range of accuracy required.

3.4.5 Calibration of component instruments is not accomplished during an ATP. However, test results recorded may be used for future retest comparisons.

3.4.6 When applicable, include announcements to building/area personnel concerning alarms to be ignored or other pertinent information in the first step. A second announcement is required at the end of the test.

3.4.7 Include the methods for processing required test changes to the procedure and for handling test exceptions.

3.4.8 Include the requirement to reverify test prerequisites prior to resumption of a test once it is suspended.

3.4.9 Consider and factor required environmental conditions into the test requirements.

3.4.10 Include acceptance criteria for each device, or check where a specific response is required. Include tolerances or limits where applicable.

3.4.11 Identify supplier manuals necessary for the conduct of tests.

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 Washington Administrative Code (WAC)

Title 296	Labor and Industries
Chapter 296-155	Safety Standards for Construction Work

1.2 SUBMITTALS: Not Used

1.3 RECORD REQUIREMENTS

1.3.1 Hanford site work requires that certain documents, defined herein, be used to record the construction process and administration of the Contract. KEH will assemble pertinent data for final disposition. Prepare, preserve, and deliver project record documents required by this Contract to KEH. Documents are in addition to submittals required in Section 01300.

1.3.2 Mark documents that will become project records prior to use for construction. Keep copies of project record documents in field office, and make available to KEH during progress of Work.

1.3.3 Some data required for project records shall be delivered to KEH during course of construction and contract administration, while others shall be assembled after completion of construction for delivery to KEH. Document delivery by retaining copy of reports delivered during course of work until construction completion, retaining copy of letter of transmittal itemizing delivered items, or other means acceptable to KEH.

1.3.4 When information for project records is to be recorded on standard KEH forms, copies of the forms will be supplied by KEH. Samples of the appropriate required forms are included in the specification sections.

1.4 DOCUMENT IDENTIFICATION

1.4.1 General: Documents required for project records are itemized herein. Identify complete documents by title or number. Notes or markings added by hand shall be legible utilizing permanent nonsmearing marking media, such as ink or felt tip markers, in contrasting color.

1.4.2 Storage and Marking: Store one set in the field office, apart from documents used in construction, and maintain in clean, dry, and legible condition. Legibly mark items to record actual construction, including

changes to dimensions and details, manufacturer's name, catalog number, and substitute products.

1.4.3 Activity and Administrative Documents: Deliver or retain in accordance with following.

1.4.3.1 Certified Payrolls: Each week deliver certified payrolls, as required by Section 108 of Contract General Conditions, to KEH, and keep copies in the field office until Contract completion. Progress payments will not be processed unless certified payrolls for work periods have been received by KEH.

1.4.3.2 Daily Force and Equipment Reports: Before noon each day, deliver one copy of a detailed daily force report, covering labor and supervision of Contractor and subcontractors for previous day. Report shall include a general description of work performed, and list major items of equipment on site.

1.4.3.3 Weekly Manpower Reports: Prepare weekly manpower reports and deliver, before 10 am on Monday, for previous week, during performance of Contract. Forms will be furnished by KEH.

1.4.3.4 Weekly Safety Meetings: Conduct weekly walkaround safety inspections and safety meetings in accordance with WAC 296-155-110. Deliver one copy of meeting minutes to KEH, as completed.

1.4.3.5 Periodic Equipment Inspections: Document initial and followup, periodic heavy equipment inspections by the Contractor. Deliver one copy to KEH, as completed.

1.4.3.6 Subcontracting Plan Reports: Deliver reports documenting conformance with Subcontracting Plan, as required by Section 89 of Contract General Conditions.

1.4.3.7 Backfill Permit: Retain backfill permits approved for work.

1.4.3.8 Soil Compaction Procedure: Retain Forms KEH-0382 completed for work.

1.4.3.9 Pour Slips: After obtaining KEH approval of concrete pour slips, deliver copies to KEH, and retain Contractor copies until Contract closeout. After closeout deliver them to KEH.

1.4.3.10 Trip Tickets: Deliver copies to KEH with each truck load of concrete and retain Contractor copies until Contract closeout. After closeout deliver them to KEH.

1.4.4 Construction, Quality Assurance, and Supporting Documents: Deliver in accordance with following when called for in specification sections.

1.4.4.1 Leak/Pressure testing records: One copy of records including NFPA certificates verifying acceptable completion of leak and pressure testing, within 5 days after completion.

1.4.4.2 Electrical testing: One copy of records verifying acceptable completion of electrical telecommunications installation, continuity, and grounding tests, within 5 days after completion.

1.4.4.3 Completed Acceptance Test Procedure (Test Results): One copy of Acceptance Test Procedure, with test results and other required information entered, within 5 days after completion.

1.4.4.4 Completed Certificate of Compliance: One copy of completed Certificate of Compliance as noted in NFPA 72, based on the above completed acceptance test procedure, along with that procedure.

1.4.5 Product Samples and Manufacturer's Instructions: In addition to submittals required in Section 01300, and requirements of this Section, information received by Contractor (from suppliers) that documents products used, and how they were installed, shall be delivered to KEH for Project Records.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

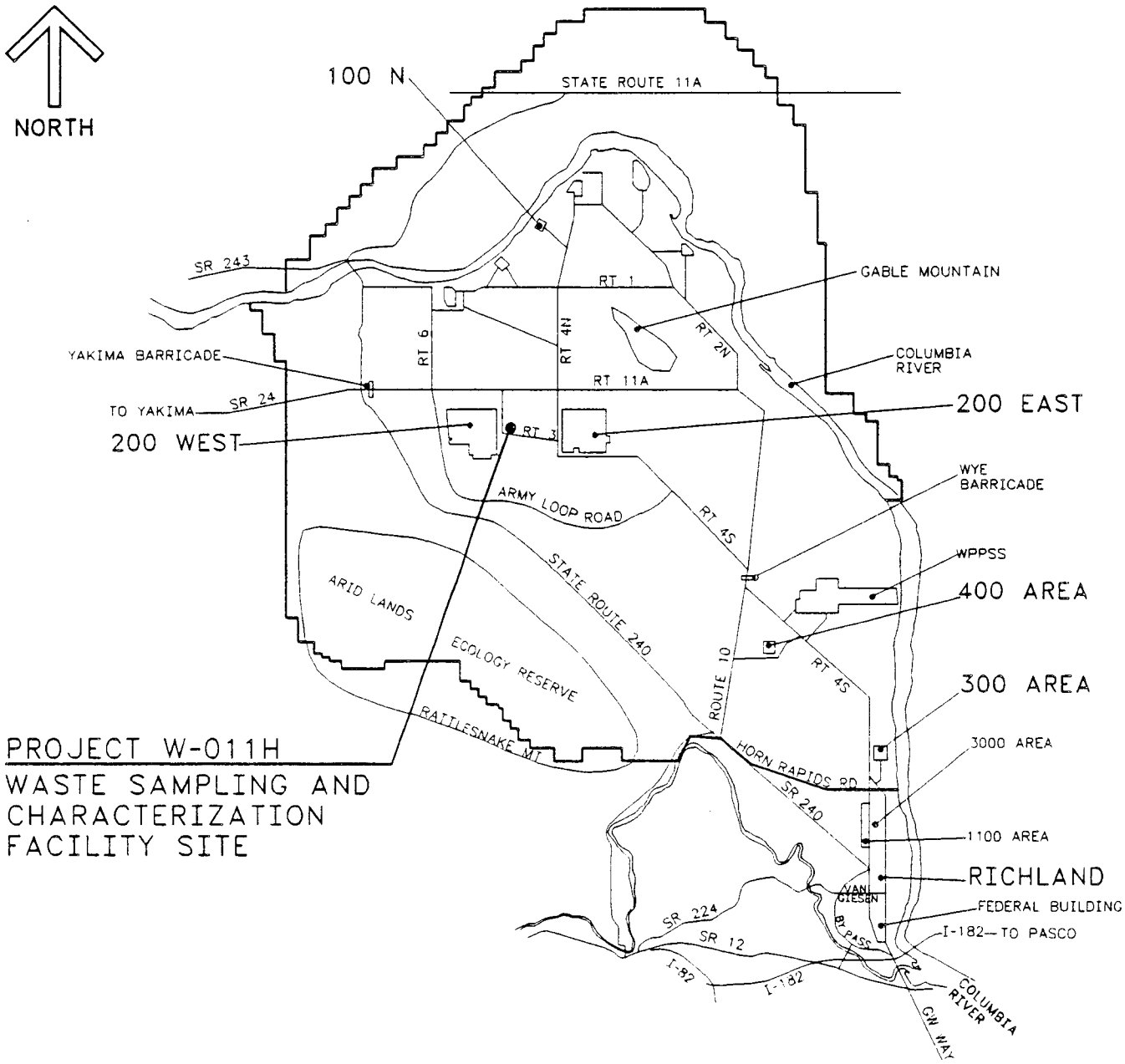
Not Used

END OF SECTION

APPENDIX A

Figures

Figure 1	Hanford Area Map
Figure 2	WSCF Site Plan
Figure 3	Building 6265, Utility Building Floor/Site Plan
Figure 4	Building 6265A, Solid Waste Storage Building Floor/Site Plan
Figure 5	Building 6267, Environmental Sample Archive Facility Floor/Site Plan
Figure 6	Building 6269, Mobile Laboratory Storage Facility Floor/Site Plan
Figure 7	Building 6270, Environmental Data Remedial Tracking System Facility Floor/Site Plan
Figure 8	Building 6270, Telephone and Paging System

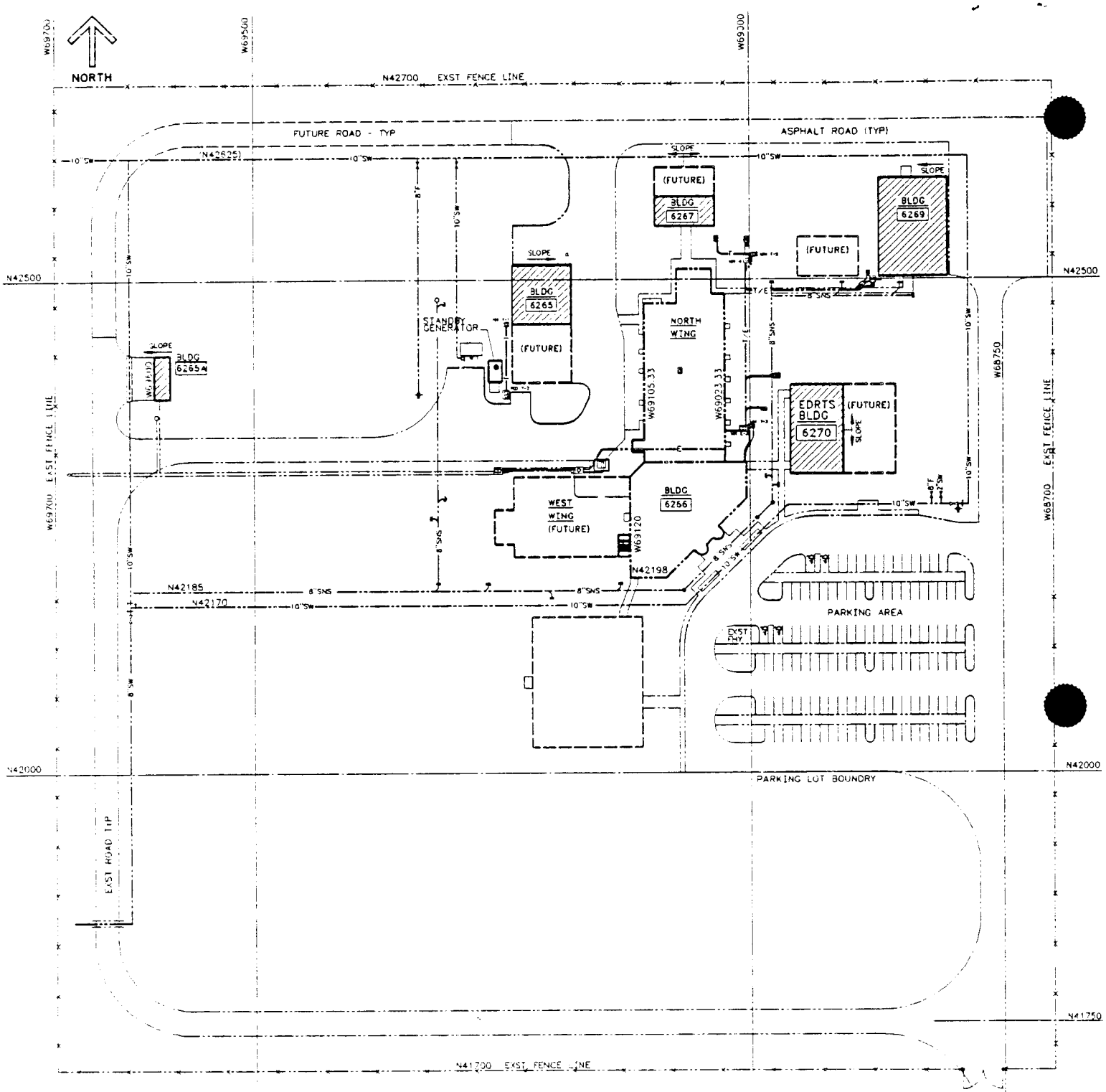


PROJECT W-011H
WASTE SAMPLING AND CHARACTERIZATION FACILITY SITE

HANFORD AREA MAP

0 5 10 15 20 30MI

FIGURE 1 CAD FILE ES9497AA



LEGEND

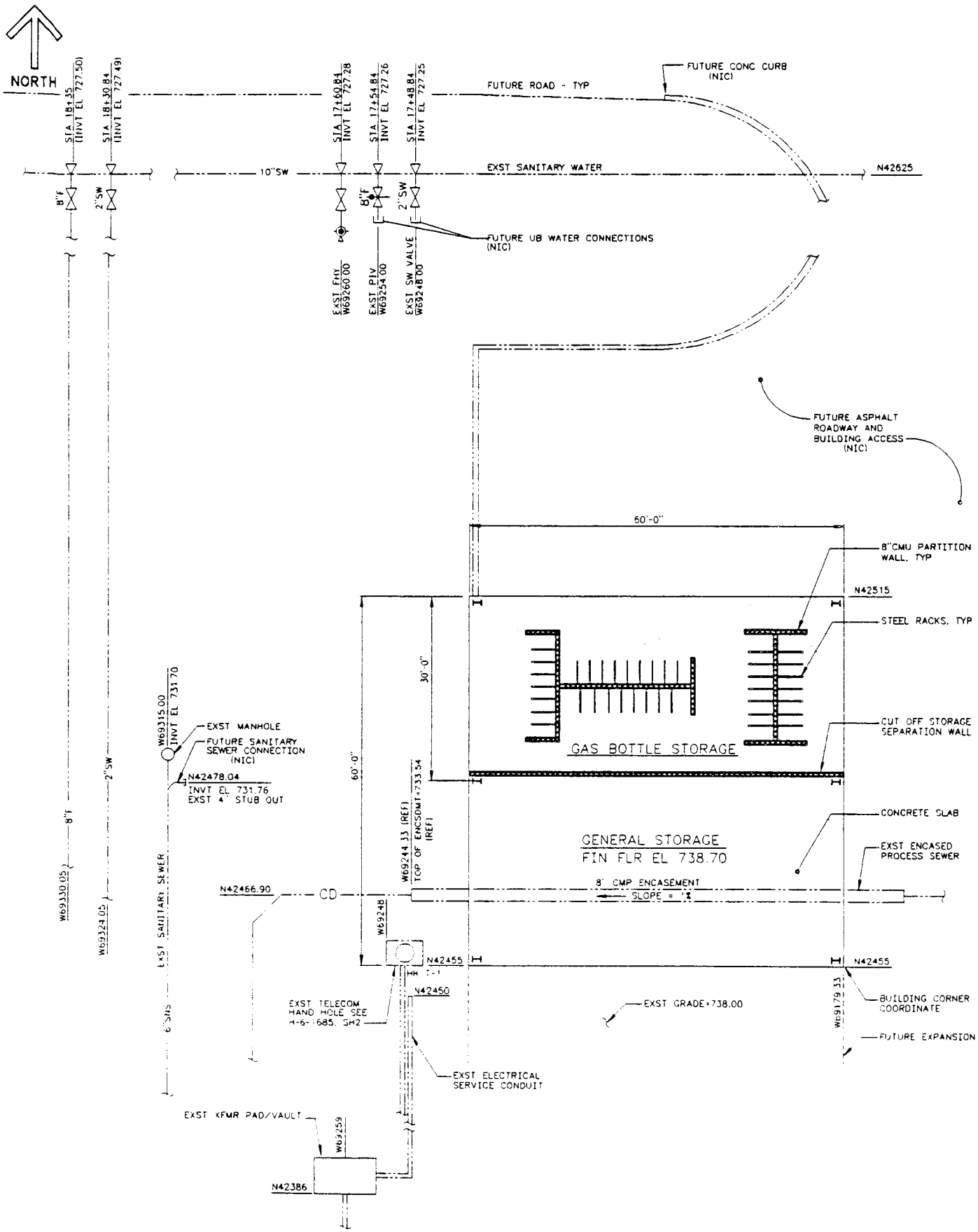
N42000	HANFORD COORD LINE	F	FIRE LINE		STUB & CAP		EXISTING
	EXST FENCE	CD	CONTAM DRAIN LINE		GATE VALVE		FUTURE
	EXISTING CONDITION	E	UGND ELECTRIC LINES		PIV W/PROTECTIVE BOLLARDS		BLDGS IN SCOPE OF WORK
	PROPOSED CONSTRUCTION	T/E	TELECOMMUNICATIONS AND ELEC LINE	FH	FIRE HYDRANT		
	FUTURE CONDITION	T	TELECOMMUNICATION LINE	SLOPE	SHED ROOF SLOPE		
SNS	SANITARY SEWER LINE	MH	SNS MANHOLE	SLOPE	GABLE ROOF SLOPE		
SW	SANITARY WATER LINE	PV	PAD/VAULT				

WASTE SAMPLING AND CHARACTERIZATION FACILITY - SITE PLAN

FIGURE 2 CAD FILE ES94974B

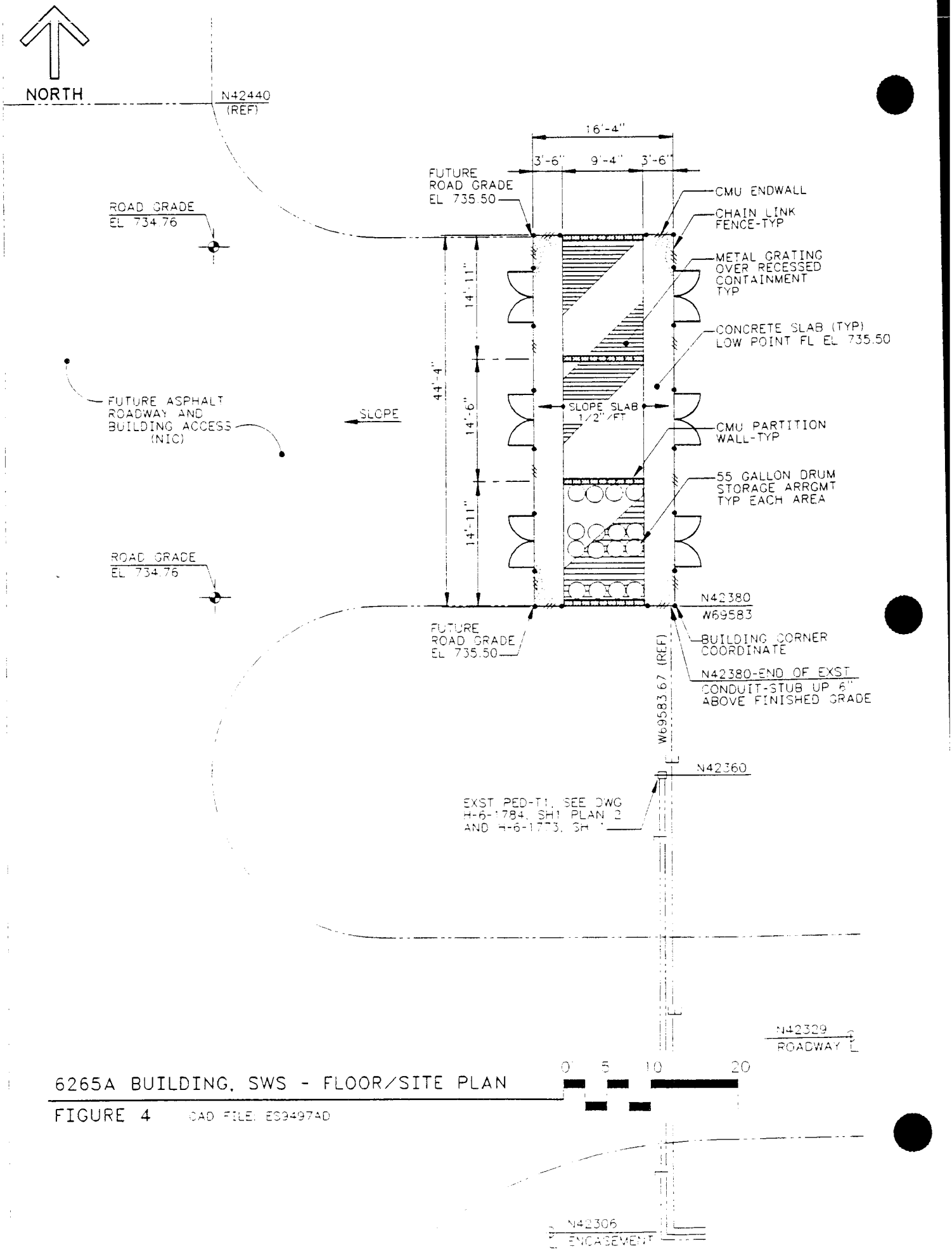
0 50 100' 200'

W-011H-DC1
Rev 0



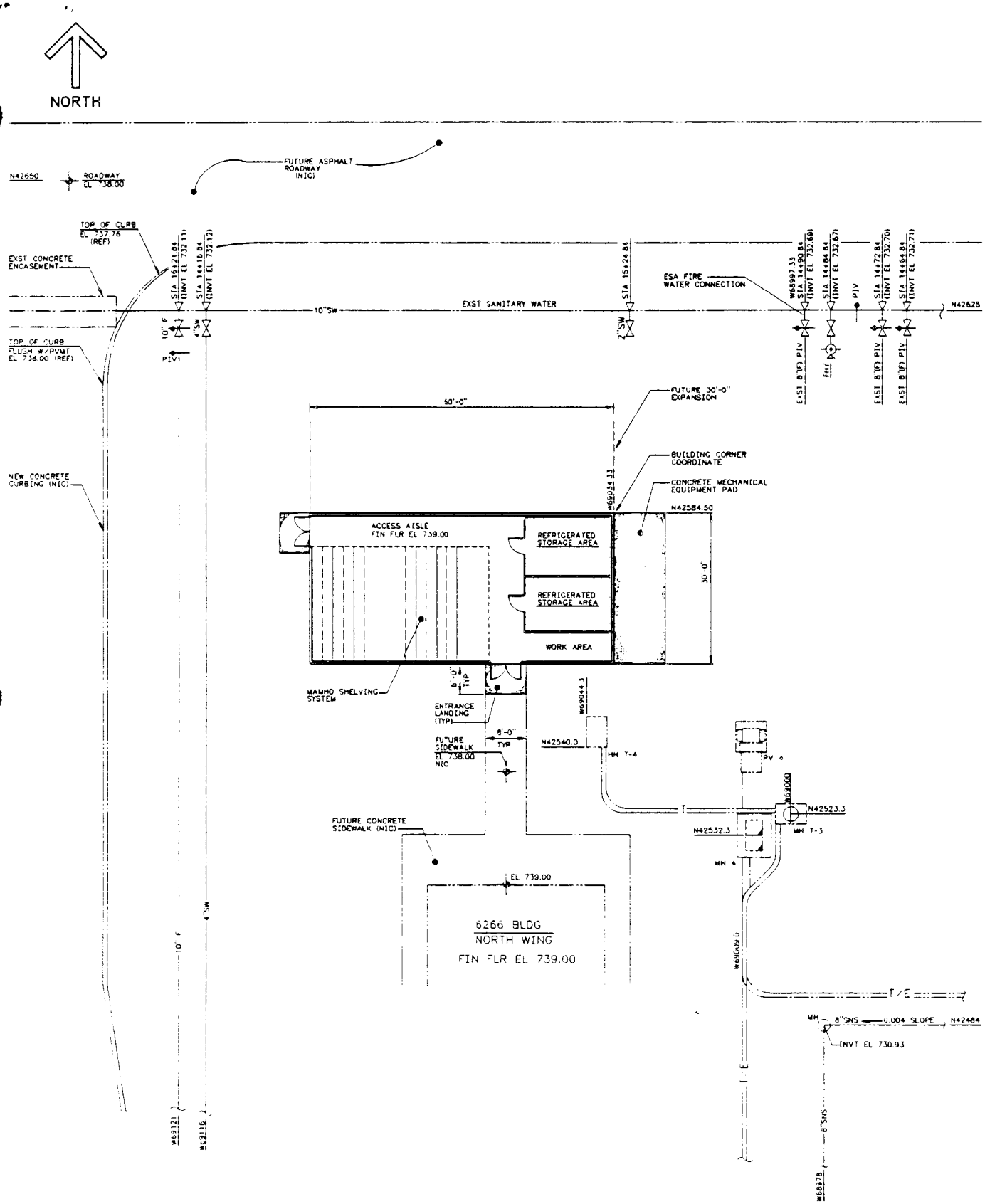
6265 BUILDING, UB - FLOOR/SITE PLAN

FIGURE 3 CAD FILE: ES9497AC



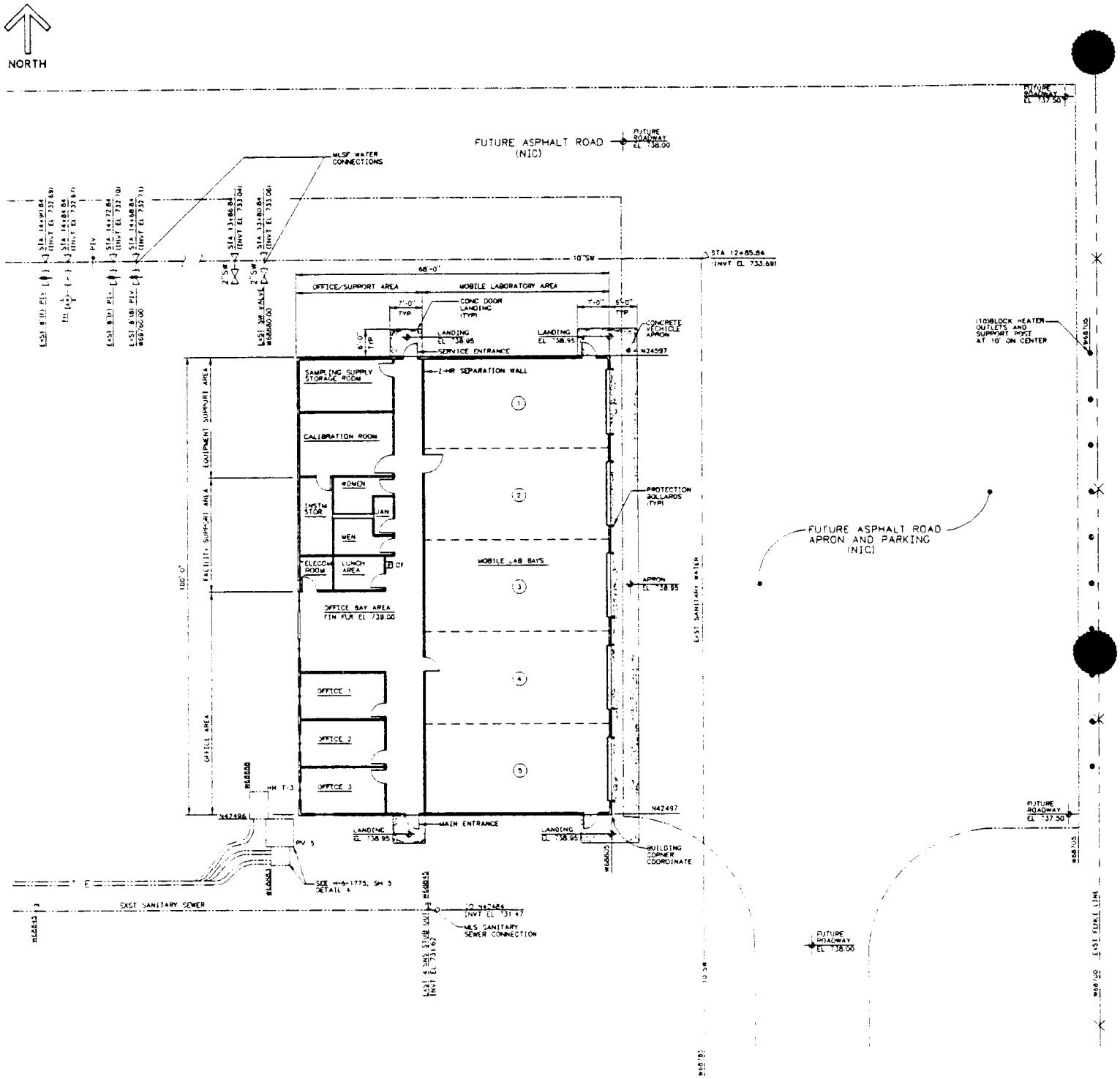
6265A BUILDING, SWS - FLOOR/SITE PLAN

FIGURE 4 CAD FILE: ES9497AD



6267 BUILDING, ESA - FLOOR/SITE PLAN

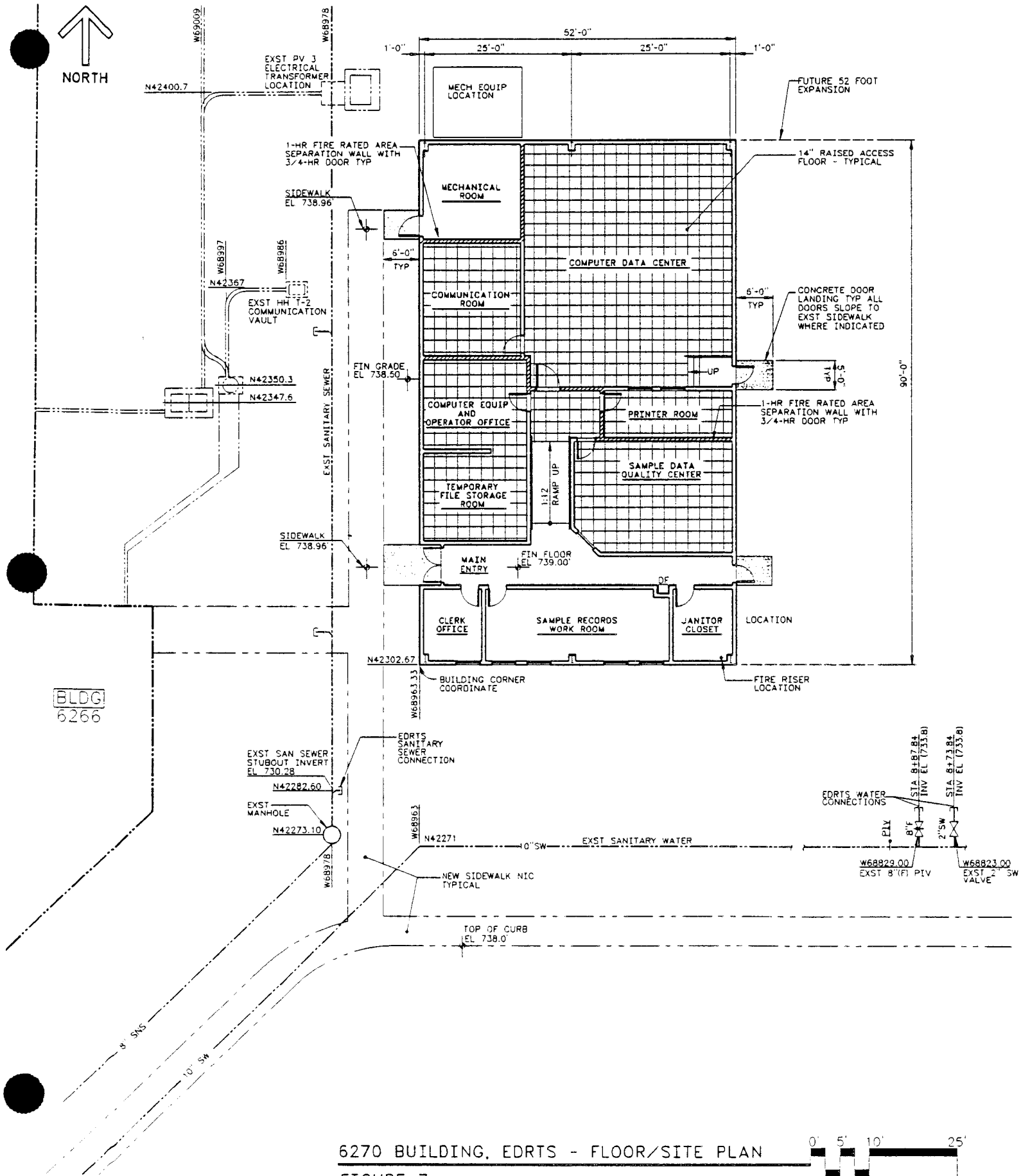
FIGURE 5 CAD FILE: ES9497AE



6269 BUILDING, MLS - FLOOR/SITE PLAN

FIGURE 6 CAD FILE: ES9497AF

0 5' 15' 25' 50'

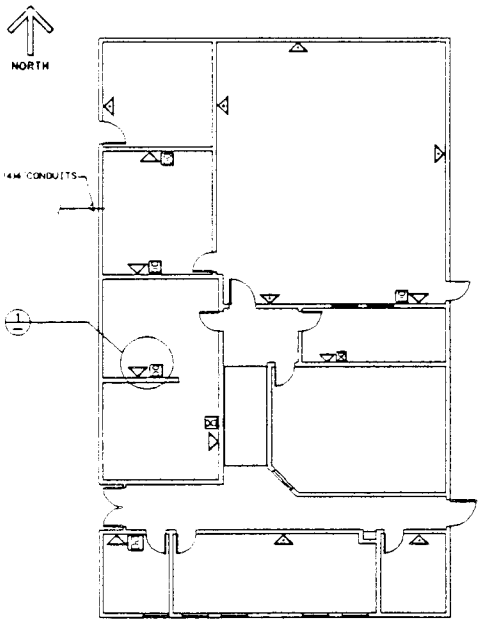


6270 BUILDING, EDRTS - FLOOR/SITE PLAN

0' 5' 10' 25'

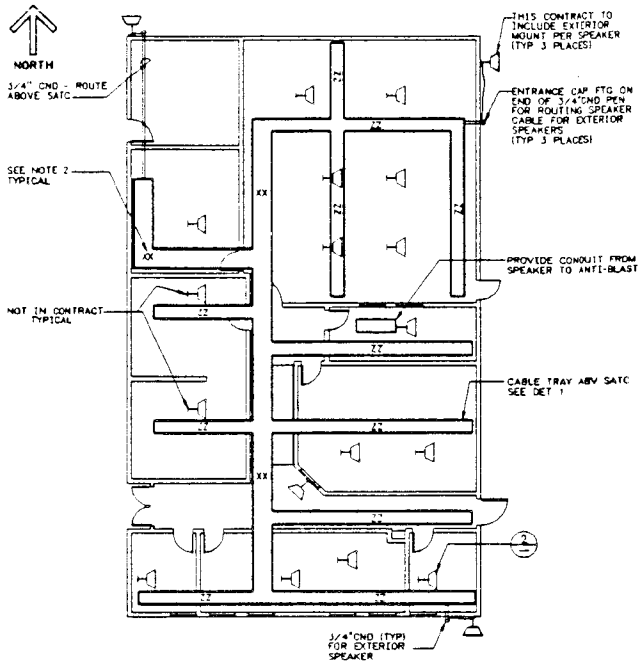
FIGURE 7

CAD FILE: ES9497AG



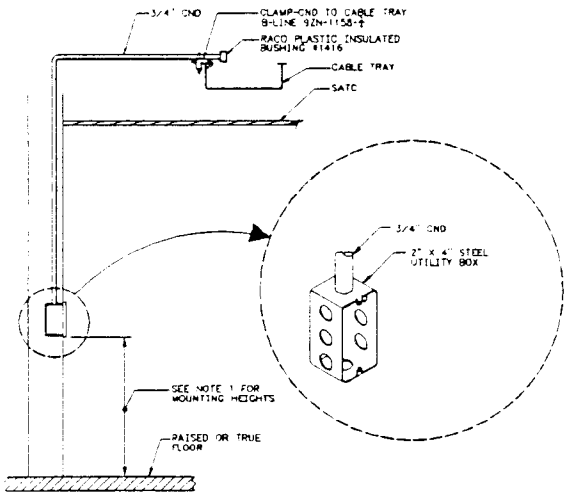
6270 BLDG DATA/TELEPHONE OUTLET LOCATIONS
SCALE: 1/8" = 1'-0"

* WIRING AND RECEPTACLES ARE NOT IN CONTRACT

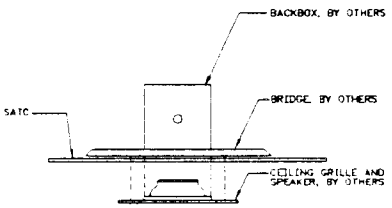


6270 BLDG CABLE TRAY AND PAGING SPEAKER LOCATIONS
SCALE: 1/8" = 1'-0"

* RACEWAY AND SPEAKER LAYOUT WILL REQUIRE RECONFIGURATION IF FLOOR PLAN LAYOUT CHANGES
* SPEAKERS AND WIRING ARE NOT IN CONTRACT

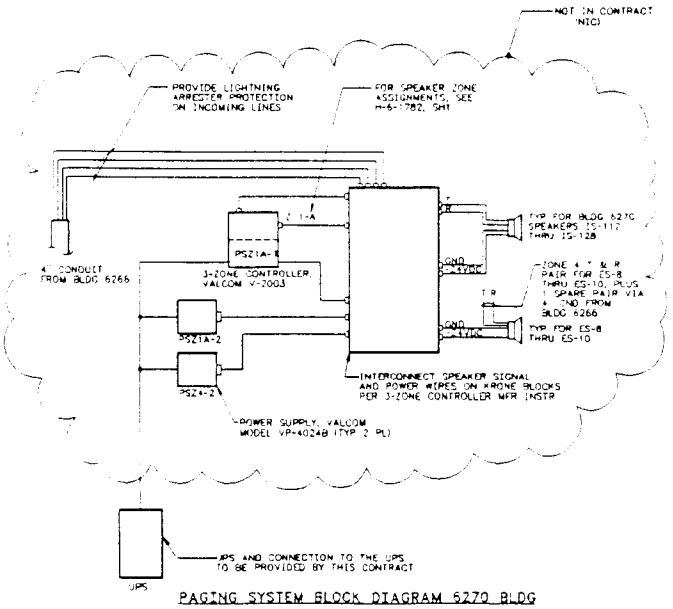


DETAIL 1
SCALE: NONE



* THIS DETAIL PROVIDED TO SHOW SPEAKER INSTALLATION DETAIL AS PROVDED BY OTHERS

DETAIL 2
SCALE: NONE



PAGING SYSTEM BLOCK DIAGRAM 6270 BLDG

LEGEND

SYMBOL	DESCRIPTION
▽	TELEPHONE OUTLET DESK MOUNT
▽	TELEPHONE OUTLET WALL MOUNT
▽	TELEPHONE OUTLET DESK MOUNT DATA OUTLET WALL MOUNT
⊢◁	SPEAKER

NOTE

1. IN CASES WHERE THERE IS A WALL MOUNTED PHONE, USE MODULAR WALL JACK (6 CND) LEVITON TYPE 630A #4223-S IN 2" X 4" STEEL UTILITY BOX MOUNTED AT 4'-6" AND DATA OUTLETS WILL BE MOUNTED AT 1'-6" FROM TOP OF FINISHED FLOOR
2. GENERAL ROUTING FOR ALUMINUM LADDER TYPE. CABLE TRAYS ABOVE SUSPENDED CEILING AS SHOWN. WORKING LOAD POUND/LINEAR FEET = 75. PROVIDE ROUTING PATH DEVIATIONS AS NEEDED TO AVOID ANY INTERFERENCE. CABLE TRAY SIZING LEGEND IS AS FOLLOWS.

XX	6" WIDE X 4" HIGH TRAY
ZZ	3" WIDE X 4" HIGH TRAY

6270 BUILDING, TELECOM PLAN AND DETAILS
FIGURE 8 CAD FILE: ES9497AJ

APPENDIX B

Gas Bottle Storage

APPENDIX B

GAS BOTTLE STORAGE

Building 6265 - Utility Building (UB)

Gas bottle storage information:

A. High purity compressed gases to be stored include:

1. Oxygen
2. Helium
3. Nitrogen
4. Propane
5. Carbon dioxide
6. Argon
7. Hydrogen
8. Acetylene
9. Nitrous oxide
10. Methane
11. Argon/methane mixture

Gas	Total Empty	Maximum Stock	Cylinder Size
Acetylene	2	2	220 ft^3
Air	5	10	220 ft^3
Argon	1	6	220 ft^3
Helium	2	4	220 ft^3
Hydrogen	6	10	220 ft^3
Methane	3	5	220 ft^3
Nitrogen	6	8	220 ft^3
Nitrous Oxide	1	2	220 ft^3
Oxygen	5	10	220 ft^3
P-10	4	10	220 ft^3
Propane	1	2	25 gal
SPECIAL GAS			
HP Air (High Purity)	1	2	220 ft^3
HP Nitrogen	1	2	220 ft^3
HP Oxygen	1	2	220 ft^3
Oxidizers	2	2	220 ft^3
Oxidizers/Poisonous	2	2	220 ft^3
Liquid Argon	3	3	3 ft^2 at base (Dwyer)
Liquid Nitrogen	3	3	3 ft^2 at base (Dwyer)
Freon	1	1	220 ft^3
Freon	Throw Away	15	1 ft^2 ea
55 gal drums	All	25	3 ft^2 ea
(Include in old Gas Dock)			

APPENDIX C

Guide ATP

ACCEPTANCE TEST PROCEDURE * _____ REV 0 DATE _____ Page 1

TEST TITLE _____

LOCATION * _____

PROJECT NUMBER * _____

PROJECT TITLE * _____

Prepared By
(Company Name)

For _____

Contract _____

PROCEDURE APPROVAL

_____ _____
Originator Date

_____ _____
Checker Date

_____ _____
Project Manager Date

*NOTE TO ATP ORIGINATOR: Enter project specific

EXECUTION AND TEST APPROVAL

EXECUTED BY

Test Director/Organization	Date	Test Operator/Organization	Date
Recorder/Organization	Date		

WITNESSES*

Witness/Organization	Date	Witness/Organization	Date
Witness/Organization	Date	Witness/Organization	Date

A-E Approval

Kaiser Engineers Hanford Company

Without exceptions _____ With exceptions resolved _____ With exceptions outstanding _____

Design Engineer	Date
Project Manager	Date

TEST APPROVAL AND ACCEPTANCE*

(Operating Contractor)

Without exceptions _____ With exceptions resolved _____ With exceptions outstanding _____

(Title or Department)	Date	(Title or Department)	Date
(Title or Department)	Date	(Title or Department)	Date

*NOTE TO ATP ORIGINATOR: KEH will establish project specific signatory titles or organizations during approval review.

TABLE OF CONTENTS

Section		Page
	TITLE/PROCEDURE APPROVAL	1
	EXECUTION AND TEST APPROVAL	2
	TABLE OF CONTENTS	3
1	PURPOSE	7
2	REFERENCES	7
3	RESPONSIBILITIES	8
4	CHANGE CONTROL	11
5	EXECUTION	11
6	EXCEPTIONS	12
7	PREREQUISITES AND EQUIPMENT REQUIRED	13
8	FIRE ALARM SYSTEM - EAST WING (example)	16
9	(SECOND SYSTEM) (as required)	—
10	(THIRD SYSTEM) (as required)	—
	EXCEPTION FORM	18
	LAST PAGE	18

NOTE: At completion of test, enter pages added during performance of test.

1 PURPOSE

(Provide a statement to describe what the ATP is expected to accomplish.)

This Acceptance Test Procedure (ATP) has been prepared to demonstrate that the (Electrical/Instrumentation) (Fire Protection) (HVAC/Instrumentation) (Mechanical) (_____) systems function as required by project criteria.

2 REFERENCES

2.1 DRAWINGS

(List drawings including sheet and revision numbers in numerical order with full title as shown in the drawing title block.)

2.2 SPECIFICATIONS

(List Construction Specifications, Procurement Specifications, and Vendor Information including revision number or date.)

2.3 ENGINEERING CHANGE NOTICES (ECN)

Prior to final test approval, enter ECNs* written against this ATP.

2.4 OTHER

(List any other references including revision number or date.)

*Engineering Change Notices or other agreed upon method for controlling revisions to the ATP.

3 RESPONSIBILITIES

3.1 GENERAL

Each company or organization participating in this ATP will designate personnel to assume the responsibilities and duties as defined herein for their respective roles. The designees shall become familiar with this ATP and the systems involved to the extent that they can perform their assigned duties.

3.2 TEST DIRECTOR

3.2.1 Coordinates testing with KEH and directs acceptance testing.

3.2.2 Acts as liaison between the participants in acceptance testing.

3.2.3 Distributes the approved testing schedule before start of testing.

3.2.4 Schedules and conducts a pretest kickoff meeting with test participants before start of testing when necessary.

3.2.5 Notifies the persons performing and witnessing the test 2 days before the start of testing.

3.2.6 Schedules a dry run when necessary.

3.2.7 Notifies concerned parties when a change is made in the testing schedule.

3.2.8 Takes necessary action to clear exceptions to the test.

3.2.9 Confirms that field testing and inspection of the system or portion of the system to be tested has been completed.

3.2.10 Stops any test which, in his/her judgment, may cause damage to the system until the problem has been resolved.

3.2.11 After verifying there is no adverse impact, may alter the sequence in which systems or subsystems are tested.

3.2.12 Ensures that required environmental conditions are maintained.

3.2.13 If a test is to be suspended for a period of time, ensures that the system is left in a safe mode.

3.2.14 Before restarting suspended test, reverifies the test prerequisites.

3.2.15 Initiates ECNs** to document required changes to the ATP.

3.2.16 Reviews recorded data, discrepancies, and exceptions.

3.2.17 Obtains information or changes necessary to clear or resolve objections during the performance of the test.

3.2.18 Signs Execution Test and Approval page when test has been performed.

3.2.19 Signs Exception form when exception has been resolved.

3.2.20 Obtains required signatures on the ATP Master prior to reproduction and distribution.

3.3 WITNESSES (Provided by Participating Organizations. One witness shall be a KEH Title III acceptance inspector.)

3.3.1 Witness the tests.

3.3.2 Review results of testing.

3.3.3 Assist the Test Director when requested.

3.3.4 Sign Execution and Test Approval page when test has been performed.

3.3.5 Sign Exception form when exception has been resolved.

3.4 RECORDER

3.4.1 Prepares a Field copy from the ATP Master.

3.4.2 Records names of designated personnel on Field copy of ATP prior to start of testing.

3.4.3 Records test instrument identification numbers and calibration expiration dates.

3.4.4 Initials and dates each test step on the Field copy as it is completed, next to the step number, or on a data sheet when provided. Records Test Data. On data sheets where there is

**See Subsection 2.3.

not room for both the initial and date, date may be entered at bottom of column.

3.4.5 Records objections and exceptions on an Exception form. Transfers information in ink or type to an Exception form master. Uses additional Exception forms as needed.

3.4.6 Signs Execution and Test Approval page when test has been performed.

3.4.7 After test is finished, assigns alpha numeric page numbers to added data sheets and Exception forms. Records page numbers in the Table of Contents.

3.4.8 Transfers changes and the final test results with Recorder's signature and dates for each step to the Master in ink or type. Submits the completed Master to the Test Director for approval signature routing. Transmits the Field copy to KEH when test has been accepted and exceptions closed-out.

3.4.9 Signs Exception form when exception has been resolved, and transmits to Test Director.

3.5 TEST OPERATOR

3.5.1 Performs test under direction of the Test Director.

3.5.2 Provides labor, equipment, and test instruments required for performing tests which have not been designated as being provided by others.

3.5.3 Requests in writing from KEH those services, materials, or equipment that have been designated as being supplied by others.

3.5.4 Confirms that equipment required for performing test will be available at the start of testing.

3.5.5 Signs the Execution and Test Approval page.

4 CHANGE CONTROL

Required changes to this ATP must be processed on ECNs** in accordance with company procedures. If a need for change is discovered in the course of running the test, the test shall be stopped until the ECN is approved.

**See Subsection 2.3.

However, this does not prevent the running of another portion of the test unaffected by the change.

5 EXECUTION

5.1 OCCUPATIONAL SAFETY AND HEALTH

Individuals shall carry out their assigned work in a safe manner to protect themselves and others from undue hazards and to prevent damage to property and environment. Facility line managers shall assure the safety of activities within their areas to prevent injury, property damage, or interruption of operation. Performance of test activities shall always include safety and health aspects.

5.2 PERFORMANCE

5.2.1 Use KEH approved copy of this ATP.

5.2.2 Conduct test meeting responsibility requirements of Section 3.0 of this ATP.

5.2.3 Perform test in accordance with steps in Section(s) 8.0 (9.0, etc) of the ATP.

5.2.4 When test has been completed, obtain signatures of test executioners and witnesses.

5.2.5 Submit the test report to KEH for approval.

NOTE 1: At this point, the "procedure" becomes a "report".

NOTE 2: There may be exceptions outstanding.

5.2.6 Clear exceptions and submit to KEH for approval.

NOTE: Ideally, the cleared exceptions would be submitted with the report. Coordinate with KEH as to allowable delay between test completion and submittals.

6 EXCEPTIONS

6.1 GENERAL

Exceptions to the required test results are sequentially numbered and recorded on individual Exception forms. This enables case-by-case resolution and approval of each exception.

Errors/exceptions in the ATP itself shall NOT be processed as test exceptions (see Section 4.0).

6.2 RECORDING

6.2.1 Number each exception sequentially as it occurs and record it on Exception form KEH-428 (sample appended), or an approved substitute.

6.2.2 Enter name and organization of objecting party for each exception.

6.2.3 Enter planned action to resolve each exception when such determination is made.

6.3 RETEST/RESOLUTION

Record the action taken to resolve each exception. Action taken may not be the same as planned action.

6.3.1 When action taken results in an acceptable retest, sign and date Retest Execution and Acceptance section of the Exception form.

6.3.2 When action taken does not involve an acceptable retest, strike out the Retest Execution and Acceptance section of the Exception form.

6.4 APPROVAL AND ACCEPTANCE

KEH provides final approval and acceptance of exceptions by checking one of the following on Exception form:

6.4.1 Retest Approved and Accepted: Applicable when Retest Execution and Acceptance section is completed.

6.4.2 Exception Accepted-As-Is: Requires detailed explanation.

6.4.3 Other: Requires detailed explanation.

KEH signs and dates the Exception form and obtains their customer approval, as required.

6.5 DISTRIBUTION

A copy of the approved Exception form is distributed to each participant. The signed original is attached to the ATP Master.

7 PREREQUISITES AND EQUIPMENT REQUIRED

7.1 PREREQUISITES

The following conditions shall exist at the start of the testing for that portion of the system being tested.

7.1.1 Systems have been inspected for compliance with construction documents.

7.1.2 Reference documents (including this ATP) have been verified for correct revision number and outstanding ECNs**.

7.1.3 Power is available.

7.1.4 Annunciator lights have been tested.

7.1.5 Test instruments have a valid calibration stamp attached. Test instrument identification numbers and calibration expiration dates have been recorded in Paragraph 7.2.

7.1.6 Steam and other process lines are valved off.

7.1.7 Water is available to the sprinkler system.

7.1.8 Methods of water disposal have been approved by Facilities Management.

7.1.9 Voice communications are available between (list locations).

7.2 EQUIPMENT AND INSTRUMENTS

Supplied by Test Operator unless otherwise noted. (Delete items not required. Add any additional necessary items.)

**See Subsection 2.3.

7.2.1 Voltohmmeters (VOM): (portable) (give ranges).
***Instrument No. _____, Calibration Expiration Date ____.

7.2.2 Ammeters: (give ranges).

7.2.3 Shorting jumpers: (give lengths).

7.2.4 Shorting jumpers with ON-OFF switch: (give lengths).

7.2.5 Pressure gages: (give ranges).

7.2.6 Variable test pressure source (VTPS):

7.2.7 Variable test vacuum source (VTVS):

7.2.8 Container: (to hold water for leak or level detector tests) (give depth).

7.2.9 Thermocouple calibration device:

7.2.10 Resistance decade box:

7.2.11 Hygrometer:

7.2.12 Thermometers: (with waterbath) (give ranges).

7.2.13 Hoses: (give size, length, and end connections).

7.2.14 Radiation test sources: (type of source) Supplied by Operating Contractor.

7.3 ABBREVIATIONS AND DEFINITIONS

7.3.1 Abbreviations: (List nonstandard abbreviations used in the text.)

ECN	Engineering Change Notice
HLAN	Hanford Local Area Network
PABX	Private Automatic Branch Exchange
RWP	Radiation Work Permit
SWP	Special Work Procedure

***Add this line to other instruments as required.

7.3.2 Definitions: (Define nonstandard terms used in the text.)

7.4 ANNUNCIATOR TAGGING AND SEQUENCE

7.4.1 Annunciator tagging:

Tagging	Location
1.	
2.	
3.	
4.	

7.4.2 Annunciator sequence: (Give sequence of annunciator(s) specified.)

EXAMPLE

8 FIRE ALARM SYSTEM - EAST WING

These tests will verify the operation of the Pyrotronics fire alarm system.

8.1 PREPARATION

_____ 8.1.1 Verify that all prerequisites of Subsection 7.1 have been met.

_____ 8.1.2 Notify building personnel that fire alarm test is in progress; evacuation not required.

8.2 SUPERVISORY TESTS

These tests will verify the supervisory function for the HD, and MS.

8.2.1 Heat Detector (HD)

_____ 8.2.1.1 Lift one wire from HD-1.

_____ 8.2.1.2 Verify that trouble LED on FACP is ON.

_____ 8.2.1.3 Reattach wire.

_____ 8.2.1.4 Verify that LED is OFF.

Record the following steps for items shown on Data Sheet 8.2.2.

8.2.2 Manual Pull Stations (MS)

8.2.2.1 Lift one wire from MS.

8.2.2.2 Verify that trouble LED on FACP is ON.

8.2.2.3 Reattach wire.

8.2.2.4 Verify that LED is OFF.

END OF SYSTEM 8 TEST

EXAMPLE

EXAMPLE

DATA SHEET 8.2.2					
STEP	PERFORM/VERIFY	Manual Pull Station (MS)			
		1-1	1-2	2-1	2-2
8.2.2.1	Lift wire				
8.2.2.2	LED is ON.				
8.2.2.3	Reattach wire				
8.2.2.4	LED is OFF				

EXAMPLE

EXCEPTION NO.	Project No.	ATP No.	Rev.
Recorded by	Organization	Date Recorded	ATP Page No.
Step No.	Requirement		

Description of Problem

Objector 1 (Name/Organization)	Objector 2 (Name/Organization)

Planned Action

Action Taken

SAMPLE

RETEST EXECUTION AND ACCEPTANCE

Retest Installation Contractor	Date	Recorder	Date
Witness 1 (Name/Organization)	Date	Witness 2 (Name/Organization)	Date
Field Engineering	Date	Test Director (Name/Organization)	Date
Design Engineering (Author of ATP)	Date	A-E Project Engineer	Date

APPROVAL AND ACCEPTANCE – OPERATING CONTRACTOR

☐ Retest Approved and Accepted ☐ Exception Accepted-as-is* ☐ Other*

* Explanation

Approver 1	Date	Approver 2	Date
Approver 3	Date	Approver 4	Date

KEH-428 (6-86)

END OF APPENDIX
C-15

APPENDIX D

Hanford Plant Standard Design Criteria

SDC-1.2	Hanford Plant Standards and National Codes and Standards
SDC-1.3	Preparation and Control of Engineering and Architectural Drawings
SDC-3.2	Minimum Depth of Underground Water Lines
SDC-4.1	Design Loads for Facilities
SDC-5.1	Heating, Ventilating and Air Conditioning
SDC-7.2	Outside Lighting and Aerial Distribution
SDC-7.4	Underground Power Distribution
SDC-7.5	Interior Power and Lighting
SDC-7.7	Communication, Signaling and Low Voltage control Systems
SDC-7.8	Fire Alarm Systems
E-12-1	Typical Hanford Plant Standard, Electrical System Grounding for Buildings

SDC-1.2

HANFORD PLANT STANDARDS AND NATIONAL CODES AND STANDARDS

This Section consists of 2 pages

Description of Revision Updated Sections A.3, B, and C		HANFORD PLANT STANDARDS DOE - RICHLAND, WASHINGTON	Number
Prepd/or Rev. by 12-14-83	Orig. Issue Date 6-11-68	GENERAL DESIGN CRITERIA	SDC-1.2
Approved R.W. Brown DOE	Date 12/14/83	HANFORD AND NATIONAL CODES AND STANDARDS	Revision No. 11

A. HANFORD PLANT STANDARDS

1. Hanford Standard Criteria, Drawings, Specifications, and Guides are contained in several volumes as shown on the Preface and Index pages of each volume. Each volume includes an index to that volume only.

2. Hanford Standards books, or separate copies of any Hanford Standard, are available from, and are issued to authorized personnel by Engineering Files, Federal Building, by means of a properly executed Reproduction Order.

3. For work designed for performance by the on-site cost type construction contractor, Hanford Standards should be used by direct reference. Reference shall be by number, revision number and title, and, when only a portion of the Standard applies, the applicable portion shall be identified: for example, Hanford Standard AC-5-3, Rev 7, Single Post Marker or Guard Post, Type II. Revision numbers shall not be included in construction specifications. For work designed for performance by a firm fixed price (FFP) contractor, Hanford Standards shall be incorporated directly into the contract drawings and/or specifications. There shall not be any HPS referenced on FFP construction drawings and specifications.

4. Requirements of national codes, standards, and specifications are in many cases modified, made more restrictive, or additional requirements imposed by Hanford standards.

5. The Hanford Standard Guides contain generalized engineering information and are advisory only.

6. Hanford Plant Standard Specifications are numbered as follows:

Mechanical Specifications	HPS-100 to 199-M
Electrical Specifications	HPS-300 to 399-E
Instrument Specifications	HPS-400 to 499-I
Arch-Civil Specifications	HPS-500 to 599-AC

7. Revisions to Hanford Plant Standards are numbered consecutively (1, 2, 3, ---). An original issue is Revision 0. Thus, a complete description of a Standard Specification would be HPS-331-E, Rev 3.

B. NATIONAL CODES AND STANDARDS (References)

1. The National Bureau of Standards Miscellaneous Publication 288, Directory of United States Standardization Activities, is a complete listing and description of national organizations who

contribute to the development of standards. It includes over 200 associations, societies, and agencies engaged in some form of engineering standards work.

2. A library of national standards is maintained in the Federal Building by the on-site Architect-Engineer. Standards publications, as well as various other handbooks, textbooks, and reference material, are available for temporary loan to Hanford personnel. Catalogs and indexes to publications of most national standards organizations are maintained in the library. Standards material not in files which pertains to Hanford interests will be procured promptly upon request.

3. References to national standards shall be made by number and title; for example, ASTM A53, Welded and Seamless Steel Pipe. References to the American National Standards Institute shall be by full name, American National Standard C80.1; or the abbreviation, ANSI C80.1 to avoid confusion with the American Nuclear Society (ANS). If only selected parts of a standard are to be referenced, the specific chapters, sections, or paragraphs shall be clearly identified.

4. The latest edition of all codes and standards in effect at the time of design effort shall be used unless there is a particular reason for an earlier issue. However, the statement "latest revision" following a referenced standard shall not be used in construction or procurement specifications.

C. NATIONAL STANDARDS REFERENCED IN DOE ORDERS

1. The DOE Orders contains numerous references to national standards. Orders of particular importance to engineering design are as follows:

   a. DOE Order 6430, General Design Criteria for Department of Energy Facilities

   b. DOE Order 5480.1A, Environmental Protection, Safety, and Health Protection Program for DOE Operations

   c. RL Supplement 5480.1, Environmental Protection, Safety Health Protection Program for Richland Operations

   d. DOE Order 5300.1A, Telecommunications

   e. DOE Order 5480.1A, Chapter XII, Prevention, Control, and Abatement of Environmental Pollution

   f. DOE Order 5632.1, Physical Protection of Classified Matter

2. As used in the DOE Orders with reference to national standards, the terms "basic", "prescribed", "shall be", and "must be", indicate that the requirements of the reference are mandatory as the minimum acceptable. The terms "recommended", "should be", and "may be", are recommended for adherence, or are to be used as acceptable guidelines.

SDC-1.3

GENERAL DESIGN CRITERIA

PREPARATION AND CONTROL OF

ENGINEERING AND FABRICATION DRAWINGS

CONTROLLED COPY

This Section consists of 18 pages plus appendix.

Description of Revision		HANFORD PLANT STANDARDS DOE - RICHLAND, WASHINGTON	Number
GENERAL REVISION			
Prep. or Rev. by P A Harman	Orig. Issue Date 10/18/74	GENERAL DESIGN CRITERIA	SDC-1.3
Approved J Williams DOE	Date 2/27/90	PREPARATION AND CONTROL OF ENGINEERING AND FABRICATION DRAWINGS	Revision No. Rev. 6

TABLE OF CONTENTS

A. DRAWING CATEGORIES

B. DRAWING SIZE

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F. COMPUTER AIDED DRAFTING

G. TITLE BLOCK

H. REVISIONS

I. REFERENCE BLOCK

J. DRAWING TRACEABILITY LIST

K. PARTS LIST

L. CLASSIFIED AND SENSITIVE DRAWINGS

M. SUPERSEDED, VOIDED DRAWINGS AND TITLE BLOCK CHANGES

N. DRAWING CONTROL

O. REFERENCES

Appendix A. Drawing Index Numbering System

PREPARATION AND CONTROL OF ENGINEERING AND FABRICATION DRAWINGS

This Standard covers the preparation and control of Engineering and fabrication drawings for Hanford facilities.

A. DRAWING CATEGORIES

1. General

a. Drawings fall under two categories, the "SK" and "H" series drawings. These series consist of conceptual, modification, prototype, construction, fabrication and non-fabrication drawings, which in turn include different types of drawings (e.g., arrangement, assembly, detail, schematic, wiring diagram, block diagram, flow diagrams, installation, layout, plot plan, P&ID, loop sheets, envelope, altered item, etc.). This list of drawing types is not restrictive and other types not identified may be used if necessary.

b. "SK" or "H" drawing numbers shall be issued and controlled by the Records Storage/Retrieval and Microfilming Group.

c. "SK" or "H" designation shall be assigned by the originator in accordance with this criteria.

2. H- Series Drawings

H- series drawings shall be prepared to depict permanent installation of facilities, hardware and equipment. These drawings are permanent records; as such they may be subject to as-built requirements upon completion of construction or fabrication.

3. SK- Series Drawings

SK- series drawings shall be prepared as temporary drawings and shall depict:

a. experimental equipment

b. limited use test equipment

c. limited use interface information (i.e., Conceptual Designs, etc.)

d. short-term application (i.e., temporary changes in design to facilities, hardware and/or equipment)

e. design criteria to equipment vendors

SK- series drawings shall not be used for permanent records. If the SK- is used for a prototype which is incorporated into a

permanent facility, it shall be "As-Built" and renumbered as an H- drawing (see Section L).

NOTE: SK numbers shall NOT be changed to H numbers by changing the SK to H; complete new numbers are assigned.

SK drawings used for conceptual designs or to convey design criteria to equipment vendors shall be identified as conceptual or Vendor Information using 1/4 inch lettering immediately above the title block.

4. Drawings depicting the final design of vendor supplied equipment may be required by procurement documents to be assigned H- series numbers and to be prepared in accordance with this criteria. Such drawings not assigned H- series numbers may utilize the vendor's numbering system and shall be certified by the vendor as "As-Built" and shall be assigned a vendor information (VI) number and shall reside in the VI file maintained by the Record Storage and Microfilming Group.

B. DRAWING SIZE

1. Five standard sheet sizes, listed below, shall be used for drawings in accordance with ANSI Y 14.1-1980. The 'F' size drawing is the preferred size.

Size	Dimensions in inches
A	8-1/2 x 11
B	11 x 17
C	17 x 22
D	22 x 34
F	28 x 40

C. DRAWING MATERIAL

1. Manually drafted drawings shall be made on 4 or 5 mil polyester drafting film, matte both sides, with 8 x 8 per inch, blue nonreproducing cross section grid, 8th lines heavy.

2. The CAD drawing material shall be 3 mil minimum drafting film, matte on one side, or 100% rag vellum, 17 pound minimum.

D. DRAWING ARRANGEMENT

1. The general drawing arrangement shall conform to ANSI Y 14.1-1980, except for the location of the parts list or list of materials and the revision block. Additional spaces have been reserved for Hanford unique items.

2. All drawings, including continuation sheets (multiple sheet) shall have a complete title block (see Section G. Title Block)

3. Drawing components when required, shall be arranged as shown in Figure 1 and as defined in this criteria.

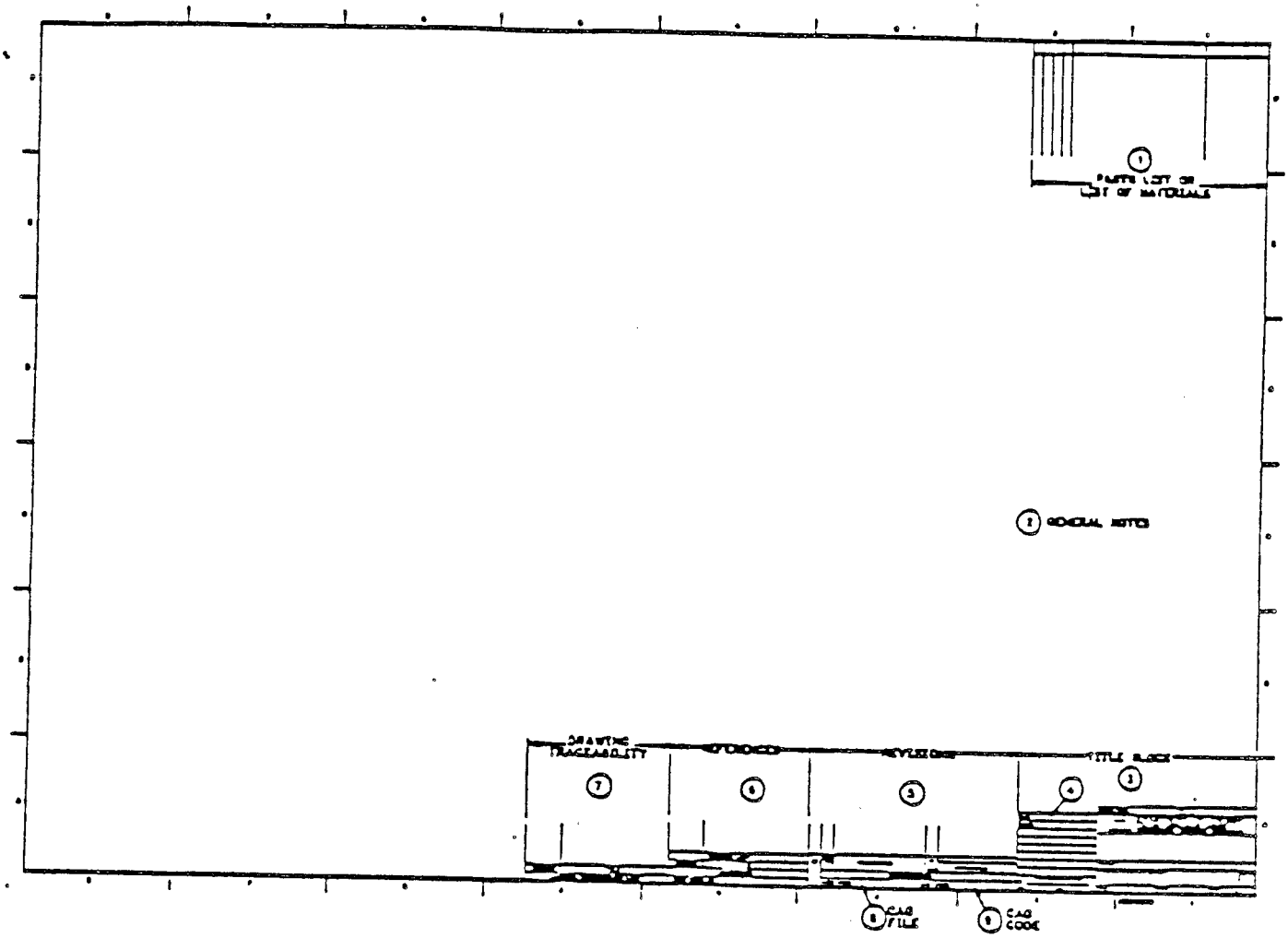

Figure 1. Drawing Arrangement.

(1) PARTS LIST OR LIST OF MATERIAL

Parts lists or lists of material shall be utilized on fabrication and assembly drawings, when appropriate. Parts lists may be arranged according to individual contractor procedures and Section K, below. Suggested width of Parts Lists having one quantity column is 7-1/2 inches; added columns may be used as necessary.

(2) GENERAL NOTES

Location indicated is the preferred position, but another location may be used if parts list or drawing geometry extend into this area. On multiple sheet drawings general notes start on sheet 1 but may be continued on subsequent sheets.

(3) DRAWING STATUS MARKING (OPTIONAL)

This space is reserved for tracking drawing status from initiation to release in accordance with individual contractor procedures.

(4) TITLE BLOCK

The title block shall be sized and configured as indicated in Section G, Title Block.

(5) REVISIONS

The revision block is sized and configured as indicated in Section H, Revisions.

(6) REFERENCES

See Section I, Reference Block.

(7) DRAWING TRACEABILITY (OPTIONAL)

A drawing traceability list is utilized according to individual contractor procedure and shall be configured as indicated in Section J, Drawing Traceability List.

(8) CADFILE

The Computer Aided Design File (CADFILE) designator is a unique file identification code which is assigned to each CAD data set to allow cross-referencing of CAD plots to specific data sets. The CADFILE designator shall be placed on all CAD data sets prior to plotting and shall be located according to Section D of these criteria. The designator shall consist of eight (8) characters and shall be formatted as indicated below. Nine (9) characters are permitted for drawings with numbers containing six (6) digits when two alpha characters are required to designate the sheet number and when the drawing is generated on equipment that allows a nine character file name.

EXAMPLES:

H-2-27918, SH 7	H-5-498, SH 32
B027918G - OK CADFILE	E00498JA - OK CADFILE
B27918G - BAD CADFILE	E0498JA - BAD CADFILE

H-4-176541, SH 28
D176541EA - OK CADFILE on systems with 9 character capacity
D176541E - BAD CADFILE cannot be done on systems imposing an 8 character limit.

WARNING!!! DATA SETS WITH 9 CHARACTER CADFILE NUMBERS ARE NOT TRANSFERABLE TO SYSTEMS WITH 8 CHARACTER LIMIT.

CADFILE designators shall be established in accordance with the following convention:

X XXXXXX X

SHEET NUMBER Sheet numbers 1 through 23 are identified by a single alpha character corresponding to the sheet number in the first number column of the Drawing Sheet Identification Convention matrix below. A second alpha character is required to identify sheets 24 through 529. This two-letter identifier is established by locating the sheet number in the matrix, establishing the first letter from the vertical alpha on the left and the second letter from the horizontal alpha at the top. This left identifier will be used on all systems for drawings having numbers of 5 or less digits. File naming limitations (8 characters) imposed by some systems make it impossible to identify drawings with 6 digit numbers and 24 or more sheets using this system. If more than 23 sheets are required for a drawing with a 6-digit number on systems so limited additional drawing numbers shall be utilized.

DRAWING NUMBER (Minus area designator, ie H-2, etc) The drawing number generally includes six (6) digits. Leading zeros are used when a drawing number is less than 6 digits. An exception is made when the drawing number is 5 digits and the drawing consists of more than 23 sheets. In this case the sheet number code consists of 2 alpha characters and the drawing number may be 5 digits.

AREA DESIGNATOR The area designator is an alpha character assigned based on the first 2 or 3 characters of the drawing number used to identify a drawing with a particular area or facility. Area designators are assigned from the following:

Alpha Character	Area Designator
A	H-1
B	H-2
C	H-3
D	H-4
E	H-5
F	H-6
G	H-7
H	Hanford Plant Standards
I	Not Used
J	H-8
K	H-9
L	H-11
M	H-12
N	SK-12
O	Not Used
P	SK-11
Q	SK-8
R	SK-7
S	Not Used
T	SK-6
U	SK-5
V	SK-4
W	SK-3
X	SK-2
Y	SK-1
Z	Reserved for non-released standard Hanford data sets.

DRAWING SHEET IDENTIFICATION CONVENTION MATRIX

		A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y
A.	1	24	47	70	93	116	139	162	185	208	231	254	277	300	323	346	369	392	415	438	461	484	507
B.	2	25	48	71	94	117	140	163	186	209	232	255	278	301	324	347	370	393	416	439	462	485	508
C.	3	26	49	72	95	118	141	164	187	210	233	256	279	302	325	348	371	394	417	440	463	486	509
D.	4	27	50	73	96	119	142	165	188	211	234	257	280	303	326	349	372	395	418	441	464	487	510
E.	5	28	51	74	97	120	143	166	189	212	235	258	281	304	327	350	373	396	419	442	465	488	511
F.	6	29	52	75	98	121	144	167	190	213	236	259	282	305	328	351	374	397	420	443	466	489	512
G.	7	30	53	76	99	122	145	168	191	214	237	260	283	306	329	352	375	398	421	444	467	490	513
H.	8	31	54	77	100	123	146	169	192	215	238	261	284	307	330	353	376	399	422	445	468	491	514
J.	9	32	55	78	101	124	147	170	193	216	239	262	285	308	331	354	377	400	423	446	469	492	515
K.	10	33	56	79	102	125	148	171	194	217	240	263	286	309	332	355	378	401	424	447	470	493	516
L.	11	34	57	80	103	126	149	172	195	218	241	264	287	310	333	356	379	402	425	448	471	494	517
M.	12	35	58	81	104	127	150	173	196	219	242	265	288	311	334	357	380	403	426	449	472	495	518
N.	13	36	59	82	105	128	151	174	197	220	243	266	289	312	335	358	381	404	427	450	473	496	519
P.	14	37	60	83	106	129	152	175	198	221	244	267	290	313	336	359	382	405	428	451	474	497	520
R.	15	38	61	84	107	130	153	176	199	222	245	268	291	314	337	360	383	406	429	452	475	498	521
S.	16	39	62	85	108	131	154	177	200	223	246	269	292	315	338	361	384	407	430	453	476	499	522
T.	17	40	63	86	109	132	155	178	201	224	247	270	293	316	339	362	385	408	431	454	477	500	523
U.	18	41	64	87	110	133	156	179	202	225	248	271	294	317	340	363	386	409	432	455	478	501	524
V.	19	42	65	88	111	134	157	180	203	226	249	272	295	318	341	364	387	410	433	456	479	502	525
W.	20	43	66	89	112	135	158	181	204	227	250	273	296	319	342	365	388	411	434	457	480	503	526
X.	21	44	67	90	113	136	159	182	205	228	251	274	297	320	343	366	389	412	435	458	481	504	527
Y.	22	45	68	91	114	137	160	183	206	229	252	275	298	321	344	367	390	413	436	459	482	505	528
Z.	23	46	69	92	115	138	161	184	207	230	253	276	299	322	345	368	391	414	437	460	483	506	529

(9) CAD CODE

The CAD Code shall be placed on each CAD data set near the CAD File before the CAD drawing is plotted and will be referred to by CAD Operations personnel to control the migration of CAD data sets across systems used at Hanford. The CAD Code will contain the following information: The contractor and area, type of hardware, type of graphic software, and the revision of graphic software with a colon (:) used to distinguish each field of information. The format shall be as follows: (Identifiers may be added to the CAD Code System by Application to the SDC-1.3 Technical Committee; 3-10-L, TCPC, 1100 Area).

XX : XXX : XXXX : X . XXX : XX

Font Designator

- The font set designation shall be two (2) characters.
- 1st character shall be the line font designator.
- 2nd character shall be the text font designator.
- The font set designator shall be as follows:

S = Standard (vendor supplied)

N = Nonstandard (contractor generated)

Revision of Graphic Software

- Number of characters as required

Type of Graphic Software

- 4 Characters Max.
- ACDX (AutoCAD)
- DDMX (Calma)
- EGSX (Hewlett Packard)
- GEOX (Calma GEODRAW)
- M10X (Hewlett Packard)
- M30X (Hewlett Packard)
- (FUTURE)

Fourth character shall be a "2" or "3" to indicate 2 or 3 dimensional drawing generation.

Type of Hardware

- 3 Characters Max.
- APL (Apollo)
- DEC (VAX)
- HP (Hewlett Packard)
- IBM (Including IBM Compatible)
- (FUTURE)

Contractor and Area of Current Residence

1 - Operations Engineering Contractor	A - 100 Area	G - 700 Area
2 - Engineer/Construction Contractor	B - 200E Area	H - 800 Area
3 - Research and Development Contractor	C - 200W Area	J - 1100 Area
4 - Site Computer Services Contractor	D - 300 Area	K - 3000 Area
5 - Fixed Price Contractor	E - 400 Area	L - Offsite
	F - 600 Area	

E. DRAFTING PRACTICE

1. Drafting practices shall be in accordance with ANSI Y 14 series or other industry accepted drafting practices and the requirements of this criteria.

2. Abbreviations shall conform with ANSI Y 1.1 except for the cases where commonly accepted industry or specific discipline usage dictates a deviation from ANSI Y 1.1. Common abbreviations, such as TYP and REF, may be used at all times. Unusual abbreviations shall be used only when space is limited. Hanford Site specific abbreviations and acronyms shall be clearly defined on the design media.

3. Symbols contained in Hanford Plant Standard Design Guides shall be used when available. (A series of symbol library design guides is currently in development.) Discipline Specific symbols (i.e., Electrical, Instrumentation, Piping, etc.) other than those contained in the Design Guides may be used only if they have been submitted to the Hanford Standard Drawing and Specification Technical Committee for possible inclusion in the HPS DG. Submittals shall be made through the individual contractor's representative to the Technical Committee.

4. Drawings shall be prepared so that prints are legible when reduced on microfilm and then re-enlarged. As an example, parallel lines shall be spaced at least 1/16 inch apart to maintain distinction.

5. Where 20 or more drawings are prepared for a single project, a list of all drawings shall be made on a separate sheet showing the drawing number, index number(s) and drawing title. The drawing list shall be the first drawing in the project set. For between 10 and 20 drawings, a list shall be placed on the first drawing of the set. For multi-sheet drawings, the number of sheets shall be shown without repeating the rest of the information (e.g., H-1-12345, 6SH). Building numbers shall be included in drawing list when more than one building is involved in the project.

6. Lettering shall be all upper case gothic except where lower case is standard (e.g., Na, Km, g). Letters and figures shall be at least 1/8 inch high; see ANSI Y 14.2M for recommended shape.

7. If typing is utilized on the drawings, it shall be all upper case of a bold, Gothic style and lines of type shall be a minimum of 1-1/2 spacing. In no case shall type be used with letter height of less than 0.1 inch.

8. A north arrow shall be placed on all maps, plans, layouts and other drawings where applicable. North shall generally be oriented to the top or left side of the sheet. All plans on a given set of drawings should be oriented the same and should match the existing plant drawing orientation.

9. The grid system used shall be identified on Site drawings. The coordinate grid system is assumed to be Hanford Plant grid unless noted otherwise on the drawing.

10. Each drawing shall, as a minimum, show the project number, where applicable, and the names of the originator and the checker. The exception would be illustrations or figures in documents such as a Functional Design Criteria, an Engineering Study or an Engineering Change Notice.

11. Prior to submittal to another authority for approval each drawing shall be independently checked and shall be approved by the cognizant engineer. Each sheet shall be treated individually for checking and approval purposes, for initial release, and for revisions.

12. Preprinted drafting film may be supplied to offsite companies. For large jobs, the offsite company may be permitted to use drafting film with the company name preprinted in the title block. Offsite companies using plant supplied drafting film shall place the name of their firm in the title block, replacing the existing company name.

F. COMPUTER AIDED DRAFTING

1. Identifier

The CAD-generated drawings shall have CADFILE and CADCODE identifiers. These identifiers shall be located below the revision block and within the border lines of the drawing. The location of the CADFILE and CADCODE identifiers is shown as Items 8 and 9 in Figure 1, Section D.

2. Manual Modifications or Revisions of CAD-Generated Drawings

Manual changes or alterations to a CAD-generated drawing should be avoided. If an issued CAD-generated drawing is changed or altered manually, the CAD data set(s) shall be updated in accordance with normal contractor procedures. Obtaining approval signatures is not considered a change or alternation.

Drawings manually changed or altered shall have a single horizontal line drawn through the CADFILE and CADCODE identifiers. This signifies that the drawing has been manually updated and the data set(s) may not be up-to-date.

If data set(s) are lost or no longer exist and will not be replaced, the CADFILE and CADCODE identifiers shall be removed from the vault retained drawing(s) at the next manual revision.

G. TITLE BLOCK

1. Title blocks are to be in conformance with ANSI Y 14.1-1980. Contents identified in the title block shall be modified to accommodate Hanford Site requirements and individual contractor approval procedures. (see Figure 2 for typical title block).

2. Information shall be entered in the numbered blocks as follows:

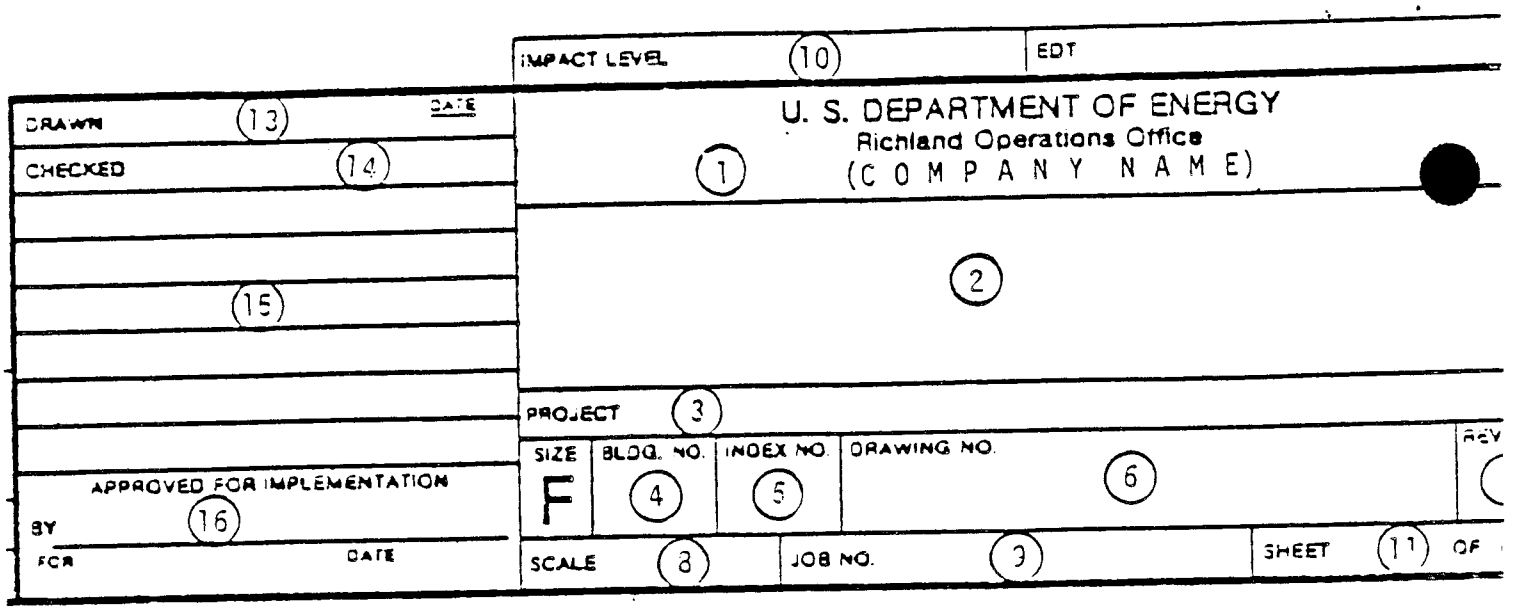

Figure 2. Title Block

(1) FIRM NAME

(2) DRAWING TITLE

a. The title is to be brief but clearly identify the subject matter.

b. The title is not to include the project or building number and includes the area number only for area-wide presentations.

c. The total number of characters including spaces shall not exceed 60.

d. Height of the lettering in the title shall be approximately 3/16 to 1/4 inch.

e. The title shall be arranged in one, two or possibly three lines centered in the block. All sheets, of multiple sheet drawings, shall have the same title, except that the last line of the title may differ to describe the contents of each sheet.

f. The same title shall not be used on more than one drawing of a given project unless different buildings are involved. If drawing content is the same for two or more sheets, a multi-sheet drawing is appropriate.

(3) PROJECT (where applicable)

The official project title preceded by the project number shall be utilized where applicable. Smaller jobs may have "project titles" assigned. Project titles shall be identified on all drawings in a set. Abbreviations may be used.

(4) BUILDING NUMBER

Existing Hanford building numbers are shown in Specification HW-5000, Building and Structure List. Numbers for new facilities are maintained by Records Storage/Retrieval and Microfilm Group. Building numbers shall be assigned prior to drawing approval. Where applicable a drawing may show two or more building references. The references shall be separated by a slash, (e.g., 405/409).

(5) INDEX NUMBERS

Index numbers are listed in Appendix A, "Drawing Index Numbering System." A number shall be used for each major category and is required on each drawing. Nonessential numbers are not shown (e.g., 0801 and 0802 are not shown along with 0800 on a single drawing). Numbers shall be assigned to accurately represent drawing content. Multiple index numbers shall be separated by a slash (e.g., 3900/7301).

Offsite A-E's obtain building, index and drawing numbers from the appropriate contractor's Project Manager or Engineer.

(6) DRAWING NUMBER

The drawing number shall be 1/4 to 3/8 inch high. Numbers are obtained from Records Storage/Retrieval and Microfilm Group.

(7) REV

Current revision number shall be used. 0 shall be used for initial release.

(8) SCALE

When the entire drawing is to the same scale, the scale shall be shown in this block. The word SHOWN shall be used where more than one scale appears on the sheet. The word NONE shall be used where a scale is not applicable (schematics, flow diagrams, etc.).

(9) JOB NO (OPTIONAL)

The job number is assigned in accordance with individual contractor procedures to identify drawings prepared for a common effort or project. May be utilized to identify a funding source.

(10) IMPACT LEVEL (OPTIONAL)

May be utilized to identify impact level of equipment or facility presented in accordance with individual company procedure.

(11) SHEET

For single sheet drawings, a 1 shall be entered. For multisheet drawing, the sheets shall be numbered in sequence starting with 1.

(12) OF

Enter total number of sheets. For single sheet drawings, a 1 shall be entered.

(13) DRAWN

The initials and surname of the originator shall be written or printed in an individualistic style as long as they are legible.

(14) CHECKED

The initials and surname of the checker shall be written and shall be legible.

(15) APPROVALS

Used for typical company internal approval. The content may be modified. The signatures shall include the initials and surname and must be legible. Approval signatures on CAD Generated Drawings may be placed adjacent to or above pre-printed names, where applicable.

(16) APPROVED FOR IMPLEMENTATION (AS APPLICABLE)

The authorizing organization's identification shall be entered (normally an Operating Contractor) following his signature. This signature provides authorization to proceed with construction, procurement, or fabrication.

(17) ENGINEERING RELEASE (AS APPLICABLE)

An authorized document number used to identify the formal release of a drawing.

H. REVISIONS

1. A revision block shall be sized in accordance with Figure 3 and located in accordance with Figure 1. Content may be modified according to individual contractor procedures.

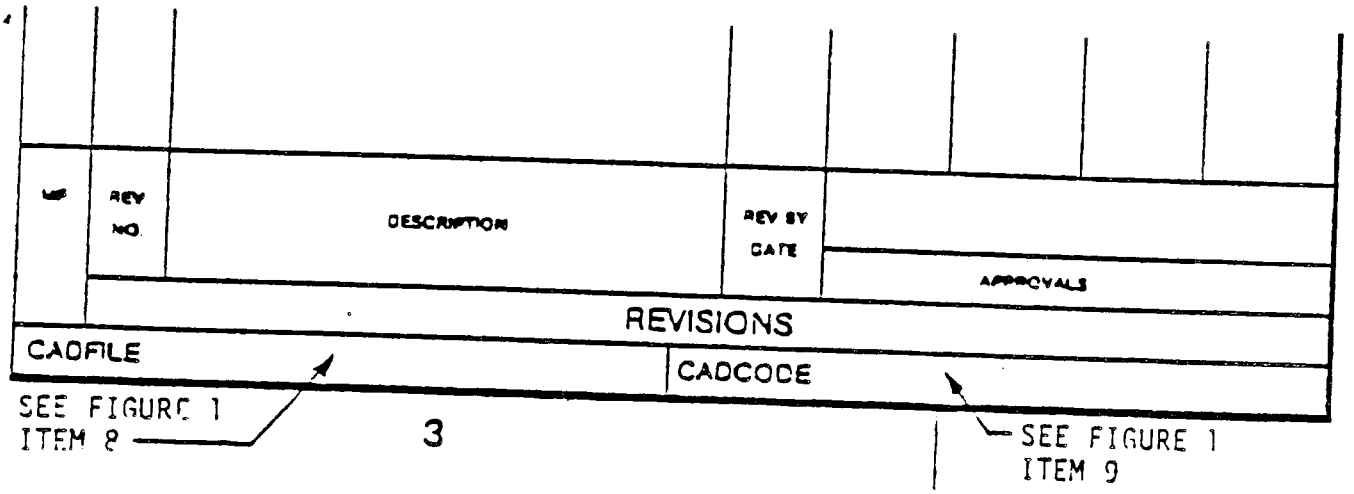

Figure 3. Revision Block.

2. Each new revision shall be listed in numerical sequence. Only Released (issued) drawings can be revised and each subsequent revision shall be released and microfilmed before another revision can be made. Latest revision number shall also be shown (see Figure 2).

3. A concise description of each revision shall be written in the past tense or the authorizing document noted. Each item shall be preceded by a lower case letter in parenthesis and ended with a drawing coordinate or zone (Z) number to facilitate location. Revisions of a general or self-explanatory nature need not have zone or prefix numbers. If a revision is made by an authorizing document, the revision description shall show the document number (ECN, EO, DC, etc.). Conservation of space is essential, therefore ANSI abbreviations shall be normally used to the best advantage.

4. If individual contractor procedures require identification of the location of the revision, a triangle with 3/8 inch sides, containing the current revision number shall be drawn as close as possible to the drawing change. The number shall include the lower case letter when applicable (e.g., 1a or 2). To further assist in locating revisions on complex drawings, the revised area may be encircled by a "cloud" drawn on the back of the drawing.

   During a subsequent revision, the "cloud" shall be removed, but the triangle may remain. Triangles from prior revisions shall be deleted.

5. The revision triangle shall not be used where the possibility of confusion with drawing symbols is likely. It is never used in the title block.

6. "As-Built" revisions reflect the actual completed installation as obtained from field inspection or appropriate contractor documentation. The statement "as-built" is entered in the description column.

7. "General" revisions shall be used on plant key maps, or other reference type drawings and drawings with extensive revisions. It is not required to delineate the changes and, therefore, revision triangles are not shown on the drawing. Current revision approval requires signature approval by appropriate authorities. Initials may be used in place of signatures provided that they are handwritten by the person approving the revision.

8. Approvals shall be per individual contractor procedure. CAD developed drawings require all previous approval signatures to be printed in the appropriate spaces.

9. The letter "M" shall be stamped to the left of the Rev column by Records Storage/Retrieval and Microfilming Group to signify that the drawing has been microfilmed for the current revision.

10. Previously approved and microfilmed revisions may be removed from the drawing when additional space is required. The removal of the revisions shall be noted in the current revision description (i.e., Removed previous revisions 1 through 5, etc.).

I. REFERENCE BLOCK

This block shall be used to list reference documents necessary for the completion of the work depicted on the drawing.

1. For Conceptual or Preliminary Design drawings, the reference documents used in preparation may be listed (Figure 4).

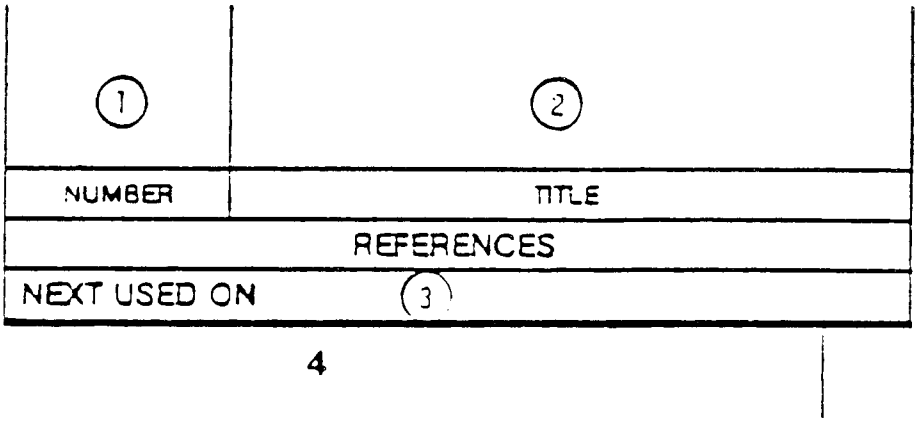

Figure 4. Reference Block.

2. For Definitive Design drawings, only the reference documents required by the construction/fabrication contractors shall be listed. National consensus standards shall not be listed. Existing equipment shall be referenced by VI (previously identified as CVI or BPF) number when such exists.

(1) Number

The identifying number of the reference document shall be entered in this column.

(2) Title

The actual, abbreviated or condensed title of the reference document shall be entered in this space.

(3) Next Used On

This space is provided for those cases where it is applicable to link together certain drawings such as subassembly, detail and installation drawings. Drawings shall be linked by referencing the next level or generation up (i.e., a subassembly drawing will list the number of the assembly or installation drawing). Drawing list numbers shall not be placed in this space.

J. DRAWING TRACEABILITY LIST

Existing drawings which are modified by the work depicted on a drawing are entered into the drawing traceability list (see Figure 5). These drawings are not required for the construction or fabrication and are not included in the reference drawing list.

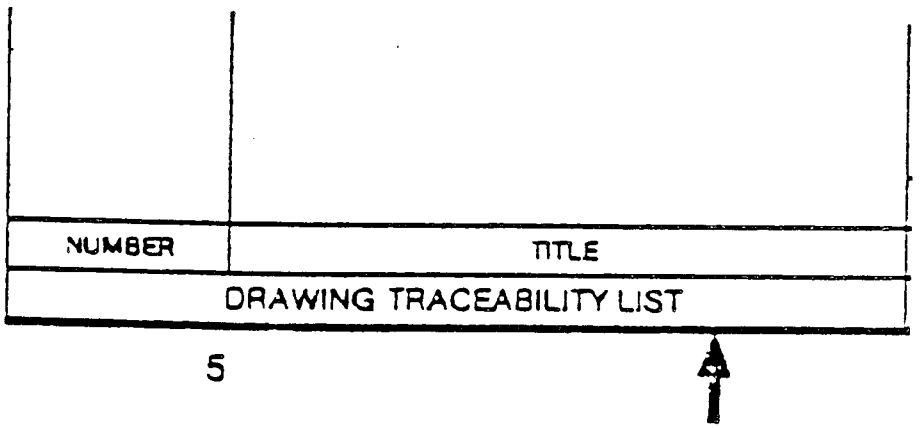

Figure 5. Drawing Traceability List.

K. PARTS LIST

1. Parts List and configuration shall be governed by individual company practices.

2. The Parts List shall contain all material and separable components on the drawing. The individual pieces of weldments, or other nonseparable assemblies, are not normally numbered separately.

3. Effort should be made to arrange the Parts List in a numerical order of importance (i.e., assembly, subassembly, detailed parts, catalog items, etc.). It is not necessary to rearrange the Parts List merely to add an additional entry.

4. Each arrangement, assembly, subassembly and detail shall have a separate and different part number. Parts that are not physically and functionally interchangeable shall have different part numbers.

5. Quantities shall be counted accurately and shown in customary trade units.

6. AR (as required) shall be used where the quantity is not known or where the quantity could vary.

7. A generic name of the item shall be listed first with supplemental descriptive words following. The description of a item shall be as complete as possible, and in accordance with accepted industry standards. If the item can be completely described in the parts list, it shall be placed there. Where the description is too lengthy to fit into that space, it shall be placed near the detail or in the NOTES, and referenced in the description column (e.g., SEE DETAIL FOR DESCRIPTION). The complete description shall be stated in one place only, not split in two or more locations.

L. CLASSIFIED AND SENSITIVE DRAWINGS

When classified or sensitive information is to be contained on any version of a drawing, an Authorized Derivative Classifier (ADC) shall review and determine the Classification Level (Top Secret, Secret and Confidential) and the Category (Restricted Data, Formerly Restricted Data, National Security Information) of the drawing. Classification questions should be referred to the Classification Office. The originating organization shall mark the drawing to reflect the Classification Level and Category; contact the Classified Files or Document Control organization to establish accountability as required; and, protect the document in accordance with security and document handling requirements.

M. SUPERSEDED, VOIDED DRAWINGS AND TITLE BLOCK CHANGES

When official approved "H" or "SK" series drawings are superseded, voided or when a building, index or drawing number is changed, a Drawing Number Change Notice (Form BD-9300-051, Figure 6) shall be completed. The completed form is to accompany the drawing(s) that have been changed in accordance with this criteria and sent to Records Storage/Retrieval and Microfilming Group. All drawings involved must accompany the form after having been prepared as follows:

1. Superseded by a drawing with a different drawing number.

   a. For the superseded drawing - Print SUPERSEDED BY DWG _____ near the title block using 1/4 inch high letters. Sign name and date below note. (Superseded drawings are removed from the active data base.)

b. For the new drawing - Complete the title block as for any new drawing. Add note near title block--SUPERSEDES DWG _____ in 1/4 inch high letters. Complete Form BD-9300-051, Drawing Change Notice, Figure 6.

2. Superseding an approved drawing with a drawing of the same drawing number.

(NOTE: A CAD revised drawing which replaces the CAD original tracing is not superseding a drawing with a drawing of the same number for the purpose of this requirement and thus no form BD-9300-015 is required.)

a. For the new drawing - Use the same drawing number and title. Print all original signatures and dates, such as draftsman, checker and approval signatures as appear on the superseded drawing. Add next higher revision number and omit all previous revisions. Add revision note (e.g., REDRAWN, GENERAL CHANGE OF DELINEATION or, REDRAWN DUE TO CONDITION OF ORIGINAL). Add signature of draftsman and date. Complete Form BD-9300-051, Figure 6.

3. Superseding a preliminary (unapproved) drawing with a drawing of the same drawing number.

a. For the superseded drawing - Destroy the original.

b. For the new drawing - Complete title block as for any new drawing. Form BD-9300-051 not required.

4. Voided Drawings

a. For the voided drawing - Print VOID near the title block. Sign name and date below. Complete Form BD-9300-051 (08-87), Figure 6. Deliver the original tracing with the completed form to Record Storage/Retrieval and Microfilming Group. (Voided drawings are removed from the active data base.)

DRAWING CHANGE NOTICE

To Engineering files Room 356 Federal Building	☐ Receiving Desk ☐ Tracing Vault ☐ Aperture Card File	E.O. Number Date of E.O.

The following change(s) made to:

☐ Drawing Number _____ Sht. _____ Date _____ Rev. No. _____ is VOIDED
Reason for Voiding _____ Project No. _____

☐ Drawing Number _____ Sht. _____ Date _____ Rev. No. _____
is superseded by
Drawing Number _____ Sht. _____ Date _____ Rev. No. _____ (new Original)

☐ Drawing Number _____ Sht. _____ Date _____ Rev. No. _____
Has been changed on same original to
Drawing Number _____ Sht. _____ Date _____ Rev. No. _____ (new Original)

☐ Drawing Number _____ Change index _____ To _____
Change Bldg _____ To _____

☐ Drawing Number _____ Title changed to _____

By	Authorized By	Contractor	Date

NOTE: Tracing(s) must accompany this form.

BD-9300-051 (08-87)

Figure 6. Drawing Change Notice.

5. Changed Drawing Numbers, Index Numbers or Building Numbers

Obtain new number. Remove the old number and add new number. Add the next higher revision number indicating the previous number in the description. Complete Form BD-9300-051, Figure 6. In addition, when a drawing number is changed, print FORMERLY DWG __(Old No.)__ in the vicinity of the title block using 1/4 inch high letters.

6. Changed Title

When it is necessary to change the title of an approved drawing, apply all rules applicable to drawing titles, add next higher revision number indicating previous title in the description and complete Form BD-9300-051, Figure 6. The completed form accompanies the revised original when it is submitted to Records Storage/Retrieval and Microfilming Group.

N. DRAWING CONTROL

1. Approved drawings shall be transmitted to Records Storage/Retrieval and Microfilming Group for reproduction, distribution, microfilming and storage.

2. The record copy of all engineering drawings is the silver halide microfilm aperture card. The original engineering drawing is a lifetime retainable document and requires special handling for retention and protection.

3. A list of persons authorized to retrieve approved drawings is provided to Record Storage/Retrieval and Microfilming Group by the respective company managements.

4. For DOE-RL managed projects, the DOE-RL Project Engineer shall approve the release of the design drawings for construction, by approving the operating contractor's document which releases the design drawings to Record Storage/Retrieval and Microfilming.

O. REFERENCES

1. American National Standards Institute

ANSI Y14 Series	Drafting Practices
ANSI Y1.1-1984	Abbreviation for Use on Drawings and in Text

APPENDIX A

DRAWING INDEX NUMBERING SYSTEM

A. GENERAL

The Drawing Index is a system of numerical digits to identify drawings for storage and retrieval. The drawing file is maintained by Record Storage/Retrieval and Microfilming Group, Federal Building, room 356, Richland, Washington. All drawings for work shall be indexed in accordance with this system and the number shown on the Title block of drawings before drawings are released and before reproduction.

INDEX SYSTEM

The complete index number comprises 4 or 6 numerical digits: Two for the primary subject, 00 to 99; two for the secondary subject, 01 to 99, and two for the tertiary subject, 01 to 99. Thus an index number might be 0804 - Architectural Equipment Location, or 590315 - Instrumentation System, Wiring Diagrams, Safety Circuits.

1. Primary Subject

00	- Listing or Index
01 through 07	- Civil
08 through 14	- Architectural and Structural
15 through 58	- Mechanical
59 through 64	- Instrumentation
65	- Electronics
70	- Flow Diagrams
71 through 81	- Electrical
82	- Insulation and Heat Tracing
83	- Blank
84 through 88	- Piping
89	- Heating, Ventilating, and Exhaust
90	- Air Conditioning Systems
99	- Miscellaneous Equipment not Identifiable or Related to Assembled Equipment

2. The primary subjects are further divided into details or secondary subjects, e.g., 0804, Architectural Equipment Locations, or 7005, Piping and Instrument Diagram-CLS. The 04 and 05 digits are added to denote the details.

3. The tertiary subjects, containing two digits, are used only in conjunction with the primary subjects, 49, 50, 59, 60, and 85 to indicate the type of drawing.

* The complete 6 digit index number for a drawing showing a wiring diagram for safety circuits would be:

Instrumentation

Wiring Diagram

Safety Circuits

59 03 15

The number is written as 590315.

4. In some instances a drawing may contain two or more index categories, e.g., Cranes (3900) and Electrical Power Plans (7301), or it may apply to two buildings, e.g., 0405 and 4621E. In these instances, both index numbers and both building numbers shall be placed in the Title Block. For example:

   0405/4621E 3900/7301

5. Spare numbers are retained throughout the primary, secondary, and tertiary subject for future expansion. They are not to be used without approval of Record Storage/Retrieval and Microfilming group.

6. Additional index numbers will be assigned by Record Storage/Retrieval and Microfilming group as required.

7. The following pages of Appendix A are a listing of the index by subject (alphabetical index) and by number.

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Cathodic Protection-Plans, Elevations, Sections, and Details - Electrical	7801
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Ceramic Fuel Elements and Related Components - Mechanical	490030
Chambers - Instrumentation	60--57
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Chemical Storage - Instrumentation	59--30
Chemical Tanks and Piping - Mechanical	490118
Coextrusion Component and Billet Assembly - Mechanical	490220
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Communication-Junction Pull Boxes, Ducts (this series includes sound powered telephone and central station system telephones) - Electrical	7606
Communications-Panel Schedules, Equipment, and Devices - Electrical	7604
Communications-Plans, Elevations, Sections, and Details - Electrical	7601
Communications-Station Schedules - Electrical	7607
Communications-Wiring Diagrams (elementary, connections and inter-connections) Block Diagrams - Electrical	7602
Communications-Wire Run Lists, Conduit, Wire Schedules, Cables - Electrical	7605
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Concrete Structural-Elevations, Sections, and Details - Architectural	0901
Concrete Structural-Shop, Reinforcing and Pour Drawings - Architectural	0902

Concrete Structural-Penetrations, Sleeve and Blockout - Architectural	0903
Concrete Structural-Penetrations, Embedment Schedules - Architectural	0904
Concrete Structural-Demolition - Architectural	0905
Conductivity - Instrumentation	6008
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Electrical Control-Panel Schedules - Electrical	7504
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Electrical Control-Control Equipment and Devices - Electrical	7508
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Electrical Only-Pole Schedules - Electrical	8004
Electrical Only-Transformer Schedules (this series includes all electrical maps other than the "Civil" map series) - Electrical	8009
Electrical Only-Wiring Diagrams (elementary, connection and inter-connection) Area One-Line Diagram - Electrical	8002
Electrical-Outside Lines - Civil	0107
Electrical-General, Wiring Requirements - Electrical	7100
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Electrical-Maps, Plot Plans, Plans and Profiles, Plans, Elevations, Sections, and Details (includes substation structures) - Electrical	8001

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Civil

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0101	Area Key Maps
0102	Area Electrical Key Maps
0103	Topography
0104	Outside Lines-Water and Gases
0105	Outside Lines-Sewers and Piping
0106	Overhead Piping, Steam Condensate, Air, and Chemicals
0107	Outside Lines-Electrical
0108	Outside Lines-Telephone and Fire Alarm
0109	General Maps
0110	Layout or Plot Plans-General Facility
0111	Excavation and Finishing Grading
0200	Roads, Walks, Parking Areas, Fences, and Airport Runways-Details and Profiles
0201	Railroads-Plans, Details, and Profiles
0202	Railroad Structures and Details
0300	Overhead Lines-Piping-Including Steam, Air, Gas, and Acids
0301	Underground Sanitary Water-Piping
0302	Underground Process Water-Piping
0303	Sewer Lines-Sanitary
0304	Sewer Lines-Process
0305	Composite of Overhead and Underground Piping
0306	Underground Lines, Steam, Air, Gas, and Acids
0307	Fuel Oil Storage and Lines

Civil (Continued)

0308	Outside Lines-Steam, Air, Gas, and Acids
0400	Waste Disposal System-Sanitary: Septic Tanks, Tile Fields, Sewage Disposal Plant, Open Ditches, and Surface Drainage and Storm Drainage
0401	Waste Disposal Systems and Burial Grounds-Process: Cribs, Scavenging Impounding Areas and Waste Facility Maps
0402	Waste Storage-Tank Farms (including all drawings, except electrical and instrumentation and jumpers)
0403	Waste Line Encasements-Diversion Boxes and Related Components
0404	Sodium Disposal Area-Burial Grounds
0405	Waste Storage Process Underground Tanks
0500	Wells, Well Fields-Irrigation Ditches and Water Supply
0501	Miscellaneous Survey Data-Columbia River Data, Civil Data
0600	Rock Boring

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0800	Architectural-Plans-May include other 0800 Category
0801	Architectural-Elevations, Section and Details-Miscellaneous Steel for Stairs, Railing, etc.
0802	Architectural-Other (includes schedules, architectural equipment details, such as bins, signs, cabinets, laboratory equipment, etc.)
0803	Architectural Doors-Shielding-Windows
0804	Architectural-Equipment Locations
0900	Concrete Structural-Plans
0901	Concrete Structural-Elevations, Sections, and Details
0902	Concrete Structural-Shop, reinforcing and Pour Drawings
0903	Concrete Structural-Penetrations, Sleeve and Blockout
0904	Concrete Structural-Penetrations, Embedment Schedules
0905	Concrete Structural-Demolition

Architectural and Structural (Continued)

1000	Steel Structural-Plans, Details, Schedules, Equipment Supports, Platforms
1001	Steel Structural-Shop or Fabrication Drawings
1002	Steel Structural-Penetrations
1100	Steel Structural-Other Stop Logs, Underwater Doors, Trap Gates, Special Nonshield Doors, Allowable Floor Load Data
1101	Steel Structural-Bench Marks and Control

Mechanical

1500	Test or Special Purpose Reactor
1501	Production or Power Reactor
1502	Reactor Fuel Transfer
1503	Reactor Instrument Tree and Drive Mechanism
1504	Reactor Control Rod and Drive Mechanism
1505	Reactor In-Vessel Handling and Drive Mechanism
1506	Reactor Core Restraints
1507	Reactor In-Vessel Storage Model
1508	Reactor Outer Shield
1509	Reactor Inner Shield
1510	Reactor Ex-Vessel Fuel Handling Equipment
1550	Reactor Vessels-Arrangements Plans, Elevations, and Sections
1551	Internal Structural Component Including Reactor Head
1552	Internals, Nonstructural Items Excluding Controls and Fuel Associated Equipment
1553	Guard Vessel-Exterior Shields and Other Cavity Components
1575	Equipment Outline and Interface Requirement
1600	Moderator-Other than Graphite

Mechanical (Continued)

1601	Moderator-Graphite
1800	Shielding-Biological
1801	Shielding-Thermal
1802	Radiation Dose Rates
1900	Control Systems-Horizontal Rods
1901	Control System-Vertical Rods
1902	Control System-Poison
1903	Tools and Equipment for Horizontal Control Rods and Vertical Safety Rods Renovation
1905	Control Rods
1906	Control Rods, Ass'y Tooling and Handling Equipment
1907	Control Rod, Absorber, Drive, Disconnect
1909	Rods Safety (SR)
1911	Rods Scram (CR)
2100	Third Safety System-Ball 3X
2200	Process Tubes (This will cover all phases or process tubes from entry of water from common header to exit of water to common discharge header also tubes from point charging machine connects to the point that fuel is discharged.
2201	Tools and Equipment (necessary for installation or removal of process tubes and their associated parts. Includes tool dolly)
2202	Tools and Equipment for Process Tube Growth Correction
2204	Tools and Equipment for Decontamination
2205	Tools and Equipment for Overboring Program
2250	Poison Column and Associated Items
2300	All Test Equipment Where Operation of Pile is Essential to Operation of Test
2301	All Facilities Build into Pile for Testing Purposes

Mechanical (Continued)

2302	Containers for Disposal of Contaminated Equipment (does not include metal handling buckets and shipping casks)
2303	Experimental Test Facilities Excluding Fuel specimens
2400	Charging Machines
2401	Discharging and Manipulator for Rear Face Work
2450	Fuel Handling-Irradiated (Transfer, etc.)
2451	In-Vessel Fuel Handling Equipment
2452	Ex-Vessel Irradiated Fuel Handling Equipment
2500	Vessels, Columns, Tanks, Dissolvers, Heat Exchangers (no moving parts)
2501	Sodium Storage Tanks
2502	Waste Storage Tanks (contaminated waste)
2504	Gas Storage Tanks
2505	Sodium Processing Tanks
2600	Machines-Process: Agitators, Pumps, Scales, Pulse Generators (moving parts)
2700	Machines and Equipment (noncontaminated zones) Shop or General Purpose
2800	Cell Equipment Fastened to Cell for Mounting Vessels, Nozzles, Dunnage, Y Pads, etc.
2900	Reactor Gas Seal, Including Boots, Strips, etc.
2901	Gas Seal Tools
3000	Fire Protection Sodium Systems
3900	Cranes (all types)
3901	Elevators
3902	Material Handling Equipment such as Conveyors, Pallets, Monorail Systems, Casks, Buckets
4000	Power House Equipment (associated with steam generation)

Mechanical (Continued)

4050	Emergency Power Generation Equipment (Mechanical)
4100	Railroad Equipment and Rolling Stock (including cask car)
4101	Motor Vehicles and Modifications
4300	Mechanical Equipment for Treatment of Water (other than piping)
4500	Impact Wrenches
4501	Remotely Operated Connectors
4600	Samplers (process, air, stack, gas, etc.)
4700	Hoods, Caves, Enclosures (remotely Operated Equipment)
4701	Tools and Equipment Necessary to Operate Equipment in Hoods, Caves, and Enclosures
4702	Manipulators
4703	Testing Equipment-Destructive
4704	Testing Equipment-Nondestructive
4705	Equipment Located in Hoods, Caves, Enclosure where Operation is Remote
4706	Reactor Capsules-Metallurgical Tests
4727	Metallurgical Test materials, Destructive and Nondestructive
4750	Machines and Equipment-Contaminated Zones
4800	Laboratory Apparatus
4900	Fuel Element Production-General
490010	Aluminum Uranium Fuel Elements and Related Components-Caps, Spires, Cans, Sleeves, Cores, Hollow Pieces, or Perfs, Dummies, Spaces, Wafers, Self-Supports
490020	Zircaloy-Uranium Fuel Elements, Billets, and Related Components-Cores, Copper or Zircaloy Components, End Caps or Plates, Brazing Rings, Self-Supports, Mixers, Perf, Dummies

	490030	Ceramic Fuel Elements and Related Components
	490040	Plutonium Fuel Elements and Related Components
	490050	Other Fuel Elements, as Cluster
4901	Fuel Element Production-Cleaning and Preparation	
	490102	Core Preparation-Pickle Machine-Etch Machine, Nickel Plating
	490104	Aluminum Component Preparation-Caps and Can Cleaning Machine, Methanol Still, Detrex Trichlor Still, Trays, Baskets, Racks
	490106	Sleeve Preparation-Sleeve Cleaning Machine, Baskets
	490108	Penetration, Loader, Baskets
	490110	Billet Core Preparation
	490112	Zircaloy Component Preparation
	490114	Nose and Cutoff Preparation
	490116	Other
	490118	Chemical Tanks and Piping
4902	Fuel Element Production-Fuel Element Assembly Equipment	
	490202	Duplex Furnace and Equipment-Ajax Induction Furnaces, Duplex Agitators, Agitator Baskets, Loader Shields, Tools
	490204	Canning Furnace and Equipment-Canning Jacks, Canning Baskets, Tongs, Shields, Tools
	490206	Canning Cycle Control, Flex-O-Timer, Valves, etc.
	490208	Quench Machines, Tanks, and Equipment
	490210	Machining, Forming, Including Tooling-Acme Gridley Cut-Off Lathes: Monarch Lathe
	490212	Welders, Buffers and Controls, Collets, Vacuum Welders
	490220	Coextrusion component and Billet Assembly
	490222	Extrusion Presses, Containers, Dies, and Tools

	490224	Other, Including Tripple Dip, Hot Press, Heat Treatment, Hydraulic Press, Hevi-Duty Resistance Furnaces
4903	Fuel Element Production-Testing and Inspection	
	490302	Component Mechanical Inspection-Pickle Inspection, Statistical Sampling, Recovered Core Inspection, Gages
	490304	Component Electronic or Ultrasonic Testing-Transformation Test, Sort Tester, etc.
	490306	Fuel Element Inspection-Radiography Inspection, Final Inspection Station, Weld Inspection, Length, Braze and Contour Inspection, Film Developing Equipment
	490308	Fuel Element Testing, Bond and Pen Tester, Autoclave Test, Bubble Tester
4904	Fuel Element Production-Component Salvage and Recover: Scrap Recovery	
4905	Fuel Element Production-Component Testing (not for new drawings)	
4906	Fuel Element Production-Component Supporting Facilities (not for new drawings)	
4907	Fuel Element Production-Special Items-Stampers; Tables; Bins; Mechanical Counters	
4920	Capsule, Storage for Strontium	
4921	Capsule, Storage for Cesium	
4922	Fuel Driver Assembly	
4925	Fuel Closed Loop In-Reactor Assembly	
4928	Fuel Special Purpose Assembly	
4931	Fuel Material Open Test Assembly	
4933	Post Irradiation Open Test Assembly	
4934	Fuel Open Test Assembly	
4935	Open Test Assemblies-Tooling	
4936	Materials Open Test Assembly	

Mechanical (Continued)

4937 Reflector Assembly

5000 Optical Systems and Devices (including TV devices)

5001 Viewing Windows and Ports

5002 Periscopes

5003 Fuels Development

- 500301 Machines, Mechanisms, and Dies for Forming, Fabricating, or Assembling
- 500302 Mechanisms for Testing, Inspection, Calibration, etc.
- 500303 Special Tools, Wrenches, etc.
- 500304 Baskets, Tubes, Containers, and Component Parts
- 500305 Vacuum Chambers and Component Parts and Equipment
- 500306 Equipment Support, Storage Racks, Hand Trucks, Tables, etc.

5010 Shipping Containers, Boxes, Pallets Conforming to DOT and RDT Regulations

Instrumentation System

5900 Instrumentation-General, Index, Notes, Listings

5901 Plans, Section, Elevations, and Details (including conduit and tubing)

5902 Panel Schedules, Wire Run Lists

5903 Wiring Diagrams (connections and inter-connections), Elementary

5904 Cable Schedules

5905 Tubing Run List

5906 Equipment Requirements

5907 Equipment Arrangements

5908 Schematic Diagrams

Sub-Subject

04	Process Radiation Monitor
05	Personnel Radiation Monitor
06	Underwater Monitor
07	Fuel Monitor
08	Pressure Monitor
09	Temperature
10	Process Water Monitor and Sampling
11	Process Water
12	Process Gas
13	Pile Motion
14	Calculator (Power)
15	Safety Circuits
16	Biological and Thermal Shield T/C System
17	Ventilation Controls
18	Power Plant Controls
19	Dissolver Cells
20	Metal Solution Feed Preparation
21	Aqueous Make-Up
22	Solvent Treatment
23	Waste Treatment
24	Precycle
25	Partition
26	Plutonium Decontamination

Sub-Subject (Continued)

27	Uranium Decontamination
28	Recovered Acid Storage
29	UNH Storage
30	Chemical Storage
31	Outside Catch Tanks
32	Tank Farms
33	Off-Gas Treatment
34	Extractors
35	Stack Sampling
36	Test Hole Facilities
37	Seismoscope
38	Optical
39	Sodium Systems
40	Flow and Temperature Monitor Data Logging System
41	Main Data-Logging System
42	Rod Control System
43	Primary and Secondary Loop Instrumentation
44	Control Room and Miscellaneous Instrumentation
45	Moisture Detection
46	Argon Systems
47	Helium Systems
48	Products of Combustion Detectors
49	Instrumentation Service Piping, SDD No. 23
50	Instrumentation Radioactive Waste, SDD No. 24

Sub-Subject (Continued)

51 Instrumentation Heating and Venting, SDD No. 25

52 Instrumentation Plant Fire Protection, SDD No. 26

53 Instrumentation Reactor Containment, SDD No. 27

54 Instrumentation Reactor, SDD No. 31

55 Instrumentation Heat Transport System, SDD No. 51

56 Instrumentation Closed Loop, SDD No. 61

57 Instrumentation Aux. Liquid Metal System, SDD No. 81

58 Instrumentation Inert Gas Receiving and Processing, SDD No. 82

59 Instrumentation Impurity Monitoring and Analysis, SDD No. 85

60 Instrumentation Reactor Plant Control, SDD No. 90

61 Digital Data Handling and Display, System 91

62 Reactor and Vessel Instrumentation System 92

63 Process Monitoring and Control Containment System 93-1

64 Process Monitoring and Control Heat Transport System 93-2

65 Process Monitoring and Control Closed Loop System 93-3

66 Process Monitoring and Control Service Piping, System 93-4

67 Process Monitoring and Control Radioactive Waste System 93-5

68 Process Monitoring and Control Heating and Vent System 93-6

69 Process Monitoring and Control Fire Protection System 93-7

70 Process Monitoring and Control Inert gas Receiving and Processing System 93-8

Instrumentation System (Continued)

Sub-Subject (Continued)

71	Process Monitoring and Control Aux. Liquid Metal System 93-10
72	Process Monitoring and Control Refueling System 93-11
73	Process Monitoring and Control Maintenance System 93-12
74	Process Monitoring and Control Leak Detection System 93-13
75	Process Monitoring and Control Annunciator System 93-14
76	Process Monitoring and Control Piping and Equipment Electrical Heating System 93-15
77	Fuel Failure Monitoring System 94
78	Flux Monitor System 95
79	Radiation Monitoring System 96
80	Plant Protection System 99

5975 Equipment Outline and Interface Requirement

Instruments - General

6000	Instruments-General
6001	Temperature
6002	Flow
6003	Level
6004	Pressure
6005	Density
6006	Humidity
6007	Moisture
6008	Conductivity
6009	Speed
6010	Viscosity

6011	Weight
6012	Specific Gravity
6013	Weight Factor
6014	Radiation
6015	Differential Pressure
6016	Acidity
6017	Interface
6018	Vibration
6019	Sound
6020	Component of a Mixture

Sub-Subject

39	General
40	Recorder
41	Controller
42	Indicator
43	Alarm
44	Recorder Controller Alarm
45	Indicator Controller Alarm
46	Integrator
47	Self-Actuated Regulating Valve
48	Transmitters
49	Primary Elements
50	Accelerator
51	Alpha
52	Amplifier

Instrumentation - General (Continued)

Sub-Subject (Continued)

53	Analyzer
54	Calculator
55	Calibrator
56	Camera
57	Chambers
58	Checkers
59	Counters
60	Probes

Electronics - General

6500	Electronics-General (Wave Type-Includes Radio, TV, Microwave and Laser)
6501	Electronics-Plans, Elevations, Sections, and Details
6502	Electronics-Wiring Diagrams (elementary, connection, and inter-connections)
6503	Electronics-Transmitters, Amplifiers, Receivers, and Control Consoles
6504	Electronic-Wave Guides and Antennas
6505	Electronic-Drill and Trim
6506	

Flow Diagrams

7000	Process Flow Diagrams
7001	Engineering Diagrams
7002	Instrument Engineering Diagrams
7003	Logic Diagram

Flow Diagrams (Continued)

7004 Piping and Instrument Diagram

7005 Piping and Instrument Diagram CLS

Electrical

Numerical Subject Series: 73, 74, 75, 76, and 77 (Cover Inside Building - Electrical)

78 and 80 (Cover Outside Building - Electrical)

7100 Electrical-General, Wiring Requirements

(This series includes drawings of a composite nature. A drawing which shows a complete installation for a facility.)

7101 Block Outs, Sleeves, Plans, and Details

7107 Studies-General

7108 Material Lists-General

7109 Indices

7201 One-Line Diagrams

7301 Power-Plans, Elevations, Sections, and Details (including grounding, block diagrams, and engineering diagrams)

7302 Power-Wiring Diagrams (elementary, connection, and inter-connection)

7303 Power-Motor Control Centers, Switchgear, Transformers, and Control Panels

7304 Power-Panel Schedules

7305 Power-Wire Run Lists, Conduit, Cable, Wire Schedules, and Tray Schedules

7306 Power-Grounding Junction, Pull Boxes, Ducts, Raceways

7307 Power-Motor and Control Station Schedules

7308 Power-Electrical Equipment (motors, heaters, etc.)

7309 Power-Lighting Protection

7401 Lighting-Plans, Elevations, Sections, and Details

Electrical (Continued)

7402	Lighting-Wiring Diagrams (elementary, connections, and inter-connections)
7404	Lighting-Panel, Schedules
7405	Lighting-Wire Run Lists, Conduit, Cable and Wire Schedules
7406	Lighting-Junction Pull Boxes, Ducts
7501	Electrical Control-Control Panel Arrangements, Signal Plans, Elevations, Sections, and Details
7502	Electrical Control-Wiring Diagrams (elementary, connection, and inter-connection) Block Diagrams
7503	Electrical Control-Timing Charts
7504	Electrical Control-Panel Schedules
7505	Electrical Control-Wire Run Lists, Conduit, Cable and Wire Schedules
7506	Electrical Control-Junction Pull Boxes, Ducts (This series includes remote signaling door bells, buzzers, annunciators.)
7507	Electrical Control-Relay and Switch Schedules
7508	Electrical Control-Control Equipment and Devices
7575	Equipment Outline and Interface Requirement
7601	Communications-Plans, Elevations, Sections, and Details
7602	Communications-Wiring Diagrams (elementary, connections, and inter-connection) Block Diagrams
7604	Communications-Panel Schedules, Equipment, and Devices
7605	Communications-Wire Run Lists, Conduit, Wire Schedules, Cables
7606	Communication-Junction Pull Boxes, Ducts (This series includes sound powered telephone and central station system telephones.)
7607	Communications-Station Schedules
7701	Fire Alarm-Plans, Elevations, Sections, and Details
7702	Fire Alarm-Wiring Diagrams (elementary, connection, and inter-connection) Block Diagrams

Electrical (Continued)

7704	Fire Alarm-Panel Schedules
7705	Fire Alarm-Wire Run Lists, Conduit, Cable and Wire Schedules
7706	Fire Alarm-Junction Pull Boxes, Ducts
7801	Cathodic Protection-Plans, Elevations, Sections and Details
7802	Cathodic Protection-Wiring Diagrams (elementary, connection, and inter-connection) Block Diagrams
7806	Cathodic Protection-Junction Pull Boxes, Ducts
7900	Criticality Monitoring Systems
7901	Plans, Elevations, Sections, and Details
7902	Wiring Diagrams (elementary, connection, and inter-connection) Block Diagrams
7904	Panel Schedules
7905	Wire Run Lists, Conduit, Cable and Wire Schedules
7906	Junction Pull Boxes, Ducts
8000	Electrical Utilities Transmission and Distribution Operating Drawings (Including Switching Diagrams and Distribution Maps)
8001	Electrical-Maps, Plot Plans, Plans and Profiles, Plans, Elevations, Sections, and Details (includes substation structures)
8002	Electrical Only-Wiring Diagrams (elementary, connection, and inter-connection) Area One-Line Diagram
8003	Electrical Only-Pole Line Details, Sag Curves
8004	Electrical Only-Pole Schedules
8005	Electrical Only-Cable Schedules
8009	Electrical Only-Transformer Schedules (This series includes all electrical maps other than the "Civil" map series.)

Insulation and Heat Tracing

8200	Insulation and Heat Tracing Reference Designs
8201	Insulation and Heater Arrangements

Insulation and Heat Tracing (Continued)

8202	Insulation Arrangements
8203	Heater Applications-Piping
8204	Heater Applications-Equipment
8205	Heater Schedules
8206	Insulation Schedules

Piping

8400	Piping-Process Water
8401	Piping-Process Water-Front or Rear Face
8402	Piping-Process Water-Foundation Cooling, Shielding, Horizontal Rods, Risers, and Crossheaders
8403	Piping-Process Water-Valve Pits or Tunnels
8404	Piping-Cell Arrangements (includes diversion boxes and trenches)
8405	Piping-Jumpers
8406	Piping-Process-Operating or Sample Galleries
8407	Piping-Process-All Other to Include: Buried or Exposed Inside Piping, Wash Down, Fog Spray, Solvent Blend, Slug Storage, Hot Shop, Utility Outlets Relative to Process Piping: Also Jets, Valves, Miscellaneous Process Piping
8408	Piping-Water Drain and Waste (noncontaminated)
8409	Piping-Radioactive Liquid Waste (water)
8500	Piping-Water-Other than Process
8501	Piping-Steam Radiators, Coils, and Condensate
8502	Piping-Steam-All Others
8503	Piping-Acids and Chemicals
8504	Piping-Gas Decay and Disposal
8505	Piping-Compressed Air
8506	Piping-Vacuum

8507 Piping-Refrigeration, Argon

8508 Piping-Sprinkler Systems

8509 Piping-Drains and Waste Inside-Other than Process

8510 Piping-Service (includes grouped services, viz., water, air, steam, drains, etc.; show on the same drawing)

8511 Piping-Hangers, Support, Anchors, Guards

8512 Piping-Hydraulic

8513 Piping-Demineralized and Distilled Water

8514 Piping-Fuel Oil

8515 Piping-Fire Extinguishing Gas, Vapor, Chemical, or Powder

8516 Piping-Heating and Cooling Water

8517 Piping-Heating and Cooling NA and NAK, Insulating Requirements

8518 Piping-Heating and Cooling Gas

8519 Piping-Cover Gas, Argon

8520 Piping-Propane

8548 Piping-Isometric

8550 Piping-NA Reactor Primary

8551 Piping-NAK Reactor Secondary

8552 Piping-NA Receiving and Processing

8553 Piping-NA Closed Loop

- 855301 Piping and Mechanical Sections A1-2-3
- 855302 Piping and Mechanical Sections B1-2-3-4
- 855303 Piping and Mechanical Sections C1-2-3-4-5-6-7-8-9
- 855304 Piping and Mechanical Sections D1-2-3-4-5-6
- 855305 Piping and Mechanical Sections E1-2
- 855306 Piping and Mechanical Sections F1-2

Piping (Continued)

	855307	Piping and Mechanical Sections G1-2-3
	855308	Piping and Mechanical Sections H1-2-3-4-5-6-7
	855309	Piping and Mechanical Sections J1-2
	855310	Piping and Mechanical Sections K1-2-3-4-5-6-7
	855311	Piping and Mechanical Sections L1-2-3
8554	Piping-NA all Other	
8555	Piping-Special Loop	
8556	Piping-NA Piping Components, Traps, Cold, Freeze, and Vapor	
85575	Piping-Equipment Outline and Interface Requirements	
8576	Piping-Reference Drawings	

Heating, Venting, Exhaust

8900	Ventilation Exhaust and Heating System-Plans, Section, Details
8901	heating and Ventilating Equipment Location
8902	Heating and Ventilating Schedules, Notes

Air Conditioning Systems

9000	Air Conditioning Systems-Plans, Sections, Details

Miscellaneous

9900	Miscellaneous Equipment Pieces or Parts-Not Identifiable as Electrical, Instrument or Mechanical Category; Unrelated to the Assembled Equipment
9901	Mechanical
9902	Electrical
9903	Instrument

Sub-Subject

01	Scope
02	Vendor Information
03	Special Tools

SDC-3.2

STANDARD DESIGN CRITERIA

FOR

MINIMUM DEPTH OF UNDERGROUND WATER LINES

This Section consists of one page only.

DESCRIPTION OF REVISION		HANFORD PLANT STANDARDS AEC - RICHLAND WASHINGTON	NUMBER
New Title Block			SDC-3.2
PREP OR REV BY	ORIG ISSUE DATE	ARCH-CIVIL DESIGN CRITERIA	
HES/WD Byrd	4-10-64	MINIMUM DEPTH OF UNDERGROUND WATER LINES	REVISION NO.
APPROVED	DATE		
CS Bucholz	8-20-73		2

STANDARD DESIGN CRITERIA
MINIMUM DEPTH OF UNDERGROUND WATER LINES

A. SCOPE

This Standard Design Criteria specifies the minimum depth of earth cover for underground water lines installed within the area of the Hanford Plant.

B. MINIMUM DEPTH OF EARTH COVER

1. Frequent Flows

Where water in pipes and mains is frequently used, causing a regular flow in the line, the minimum earth cover above the top of pipe shall be 30 inches. Pipes and mains located under roads, streets, parking areas, or other locations where the earth cover will be well compacted, the minimum earth cover above top of pipe shall be 36 inches.

2. Infrequent Flows

Where water in pipes and mains does not flow normally, or where water is infrequently used (dead end installations, pipe lines servicing safety showers, fire hydrants, etc.), the minimum earth cover above top of pipe shall be 42 inches.

SDC-4.1

STANDARD ARCH-CIVIL DESIGN CRITERIA

DESIGN LOADS FOR FACILITIES

CONTROLLED COPY

This section consists of 26 pages.

Description of Revision		HANFORD PLANT STANDARDS DOE - RICHLAND, WASHINGTON	Number
General Revision			
Iss. or Rev. by	Orig. Issue Date	Architectural-Civil Design Criteria	SDC-4.1
Approved DOE	Date 9-6-89	Design Loads for Facilities	Revision No. 11

W-011H-DC1 KEH-32 (12-85)

REVISION 11
COMMENTARY

Revision 11 incorporates the guidance stipulated in DOE Order 6430.1A and its primary reference UCRL-15910 in order to upgrade the natural phenomena loading requirements for non-reactor structures. The previous requirements for the design and evaluation of reactor structures have been maintained.

The probabilistic hazards exposure identified in UCRL-15910 for the Hanford Site from both seismic and wind phenomena have been verified by independent study. This effort is documented in WHC-SD-MP-DP-001. Structure categories have been revised to reflect the Facility Use Category in UCRL-15910. Structures, systems, and components will be classified according to Safety Class as given in DOE-RL 4700.1.

The design basis wind velocity is a function of the Safety Class of the structures. The tornado criteria has been corrected to the criteria defined in the Final Safety Analysis Report (FSAR) and N-Reactor Updated Safety Analysis Report (NUSAR) for the onsite reactor facilities. The controlling wind velocities for non-reactor structures at the Hanford site is now based on the probabilistic extreme wind values identified in UCRL-15910.

The 0.25"g" site specific safe shutdown earthquake (SSE) has been maintained for the reactor structures. The seismic exposure for the non-reactor facilities is dependent on the safety classification of the structure. An additional small magnitude, high frequency, low energy earthquake has been imposed on Safety Class 1 equipment qualification to address this most probable seismic event at the Hanford Site. Studies have determined that this type of event does not result in significant ground motion that would affect buildings, but the influence on equipment, especially that mounted on ground elevation base slabs, needs to be addressed.

Revision 11 also modifies the ashfall loading requirements for the design of Safety Class 1 structures to be consistent with the latest data generated by WPPSS. It includes figures of the new spectra for non-reactor facilities along with tabular data which can be used to construct spectra for the analytical evaluation of reactor and non-reactor facilities.

This standard is effective upon issue with the following exception: Projects which have started Title I or Title II Design prior to the issue date of this revision may continue to use design criteria in effect at the time Title I/II Design commenced. DOE organizations with first-line responsibilities may invoke Revision 11 criteria to projects already in Title I/II Design, but must determine to what extent these design criteria should be applied, based on safety, cost, and schedule effect.

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SDC 4.1

STANDARD DESIGN CRITERIA
DESIGN LOADS FOR FACILITIES

A. GENERAL DESIGN REQUIREMENTS

1. These criteria establish the design loads and acceptance criteria for all facilities and new additions or for modifications of existing facilities at Hanford. Deviations from the natural phenomena design loads shall be approved by DOE prior to implementation. All deviations shall be justified in the design report.

2. Except as modified or amended by these criteria, the following guidelines, codes and standards shall apply.

   a. General design criteria for facilities, exclusive of reactor facilities safety systems, shall conform to the "Department of Energy General Design Criteria Manual" (DOE Order 6430.1A), "Uniform Building Code" (UBC), and ANSI A58.1. American National Standards Institute (ANSI), "Minimum Design Loads for Buildings and Other Structures."

   b. General design criteria for reactor facilities and their safety systems shall conform to that specified in the appropriate SAR (PSAR, FSAR). New reactor facilities must be designed according to DOE Order 5480.6 and 10CFR100.

   c. Concrete members and assemblies shall be designed according to the American Concrete Institute (ACI), "Building Code Requirements for Reinforced Concrete" (ACI-318), "Code Requirements for Nuclear Safety Related Concrete Structures" (ACI-349), and UBC, Chapter 26.

   d. Structural steel members and connections shall be designed in accordance with the American Institute of Steel Construction (AISC), "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," the American Welding Society (AWS), Standard D1.1, "Structural Welding Code," ANSI N690 "Nuclear Facilities - Steel Safety-related Structures for Design Fabrication and Erection," and UBC, Chapter 27.

   e. Wood members shall be designed according to the National Forest Products Association, "National Design Specification for Stress-Grade Lumber and Its Fastenings," and UBC, Chapter 25.

f. Masonry design shall be in accordance with ACI-531, "Building Code Requirements for Concrete masonry Structures," and UBC, Chapter 24.

g. "Design and Evaluation Guidelines for DOE Facilities Subjected to Natural Phenomena Hazards," UCRL-15910: As specified by DOE Order 6430.1A this document shall be used for natural phenomena hazards loadings for non-reactor facilities.

3. For design purposes and the application of these criteria, four safety classifications of structures, systems, and components are defined. The correlation between Safety Class designation in DOE-RL 4700.1 and the Facility Use Category designation in UCRL-15910 for non-reactor facilities is as follows.

Safety Class 1 = High Hazard
Safety Class 2 = Moderate Hazard
Safety Class 3 = Low Hazard/Important
Safety Class 4 = General Use

Facility Use Category may be upgraded by DOE direction to provide additional conservatism as outlined in UCRL-15910, Section 2.1. Specific criteria for wind loads and earthquake ground motions are stipulated for each safety class. Structures, systems, and components of any safety class need not be subjected simultaneously to tornado, earthquake ground motions and design basis accidents. The rules for combining loads are given in the codes and standards cited in Section H or elsewhere in these criteria.

B. SAFETY CLASS 1 STRUCTURES, SYSTEMS AND COMPONENTS

Safety Class 1 structures, systems and components, (DOE Order 6430.1A Safety Class), are those that perform a function required for nuclear criticality safety or whose failure might result in a significant release of radioactive, hazardous, or toxic materials as defined by DOE Order 6430.1A, Division 13, as it relates to non-reactor nuclear facilities. Included in this category are those systems and components vital for safe shutdown. Safety Class 1 structures shall be designed for normal loads, as well as wind loads and roof loads. Load combinations and allowable stresses for these loads shall be as noted in Section H. Additionally, these Class 1 structures must meet the following natural phenomena loading. The loadings are differentiated between reactor and non-reactor facilities.

Reactor Safety Class 1 structures, systems and components shall be designed for the effects of extreme environmental loads, including Safe Shutdown Earthquake (SSE), Operating Basis Earthquake (OBE), Design Basis Tornado (DBT), Design Basis Ashfall, and Probable Maximum Flood (PMF). Where applicable, other abnormal loads specified by the SAR (PSAR, FSAR) such as those generated by a postulated high energy pipe break shall also be considered.

Non-Reactor Safety Class 1 structures, systems and components are to withstand the effects cited above for reactor facilities with the exceptions: 1) SSE is identified as the Design Basis Earthquake (DBE); 2) OBE is not required; 3) Design Basis Tornado is replaced by Design Basis Wind, and 4) Other abnormal loads considered on a case by case basis.

1. Design Basis Tornado (Reactor Safety Class 1 Facilities Only)

   a. Reactor Safety Class 1 structures, systems and components shall be designed to withstand the effects of a tornado having a maximum tangential wind speed of 150 miles per hour (mph) plus a 25 mph translational wind speed (or a resultant wind speed of 175 mph) over the full height of the structure without loss of capability to contain any radioactive material or to perform their safety function. Wall and roof pressure coefficients shall be in accordance with ANSI A58.1.

   b. Reactor Safety Class 1 structures, systems and components shall be designed to withstand the differential pressure loading which results from a 0.75 psi ambient pressure decrease in three seconds, held for one second, and return to ambient at the same rate. Suitable allowances for venting and for structural components shielded from such ambient pressure changes may be made.

   c. The effects of the following tornado-generated missiles on Reactor Safety Class 1 structures, systems and components shall be analyzed. Protection from penetration and secondary effects of scabbing shall be provided. Investigation of the surrounding region for possible missile materials should be made. The following objects traveling end-on at any height could result from a 175 mph tornado.

      (1) 2" X 12" wood plank, 12 ft long, at 100 mph

      (2) 4′ x 8′ plywood sheet, 3/4" thick, at 150 mph

      (3) 26" X 20′ sheet of 20 gauge corrugated steel siding, at 150 mph.

Vertical missile velocity is 2/3 missile horizontal velocity. The horizontal and vertical velocities should not be vectorially combined.

These requirements are applicable in all cases except where adjacent structures or high ground create a potential for more damaging missiles or missile impacts at higher elevations.

Automobiles, railroad flatcars, and similar heavy compact objects would not become air-borne.

2. <u>Design Basis Wind (DBW)</u> (Non-Reactor Safety Class 1 Facilities Only)

Non-reactor Safety Class 1 (UCRL 15910 High Hazard) structures, systems and components shall be designed in accordance with ANSI A58.1 using the following design basis wind value. High Hazard Facilities as defined in UCRL 15910 are designed to a wind having a probability of 1×10^{-4}.

Fastest-Mile Speed @Height (H) = 33 Feet (10 Meters)	90 mph
Importance Factor	1.0
Exposure Class	C
Missile (horizontal)	2 X 4 Timber Plank 15 lb @ 50 mph (73.5 fps) maximum trajectory height = 50 ft.

Vertical missile velocity is 2/3 missile horizontal velocity. The horizontal and vertical velocities should not be vectorially combined.

Protection from missile penetration and the secondary effects of scabbing shall be provided.

These requirements are applicable in all cases except where adjacent structures or high ground create a potential for more damaging missiles or missile impacts at higher elevations.

These Design Basis Wind Tornado criteria values were established by DOE document UCRL-53526, "Natural Phenomena Hazards Modeling Project: Extreme Wind/Tornado Hazard Models for Department of Energy Sites," prepared by Lawrence Livermore National Laboratory, February, 1984.

3. Earthquake Loads for Safety Class 1 Structures

a. Seismic Input

(1) Safe Shutdown Earthquake (SSE) for Reactor Structures

Response spectra for the design ground motion of the Safe Shutdown Earthquake (SSE) for existing reactor facilities are specified in Figure 1. These design response spectra are applied for the horizontal directions in the free field. For vertical motion, the design response spectra shall be taken as two-thirds the response spectra for the horizontal motion over the entire range of the frequencies. Combined directional loading shall conform to Regulatory Guideline 1.92.

(2) Operational Basis Earthquake (OBE) for Reactor Structures

Reactor Safety Class 1 structures shall have the additional requirement to be designed to withstand an Operating Basis Earthquake and remain operational, unless otherwise justified. The OBE shall have a maximum free field horizontal ground acceleration of 0.05 g (Figure 2), and a simultaneous maximum vertical ground acceleration equal to 2/3 of the horizontal. Simplified and generic design procedures may be used with proper analytical justification in the design documents, if they conservatively account for the dynamic behavior of the structure and members during the postulated earthquake.

(3) Design Basis Earthquake (DBE) for Non-Reactor Structures

Response spectra for the design ground motion for the Design Basis Earthquake Non-reactor Safety Class 1 Structures are specified in Figure 3. These design response spectra are applied for the horizontal directions in the free field. For vertical motion, the design response spectra shall be taken as 2/3 of the horizontal spectra over the entire range of frequencies. Existing structures may be evaluated using methods defined in UCRL-15910, Section 4.4.1. An Operational Basis Earthquake (OBE) is not required for non-reactor structures.

b. Damping

The percentage of critical damping used in the design and analysis of reactor Safety Class 1 facilities shall conform with NRC Regulatory Guide 1.61 for reactor facilities, unless otherwise justified in the design report. The percentage of critical damping used for the design, and analysis of non-reactor facilities shall conform to the values in UCRL-15910, unless otherwise justified in the design documentation.

c. Analytical Requirements

The earthquake analysis for Safety Class 1 Facilities shall address the following considerations:

- Soil-structure interaction
- Development of floor response spectra
- Three components of earthquake motion
- Combination of model responses
- Interaction of non-Safety Class 1 items with Safety Class 1 items
- Effects of soil parameter variations on floor response spectra
- Natural frequencies and response loads
- Procedures used for analytical modeling
- Account for torsional effects

Further guidance may be found in NRC SRP 3.7.2 and UCRL-15910.

4. Earthquake Loads for Safety Class 1 Systems, Components, Equipment and Supports - Reactor and Non-Reactor

a. Seismic Input

For both reactor and non-reactor Safety Class 1 systems, components, equipment and supports, the floor response spectra at the mounting points are used as seismic input. The floor response spectra are derived from the seismic time history analyses of the structure containing Safety Class 1 items. Additionally, those components that require proven operability during a seismic event, must be evaluated with floor response spectra which also accommodates the small magnitude earthquake spectra provided in Figures 4b and 4c, unless alternate techniques can be justified.

b. Damping

The percentage of critical damping used for the design and analysis of Safety Class 1 systems, components, equipment and supports shall conform with the recommended damping values in Section 3.b. If different damping values are used, technical justification must be provided in the design documentation.

c. Seismic Analysis Methods

Accepted methods of seismic analysis for Safety Class 1 reactor systems and equipment are contained in NRC Standard Review Plan No. 3.7.3 and No. 3.9.2 Section II. Alternately for non-reactor Safety Class 1 systems and components, UCRL-15910 may be used. A dynamic analysis shall be performed unless justification for the conservatism of alternative methods is provided in the design documentation.

d. Testing

Testing is required to prove operability where operability is necessary to perform a safety function, unless operability is proven by analysis.

e. Electrical Equipment

Safety Class 1 electrical equipment shall meet the criteria for qualification of IEEE 344 (ANSI N41.7) "Recommended Practices for Seismic Qualification of Class 1E Equipment of Nuclear Power Generating Stations." Additionally, those components that require proven operability during and after a seismic event, must be evaluated with floor or equipment spectra accommodating the small magnitude earthquake spectra provided in Figures 4b and 4c, unless alternate techniques can be justified. These spectra shall be utilized in lieu of the OBE event in application of IEEE 344.

5. Design Basis Ashfall

A volcanic ashfall is considered to be a potentially occurring natural phenomenon in the category of tornado and earthquake. All new Safety Class 1 structures, systems and components are required to meet the design basis ashfall criteria as follows:

Thickness of ashfall:

4.5 inches uncompacted
3 inches compacted
Duration and rate of ashfall:

Duration of ashfall	20 hours
Maximum ashfall rate	0.45 inches per hour for 6 hours
Average ashfall rate	0.15 inches per hour

Design ashfall loading:

24 psf dry, compacted

Density of ash:

Dry, loose	72 pcf
Dry, compacted	96 pcf
Wet, compacted	101 pcf

Ashfall loading is to be combined with snow load. Ashfall in combination with snow loading will normally produce the highest loading for design. Ashfall loading is not to be combined with earthquake.

6. Probable Maximum Flood (PMF)

Safety Class 1 facilities, if located in the flood-affected zone of the Columbia River, are required to be designed for Probable Maximum Flood (PMF). The PMF for locations on the Columbia River within the Hanford reservation is 1,440,000 cubic feet per second (cfs) of river flow. The water surface elevation at the PMF is shown on Figure 6. Wave action should be considered where applicable.

C. SAFETY CLASS 2, 3, AND 4 STRUCTURES, SYSTEMS AND COMPONENTS

Safety Class 2, 3, and 4 structures, systems, and components are those that are not Safety Class 1 and are respectively specified as onsite safety related, occupational safety related or non-safety items.

1. Wind Loads

a. Design shall be in accordance with ANSI A58.1, Section 6, using the following criteria:

	Safety Class 2	3	4
Fastest Mile Windspeed	80	70	70
Importance Factor	1.0	1.07	1.0
Exposure Category	C	C	C

b. Design for higher wind pressures shall be considered for locations subject to unusual wind velocity such as the top of Rattlesnake Mountain where winds of approximately 160 mph have been estimated.

c. The Hanford Area is subject to prolonged, straight and gusting winds prevalent from the west and southwest. Particular attention shall be given to adequate fastening of roof to walls and to details such as flashings, ventilators, access openings, louvers, etc.

2. Earthquake Loads

Earthquake loads shall be calculated in accordance with UCRL-15910, Section 4. The correlation between Safety Class Designation, and the Facility Use Category in UCRL-15910 is shown in Section A.3. The combination of multi-directional earthquake loads is defined in UCRL-15910, Section 4.4.3. System and component loading shall be consistent with UCRL-15910, Section 4.4.4.

The following values shall be used for seismic evaluation:

	Safety Class		
	2	3	4
Free Field Hor. Accel. (g)	.12	.12	.09
Critical Damping	UCRL-15910	5%	5%
Importance Factor	2.0	1.25	1.0

Additionally, Safety Class 2 structures must have a dynamic analysis performed consistent with UCRL-15910 utilizing the seismic spectra in Figure 5 and direction in Section B.3.a of this document, unless otherwise justified in the design documentation.

3. Roof Loads

a. Roof live loads shall be in accordance with ANSI A58.1, Section 4.

b. Snow loads shall be in accordance with ANSI A58.1, Section 7. Fifteen pounds per square foot (psf) shall be used as the ground snow load, Pg, but in no case shall roofs be designed for less than 20 psf snow load.

c. Additional load for ashfall is not required for Safety Class 2, 3 or 4. Ashfall loading is covered by and not combined with snow load.

D. ELEVATED STEEL WATER TANKS, STANDPIPES, AND RESERVOIRS

The design requirements of National Fire Protection Association and the American Water Works Association, shall be used as the basis of design for elevated steel water tanks, standpipes, and reservoirs, unless otherwise justified in the design documentation.

E. CHIMNEYS AND STACKS

Design of concrete chimneys and stacks shall conform to ACI-307, "Specification for the Design and Construction of Reinforced Concrete Chimneys," unless otherwise justified in the design documentation. Masonry and steel chimney design is also addressed in UBC Chapter 37.

F. FOUNDATIONS AND RETAINING WALLS

1. Design of foundations and retaining walls shall, in general, be in accordance with the UBC. Concrete design shall be according to UBC and ACI-318. Masonry design shall comply with UBC and ACI-531.

2. The minimum depth to the bottom of foundations of permanent structures (except elevated tanks and stacks) shall be 2'-6" below finished grade, except that footings shall bear on undisturbed earth, whichever is the greater depth.

3. The minimum depth to the bottom of foundations supporting elevated tanks and stacks shall be 4'-0" below finished grade, except that footings shall bear on undisturbed earth, whichever is the greater depth.

4. If it is not possible or practicable to place footings on undisturbed earth, footings and foundations may be placed on properly compacted backfill that has bearing capacity sufficient to meet design requirements.

G. SOIL PRESSURES

1. The allowable soil pressure from Chapter 29 of the UBC may be used for design of facilities where precise soil bearing information is not available. These values are considered to be for undisturbed earth.

2. For permanent facilities, the subsurface soil and ground water conditions at the building site shall be determined by means of borings, test-pits, triaxial shear tests, or other approved field and laboratory methods.

3. Dynamic Earth Pressures

The effect of dynamic earth pressures shall be considered in the design of Safety Class 1 and 2 below grade structures.

4. Lateral Earth Pressure - Static Case

For sites where the specific soil properties have not been determined by subsurface soils investigations, the following lateral earth pressures shall be used for design:

a. Cantilever or other flexible walls exposed to earth fill shall be designed for a static equivalent fluid pressure of 30 pounds per square foot (psf), based on an active earth pressure coefficient, K_a, of 0.27 and soil density of 110 pounds per cubic foot (pcf).

b. Basement or other rigid walls exposed to ordinary compacted backfill shall be designed for a static equivalent fluid pressure of 55 psf, based on at-rest earth pressure coefficient, K_o, of 0.50 and a soil density of 110 pcf.

c. Rigid walls exposed to backfill compacted to at least 75% of relative density shall be designed for 77 psf, based on a k_o of 0.70.

d. Superimposed lateral pressures due to uniform surcharge loadings shall be calculated using appropriate earth pressure coefficients as shown in a, b, and c. Resultant forces due to point and line loads shall be added.

e. Where walls will be subject to ground water head, the hydrostatic head shall be added to the equivalent fluid pressure of retained earth.

f. Consideration shall be given to passive soil loading produced by thermal growth of sub-grade structures.

H. LOAD COMBINATIONS AND ALLOWABLE STRESSES

1. Load combinations and allowable stresses for all structures, systems and components shall be in accordance with standard codes, including the following:

- American Concrete Institute "Building Code Requirements for Reinforced Concrete" (ACI-318) and "Code Requirements for Nuclear Safety Related Concrete Structure" (ACI-349).

- American Institute of Steel Construction, "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings".

- American Concrete Institute, "Building Code Requirements for Concrete Masonry Structures" (ACI-531).

- International Conference of Building Officials, "Uniform Building Code" (UBC).

2. Load combinations and allowable stresses for Safety Class 1 and 2 non-reactor structures, systems, and components shall be in accordance with UCRL-15910 for Moderate and High Hazard Facilities, ACI-349, ANSI/AISC N690-1984 and 6430.1A, as applicable.

3. Load combinations and allowable stresses for masonry walls in Safety Class 1 structures shall be in accordance with NRC SRP Section 3.8.4, Appendix A.

4. Load combinations and allowable stresses for Safety Class 1 reactor structures, systems, and components shall be in accordance with the Reactor Safety Analysis Report (SAR) requirements of SRP 3.8.3 and 3.8.4.

I. MOBILE OFFICES (TRAILERS) AND TEMPORARY STRUCTURES

Mobile offices, trailers and other temporary structures shall be supported by a system designed to Safety Class 4/General Use criteria. Anchors and supporting piers can be individual units and must resist all lateral and vertical loads defined in these criteria.

FIGURES AND TABLES

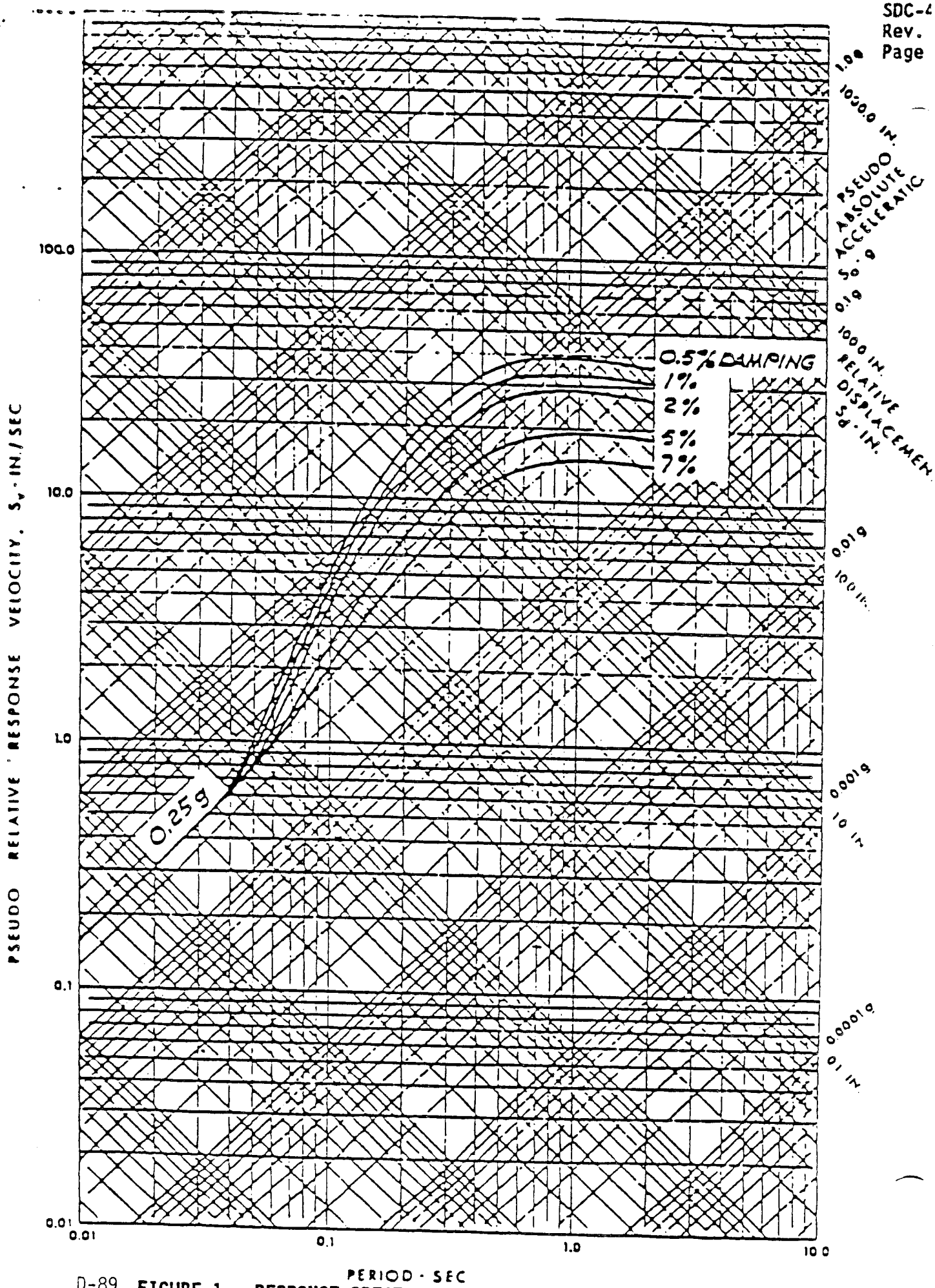


FIGURE 1 RESPONSE SPECTRA, SAFE SHUTDOWN EARTHQUAKE FOR EXISTING REACTORS

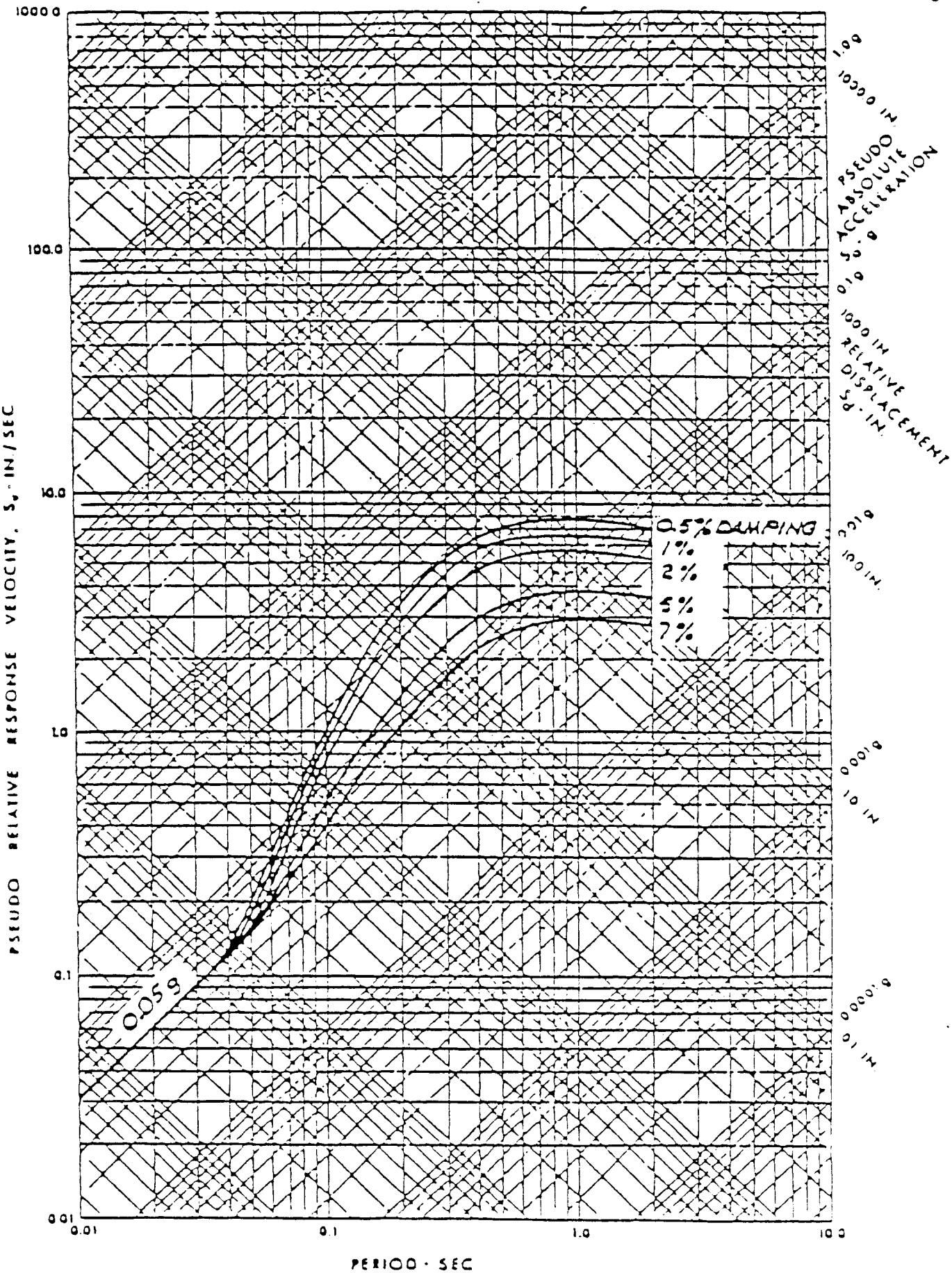


FIGURE 2 RESPONSE SPECTRA, OPERATING BASIS EARTHQUAKE FOR EXISTING REACTORS

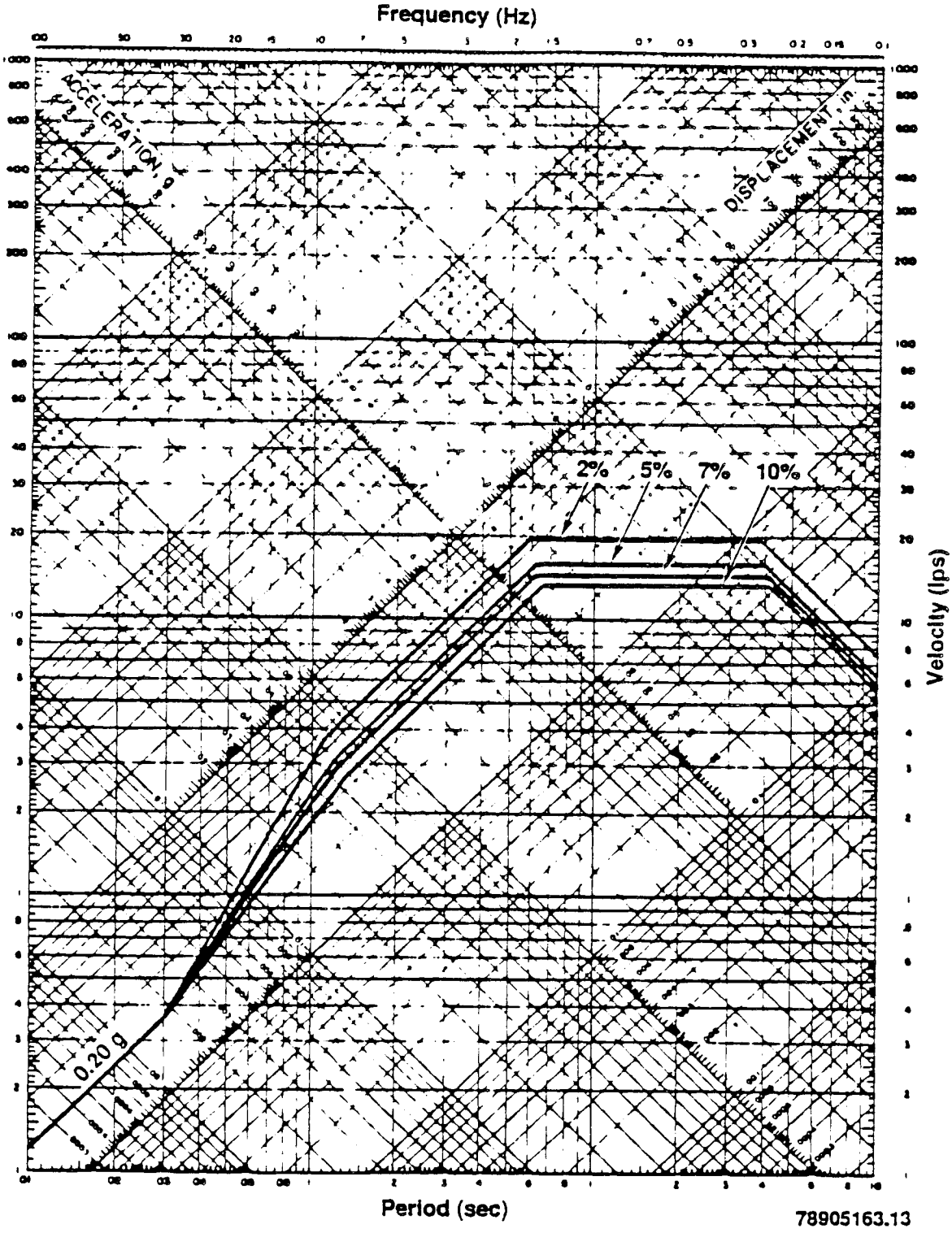


FIGURE 3 RESPONSE SPECTRA - NON-REACTOR SAFETY CLASS 1 for 2, 5, 7, AND 10% CRITICAL DAMPING, 0.20g

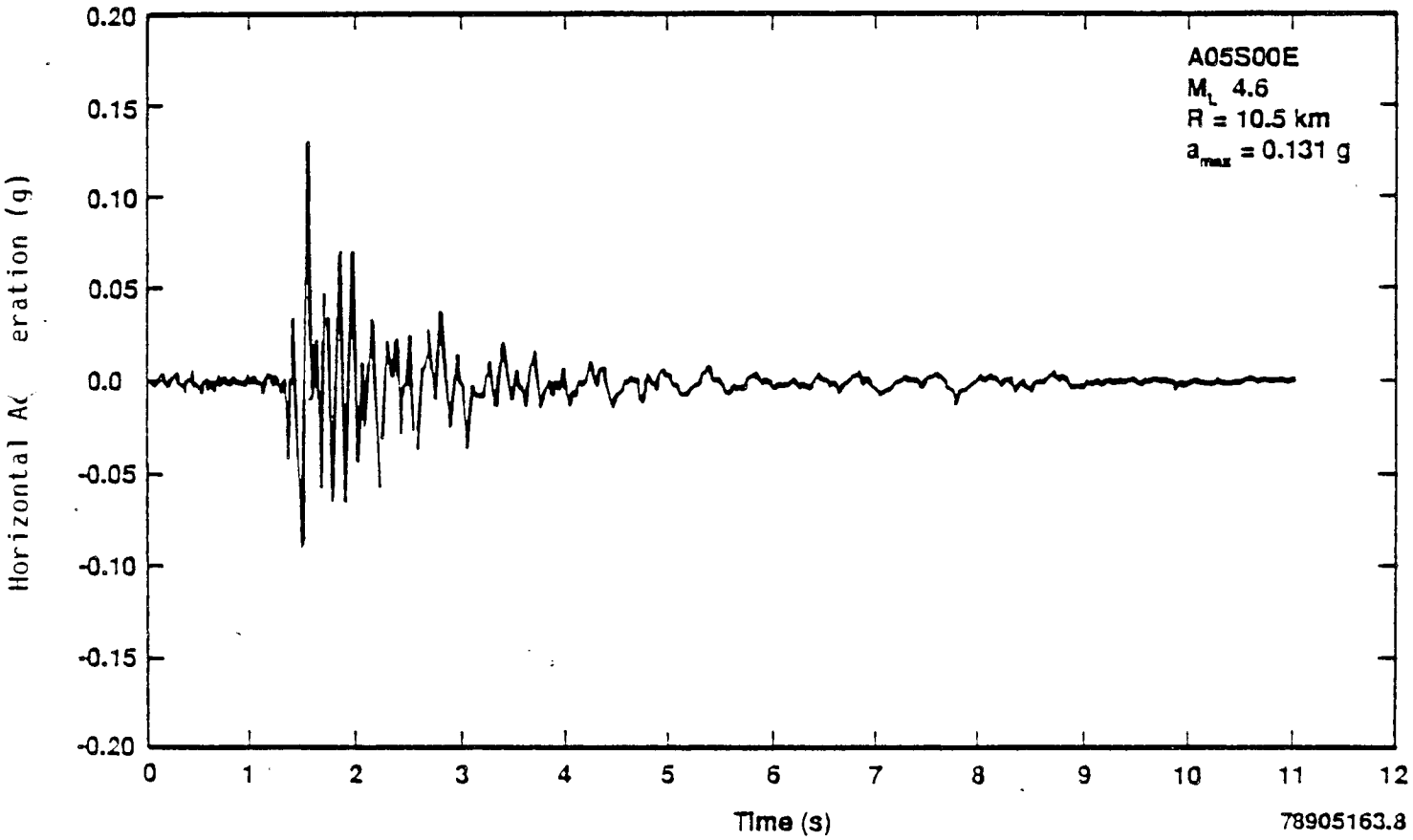


FIGURE 4a TYPICAL TIME HISTORY FOR SMALL-MAGNITUDE EARTHQUAKE

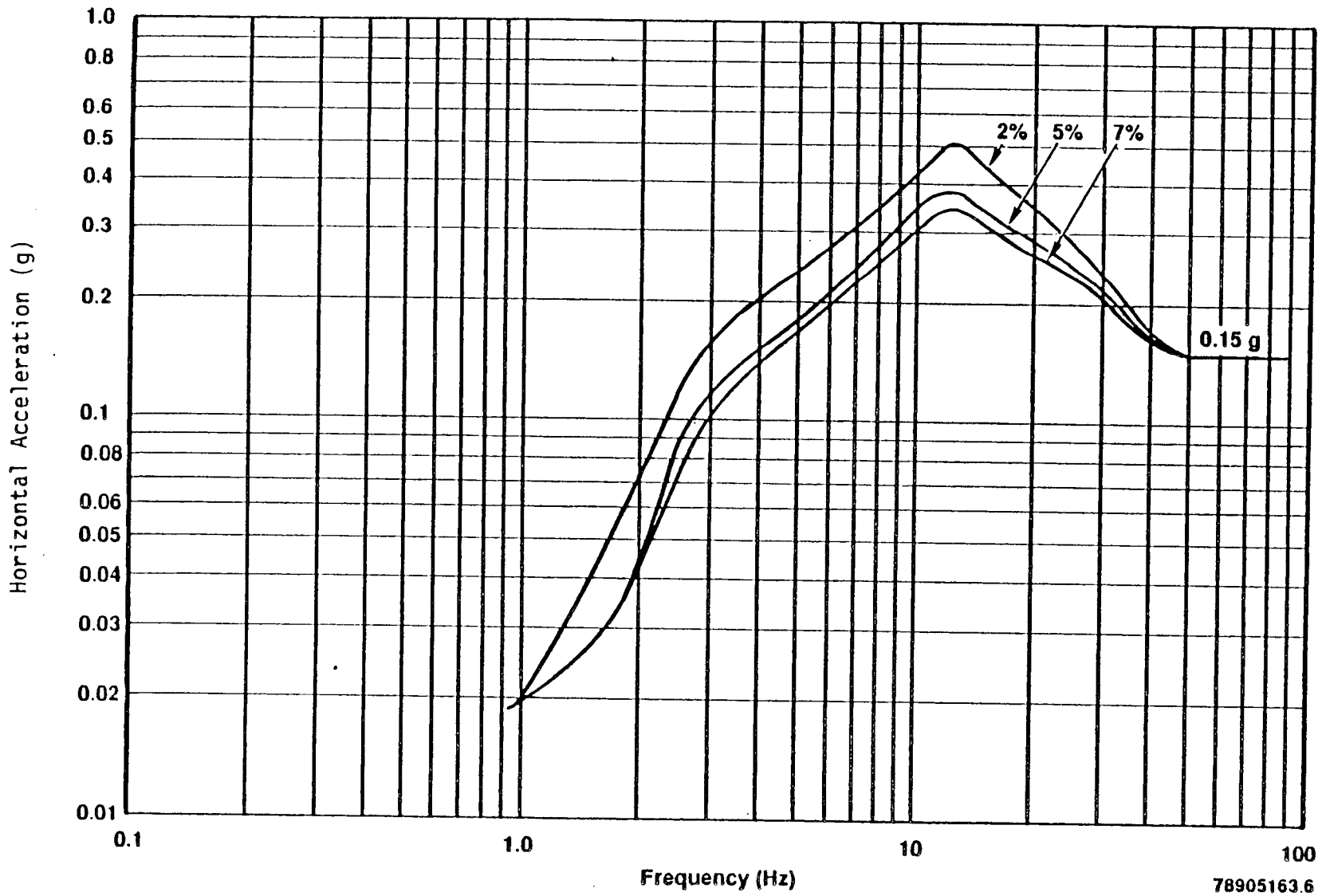


FIGURE 4b RESPONSE SPECTRA FOR SMALL-MAGNITUDE, NEAR-FIELD EARTHQUAKE, 0.15g
(ALL AREAS EXCEPT 100 AND 2[illegible] AREAS)

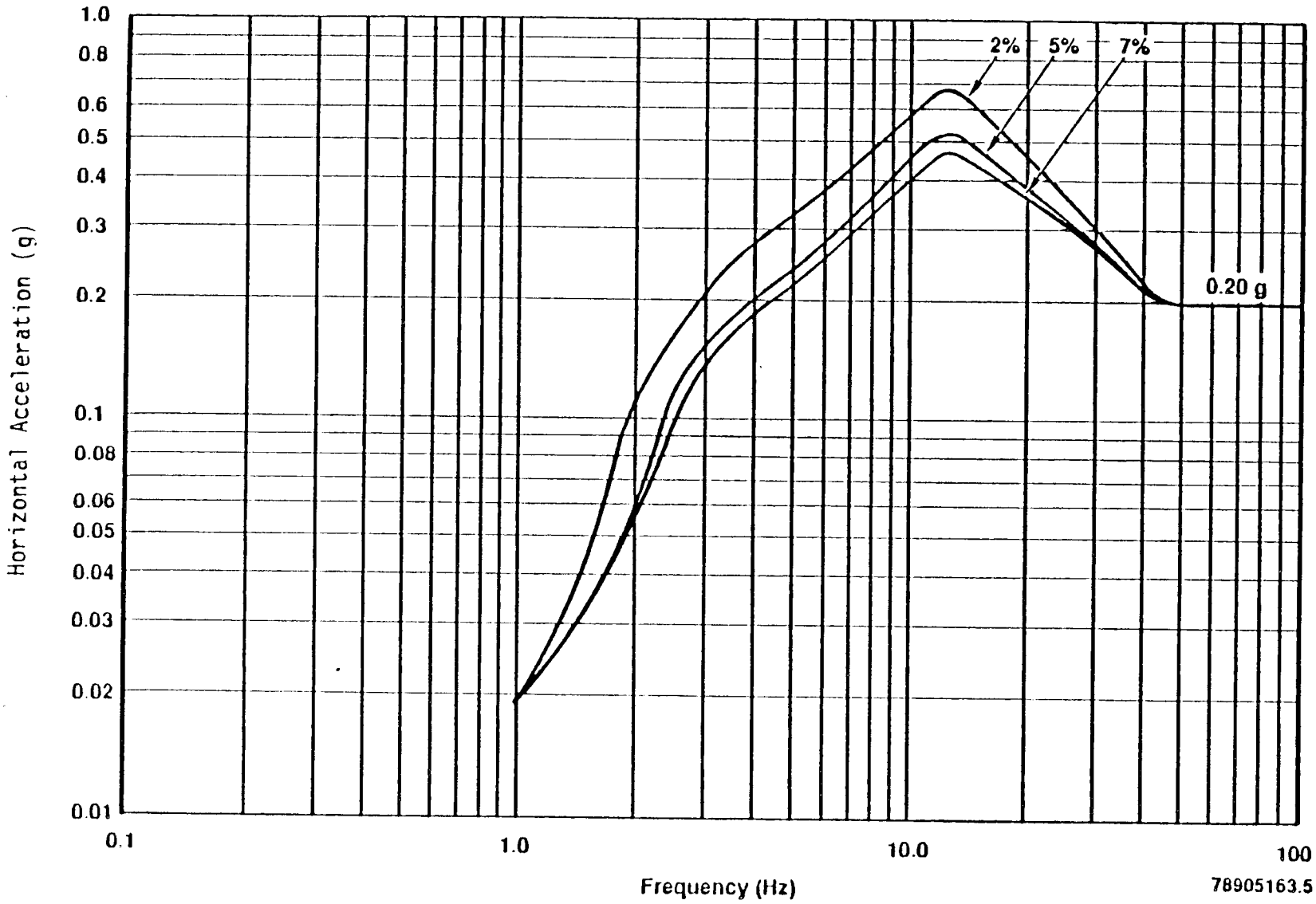


FIGURE 4c RESPONSE SPECTRA FOR SMALL-MAGNITUDE, NEAR-FIELD EARTHQUAKE, 0.20g (100 AND 200 AREAS ONLY)

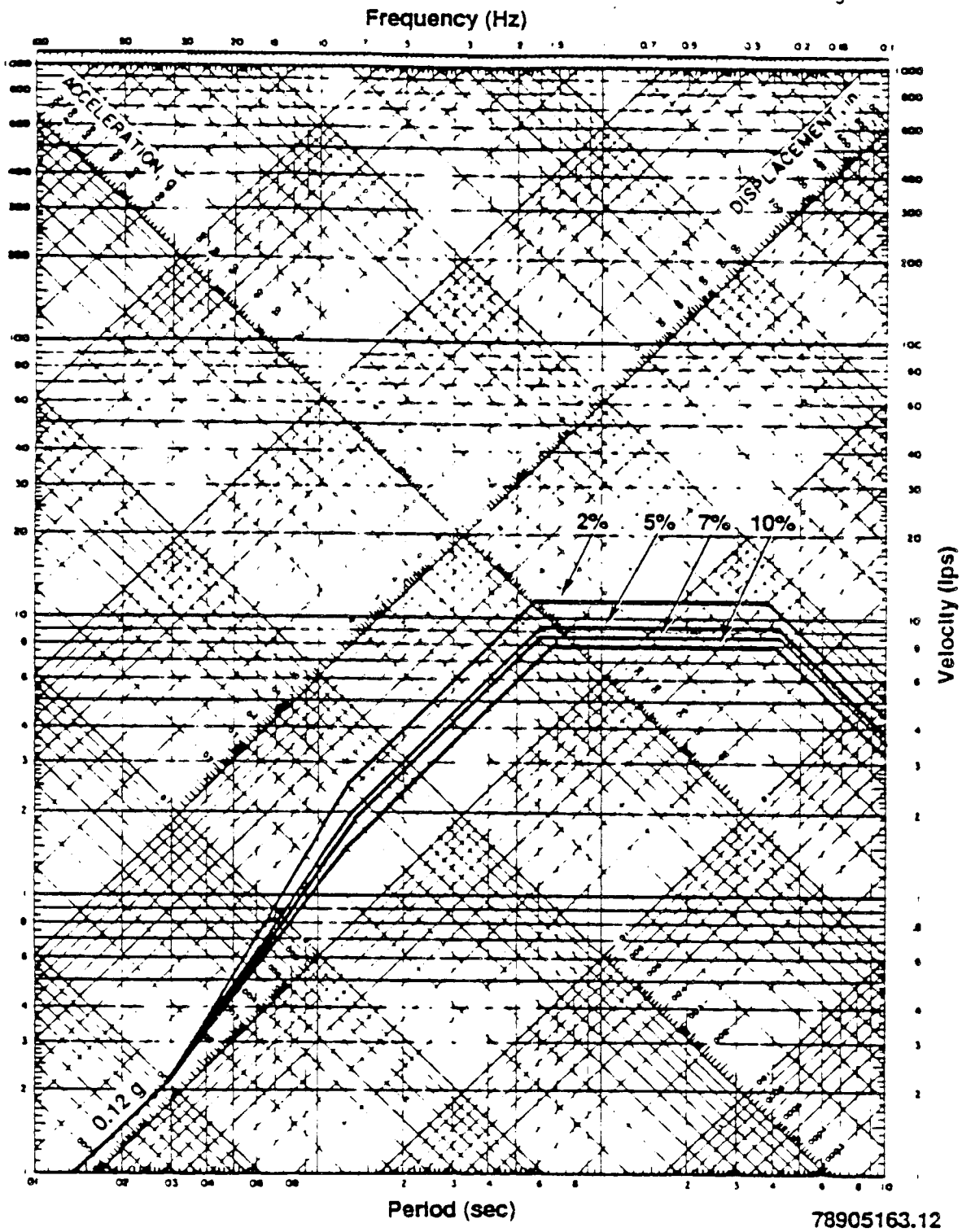
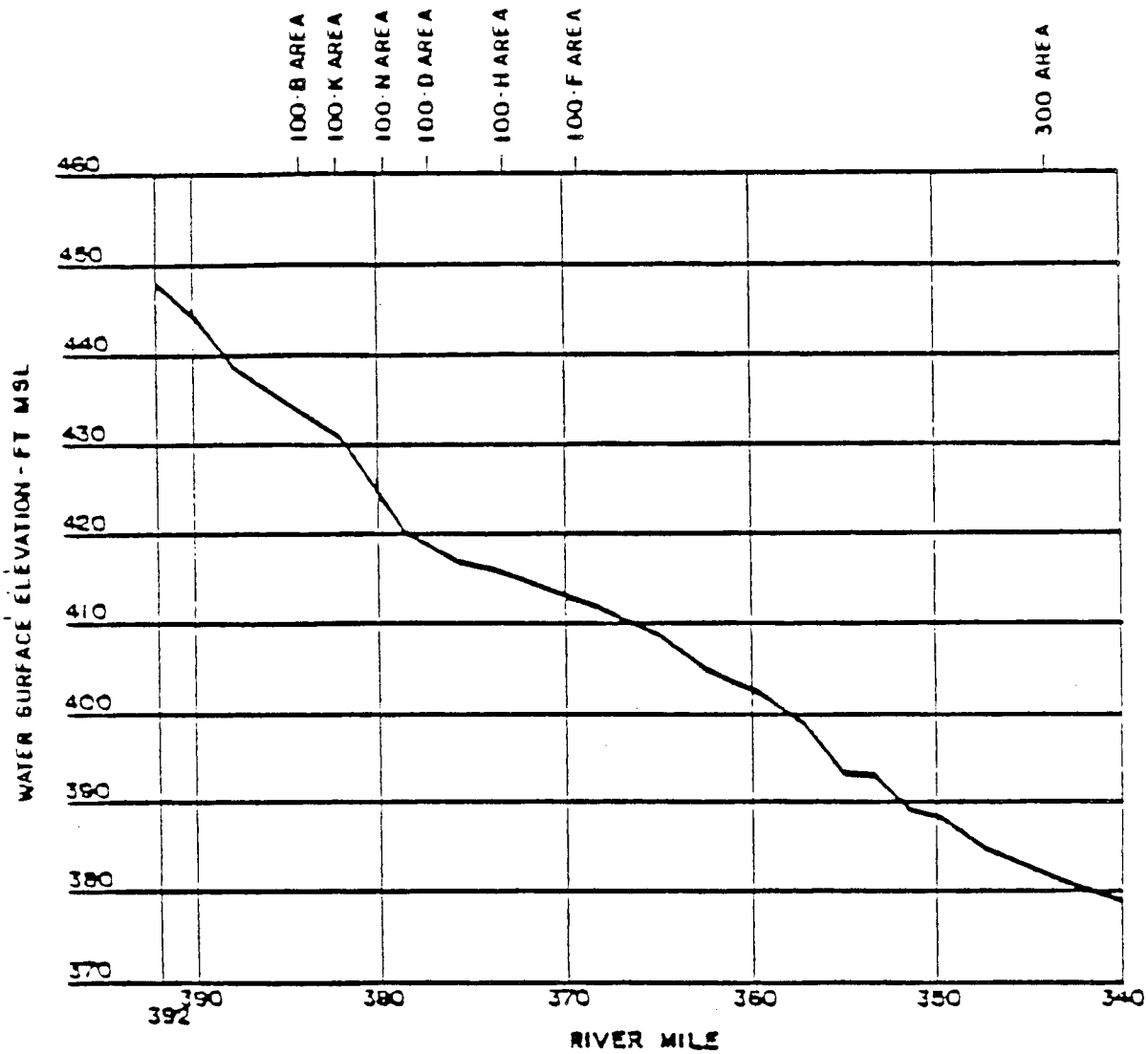


FIGURE 5 RESPONSE SPECTRA - NON-REACTOR SAFETY CLASS 2, FOR 2, 5, 7, AND 10% CRITICAL DAMPING, 0.12g



COLUMBIA RIVER MILE 340 TO RIVER MILE 392 PROBABLE MAXIMUM FLOOD (PMF)
1,440,000 CFS MEAN SEA LEVEL (MSL) WATER SURFACE ELEVATION

FIGURE 6

TABLE 1

SAFE SHUTDOWN EARTHQUAKE ACCELERATIONS FOR EXISTING REACTORS
(CORRESPONDS TO FIGURE 1, HORIZONTAL ZPA = 0.25g)

FREQUENCY VERSUS ACCELERATION

	ACCELERATION (g's)					
Frequency (Hz)	0.5%	1%	2%	5%	7%	% Damping
0.5	0.30	0.26	0.21	0.16	0.11	
1.0	0.66	0.55	0.46	0.31	0.24	
1.5	0.96	0.82	0.70	0.46	0.36	
2.0	1.2	1.0	0.85	0.55	0.41	
3.0	1.4	1.2	1.0	0.61	0.46	
5.0	1.4	1.2	1.0	0.60	0.41	
8.0	1.0	0.90	0.72	0.46	0.37	
15.0	0.48	0.40	0.36	0.30	0.27	
20.0	0.32	0.30	0.25	0.25	0.25	
33.0	0.25	0.25	0.25	0.25	0.25	
100.0	0.25	0.25	0.25	0.25	0.25	

Interpolate on log-log plots.

TABLE 2

OPERATING BASIS EARTHQUAKE ACCELERATIONS FOR EXISTING REACTORS
(CORRESPONDS TO FIGURE 2, HORIZONTAL ZPA = 0.05g)

FREQUENCY VERSUS ACCELERATION

	ACCELERATION (g's)					
Frequency (Hz)	0.5%	1%	2%	5%	7%	% Damping
0.5	0.06	0.05	0.04	0.03	0.02	
1.0	0.11	0.11	0.09	0.06	0.05	
1.5	0.19	0.16	0.14	0.09	0.07	
2.0	0.24	0.20	0.17	0.11	0.08	
3.0	0.28	0.24	0.20	0.12	0.09	
5.0	0.28	0.24	0.20	0.12	0.08	
8.0	0.20	0.18	0.14	0.09	0.07	
15.0	0.10	0.08	0.07	0.06	0.05	
20.0	0.06	0.06	0.05	0.05	0.05	
33.0	0.05	0.05	0.05	0.05	0.05	
100.0	0.05	0.05	0.05	0.05	0.05	

Interpolate on log-log plots.

TA . 3

0.2g HORIZONTAL RESPONSE SPECTRA CONTROL POINTS

MEDIAN CENTERED NEWMARK-HALL
(CORRESPONDS TO FIGURE 3)

PER CENT DAMPING	2%		5%		7%		10%		12%	
Control Points	f(Hz)	a(g)	f(Hz)	a(g)	f(Hz)	a(g)	f(Hz)	a(g)	f(Hz)	a(g)
a=0.20										
E	0.1	0.012	0.1	0.010	0.1	0.010	0.1	0.009	0.1	0.008
D	0.26	0.084	0.25	0.065	0.25	0.059	0.24	0.052	0.24	0.048
C	1.73	0.55	1.64	0.42	1.60	0.38	1.53	0.33	1.50	0.30
B	8.0	0.55	8.0	0.42	8.0	0.38	8.0	0.33	8.0	0.30
A	33.0	0.20	33.0	0.20	33.0	0.20	33.0	0.20	33.0	0.20
A'	100.0	0.20	100.0	0.20	100.0	0.20	100.0	0.20	100.0	0.20

TABLE 4

0.12g HORIZONTAL RESPONSE SPECTRA CONTROL POINTS
(CORRESPONDS TO FIGURE 5)

PERCENT DAMPING	2%		5%		7%		10%		12%	
Control Points	f(Hz)	a(g)	f(Hz)	a(g)	f(Hz)	a(g)	f(Hz)	a(g)	f(Hz)	a(g)
a=0.12										
E	0.1	0.007	0.1	0.006	0.1	0.006	0.1	0.005	0.1	0.005
D	0.26	0.050	0.25	0.039	0.25	0.035	0.24	0.031	0.24	0.029
C	1.73	0.33	1.64	0.25	1.60	0.23	1.53	0.20	1.50	0.18
B	8.0	0.33	8.0	0.25	8.0	0.23	8.0	0.20	8.0	0.18
A	33.0	0.12	33.0	0.12	33.0	0.12	33.0	0.12	33.0	0.12
A	100.0	0.12	100.0	0.12	100.0	0.12	100.0	0.12	100.0	0.12

Interpolation between control points on log-log plots only.
See Figure 7 for example plot.

TABLE 5

0.15g, HORZONTAL SMALL MAGNITUDE EARTHQUAKE (ALL AREAS EXCEPT 100 AND 200 AREAS) (CORRESPONDS TO FIGURE 4b)

Frequency	ACCELERATION (g) 2%	5%	7%	Damping
33.0	0.21	0.20	0.19	
25.0	0.29	0.25	0.24	
20.0	0.35	0.29	0.27	
12.5	0.51	0.39	0.35	
10.0	0.44	0.35	0.31	
5.0	0.24	0.18	0.17	
3.3	0.18	0.13	0.12	
2.5	0.12	0.09	0.08	
1.7	0.05	0.03	0.03	
1.0	0.02	0.02	0.02	
0.33	0	0	0	

TABLE 6

0.20g, HORIZONTAL SMALL MAGNITUDE EARTHQUAKE (100 AND 200 AREAS ONLY) (CORRESPONDS TO FIGURE 4c)

Frequency	ACCELERATION (g) 2%	5%	7%	Damping
33.0	0.28	0.26	0.26	
25.0	0.38	0.33	0.31	
20.0	0.46	0.39	0.36	
12.5	0.68	0.52	0.47	
10.0	0.58	0.46	0.41	
5.0	0.32	0.24	0.22	
3.3	0.24	0.17	0.16	
2.5	0.16	0.12	0.1	
1.7	0.07	0.04	0.04	
1.0	0.02	0.02	0.02	
0.33	0	0	0	

TABLE 7

FORMULAS FOR DETERMINATION OF CONTROL POINTS FOR MEDIAN CENTERED NEWMARK-HALL SPECTRA

1. Competent soil V_s < 3500 ft/sec

a = PGA (g)

$v_g = 48\ a_g$ (in/sec)

$d_g = 36\ a_g$ (in)

Where: a = Peak horizontal free-field ground acceleration
v_g = Peak horizontal free-field ground velocity
d_g = Peak horizontal free-field ground displacement
V_s = Shear wave velocity of soil at site

2. Spectrum Amplification Factors

Damping	A	V	D
2%	2.74	2.03	1.63
5%	2.12	1.65	1.39
7%	1.89	1.51	1.29
10%	1.64	1.37	1.20
12%	1.50	1.28	1.13

Where: A = Acceleration Amplification; V = Velocity Amplification and D = Displacement Amplification

3. Control Point Determination

Control Point	Frequency (Hz)	Spectral Acceleration (g)
E	0.1	$\frac{0.395\ d_{max}}{g}$
D	$\frac{v_{max}}{2\ d_{max}}$	$\frac{v^2_{max}}{g\ d_{max}}$
C	$\frac{g\ a_{max}}{2\ v_{max}}$	a_{max}
B	8.0	a_{max}
A	33.0	a_g
A′	100.0	a_g

Where: g = acceleration of gravity (386 in/sec)
$a_{max} = a_g \cdot A$
$v_{max} = v_g \cdot V$
$d_{max} = d_g \cdot D$

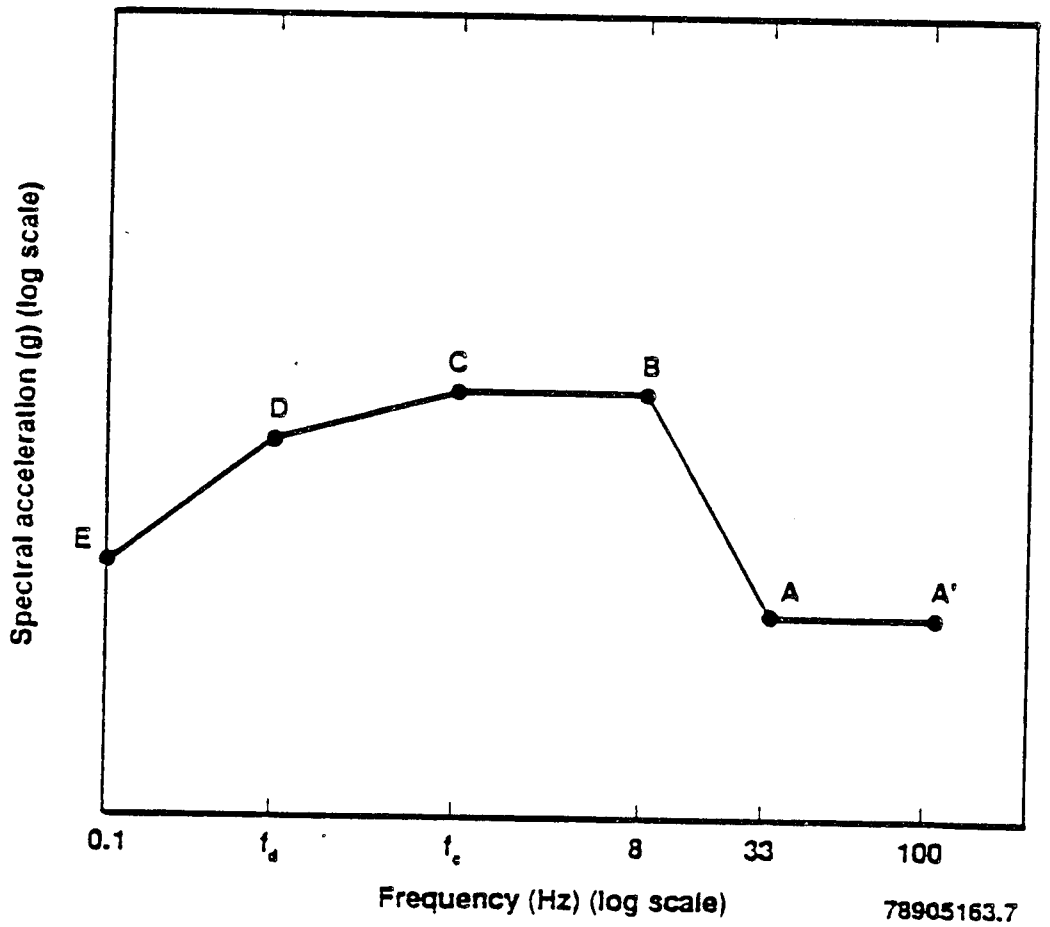


FIGURE 7 CONTROL POINTS FOR MEDIAN CENTERED NEWMARK HALL SPECTRA
SEE TABLES 3 AND 4

SDC-5.1

STANDARD DESIGN CRITERIA

FOR

HEATING, VENTILATING AND AIR CONDITIONING

This Section
consists of 13 pages

DESCRIPTION OF REVISION		HANFORD PLANT STANDARDS DOE - RICHLAND, WASHINGTON	NUMBER
General Revision			
PREP.OR REV. BY IMA Garcia	ORIG.ISSUE DATE 6-27-62	DESIGN CRITERIA	SDC-5.1
APPROVED D.O.E.	DATE 2/28/79	HEATING VENTILATING, AND AIR CONDITIONING	REVISION NO. 6

SDC-5.1

STANDARD DESIGN CRITERIA FOR HEATING, VENTILATING, AND AIR CONDITIONING

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Revised 2-5-79

STANDARD DESIGN CRITERIA FOR

HEATING, VENTILATING, AND AIR CONDITIONING

A. SCOPE

1. These criteria shall be used by Project Design Criteria writers and designers as a basis for the heating, ventilating and air-conditioning systems at Hanford.

   NOTE: The subject matter covered by these criteria is so extensive and the specific requirements of different projects vary so widely, it is not possible to be specific in many areas. It will therefore be necessary to supplement the requirements herein with specific requirements in each Project Design Critera; i.e. the indoor design conditions.

2. Except as modified by the Project Design Criteria, these criteria shall govern.

3. All system design and equipment selection shall be supported by formal calculations.

4. For general design considerations, see Hanford Standard Design Criteria SDC-1.1, General.

B. REFERENCES

The following references are listed for the convenience of the Project Design Criteria writer and the designer. They are mandatory only where specifically called out in the body of these criteria or by law. References are listed by number and title, but without issue date. The issue in effect on date of design effort is applicable.

1. AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS (ASHRAE)

   a. Handbook of Fundamentals

   b. ASHRAE Handbook and Product Directory - Systems

   c. ASHRAE Handbook and Product Directory - Applications

   d. ASHRAE Handbook and Product Directory - Equipment

   e. Filter Efficiency Ratings - ASHRAE 52

2. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

   National Fire Codes, Vols. 1-16, Primarily Vol. 9

3. AIR MOVING AND CONDITIONING ASSOCIATION (AMCA)

   a. Standards Handbook, AMCA-99

   b. Test Code for Air Moving Devices, AMCA-210

   c. Standard Test Code for Sound Rating, AMCA-300

   d. Test Method for Louvers, Dampers, and Shutters, AMCA-500

4. INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

   - Uniform Plumbing Code

5. AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

   - All Standards

6. UNDERWRITERS' LABORATORIES (UL)

   a. Building Materials Directory

   b. UL-586 - Safety Standard for High Efficiency Air Filter Units

   c. UL-900 - Safety Standard for Air Filter Units

7. AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

   - Industrial Ventilation, a Manual of Recommended Practice

8. SHEETMETAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION (SMACNA)

   a. Low Pressure Duct Construction Standards

   b. High Pressure Duct Construction Standards

   c. Accepted Industry Practice for Industrial Duct Construction

   d. Fibrous Glass Duct Construction Standards

   e. Duct Liner Application Standards

   f. Guidelines for Energy Conservation in Existing Buildings

   g. Guidelines for Energy Conservation Systems in New Buildings

   h. Thermoplastic Duct (PVC) Construction Manual

i. Manual for the Balancing and Adjustment of Air Distribution Systems

j. Testing, Balancing, and Adjusting of Environmental Systems

k. Guidelines for Seismic Restraints of Mechanical Systems

9. UNITED STATES GOVERNMENT

a. Federal Register - Title 29 - Labor, Chapter XVII - Occupational Safety and Health Administration (OSHA)

b. ERDA Manual - Appendix 6301, especially Part I, Section D.

c. Federal Standard No. 209 - Clean Room and Work Station Requirements

d. Federal Register - Title 10 - AEC Section 20.106 - Radioctivity in Effluents to Unrestricted Areas (including Appendix B)

e. ERDA 76-21 - Nuclear Air Cleaning Handbook

f. Regulatory Guides (National Regulatory Commission - NRC)

- 3.12 General Design Guide for Ventilation Systems of Plutonium Processing and Fuel Fabrication Plants

- 3.32 General Design Guide for Ventilation Systems for Fuel Reprocessing Plants

g. Federal Specifications (FS)

• HH-I-545	Insulation, Thermal Aid and Accoustical (Mineral Fiber, Duct Lining Material)
• HH-I-551	Insulation Block and Boards, Thermal (Cellular Glass)
• HH-I-558	Insulation, Blocks, Boards, Blankets, Felt, Sleeving (Pipe and Tube Covering) and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type)

10. HANFORD STANDARDS

a.	HPS-151-M	HEPA Filters
b.	SDC-1.1	Preparation of Functional Design Criteria, Specifications, ATPs, and CVI Files
c.	SDC-1.3	Preparation and Control of Engineering and Architectural Drawings
d.	SDC-4.1	Design Loads for Structures
e.	SDC-9.1	Noise Control
f.	HPS-355-E	Squirrel-Cage Induction Motors

11. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

a.	N101.1	Efficiency Testing of Air Cleaning Systems Containing Devices for Removal of Particles
b.	N510	Standard for Testing of Nuclear Air Cleaning Systems
c.	Z9.2	The Design and Operation of Local Exhaust Systems

d. Other Standards as Required

12. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) (current issue)

a.	ASTM A36	Structural Steel
b.	ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
c.	ASTM A105	Forgings, Carbon Steel, for Piping Components
d.	ASTM A120	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated (Galvanized), Welded, and Seamless, for Ordinary Uses

e. ASTM A240 — Heat-Resisting Chromium and Chromium-Nickle Stainless Steel Plate, Sheet, and Strip for Fusion-Welded Unfired Pressure Vessels

f. ASTM A276 — Stainless and Heat-Resisting Steel Bars and Shapes

g. ASTM A527 — Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality

C. OUTDOOR DESIGN ENVIRONMENT

1. AIR TEMPERATURE

Outside design temperatures shall be as follows:

a. Winter

Application - 99%	Area	Temp (F^o)
Industrial, process and non-personnel comfort	All	9°

Application - 99-1/2%	Area	Temp (F^o)
Personnel comfort - typical office buildings	All	12°

b. Summer

Application - 1% db, 1% wb	Area	Temp (F^o)
Industrial, process, laboratory and other non-personnel comfort systems	All	101db 68wb

Application - 2-1/2% db, 5% wb	Area	Temp (F^o)
Personnel comfort - typical office buildings	All	98db 66 wb

2. WIND VELOCITY

For heating and cooling design in conjunction with the above design temperatures, the wind velocity shall be 15 MPH.

3. GROUND TEMPERATURE

The design ground temperature ten feet below grade shall be 55°.

4. STRUCTURAL LOADS

For wind and earthquake loads refer to Hanford Standard SDC-4.1, Design Loads for Structures.

5. SOLAR RADIATION

Values for solar radiation shall be taken from Hanford Weather Data as prepared by "BNW" Atmospheric Physics' current averages.

D. INDOOR DESIGN CONDITIONS

Heating and cooling inside design temperatures shall be per ERDA Appendix 6301, Part I, D.

For heating applications, see Tables I and II.

REQUIRED MINIMUM INSULATION VALUES PER 6301, PART I, SECTION D

FOR HANFORD SITE APPLICATIONS

	STORAGE	WAREHOUSE	SHOP-KITCHEN	RESTROOM	PERSONNEL COMFORT	CHANGE ROOM	
			TABLE I INTERIOR (°)				
ROOF	50	55	65	68	72	75	
LABORATORY			16.00	16.86	18.00	18.86	"R"
PROCESS INDUSTRIAL			0.0625	0.0593	0.0556	0.0530	"U"
PERSONNEL COMFORT ONLY	10.86	12.29	14.86	16.00	17.14	17.71	"R"
	0.0921	0.0814	0.0673	0.0625	0.0583	0.0565	"U"
			TABLE II INTERIOR (°F)				
WALLS	50	55	65	68	72	75	
LABORATORY PROCESS INDUSTRIAL			12.64	13.32	14.22	14.90	"R"
			0.0791	0.0751	0.0703	0.0671	"U"
PERSONNEL COMFORT ONLY	8.58	9.71	11.97	12.64	13.55	14.22	"R"
	0.1166	0.1030	0.0836	0.0791	0.0738	0.0703	"U"

Rev: 2-5-79

E. DESIGN CALCULATIONS

1. General design calculations and load estimating procedures shall be based on data in the ASHRAE Handbook of Fundamentals and ERDA Appendix 6301, Part I, D.

   a. Heating

      The location annual heating degree-days shall be used for determining the minimum thermal resistance, per ERDA Appendix 6301, Part I, D., Tables 1, 2, and 3, and Tables I and II of Paragraph D (this document).

   b. Cooling

      The opaque wall maximum "U" factor shall be determined by a method as presented in the ASHRAE Handbook of Fundamentals. The roof maximum "U" factor shall be determined by the heating criteria. (Subparagraph 1.a)

F. OUTSIDE AIR

1. COMFORT

   a. A minimum of 5 CFM per person shall be provided unless otherwise indicated to meet design requirements.

G. CONTAMINATION CONTROL

When there is a possibility of release of radioactive or toxic material in a space, the following considerations apply:

1. The quality of the discharge of the exhaust system shall conform to the requirements established by 10 CFR 20.106 and OSHA.

2. System design shall follow the requirements of the Industrial Ventilation Manual.

3. The number of hoods, doors, etc. that may be open simultaneously shall be established by the Project Design Criteria.

4. The requirements for any redundant or spare equipment shall be called out in the Project Design Criteria. (Also see Section I)

5. Controls shall be provided on the exhaust system so that the relative pressures between areas do not change appreciably under various operating conditions including the shut-down of the supply system by failure or by the fire alarm system.

6. Pressure differentials shall be established so that air flow is from zones of least contamination to zones of most contamination.

7. Filters shall be placed close to sources of contamination to help keep the balance of the system uncontaminated and to prevent cross-contamination between areas in the event of exhaust system failure.

8. The design shall not combine contaminated air with uncontaminated air thereby causing the high efficiency filter bank to be unnecessarily large.

9. Provision shall be made for the installation of continuous air sampling apparatus in the exhaust stacks from all facilities where radioactive or toxic materials are used.

H. METHOD OF COOLING AND HEATING

The method of cooling and heating shall be per ERDA Appendix 6301, Part I, D.

Energy usage and life cycle costing shall be employed as required.

I. SYSTEM RELIABILITY

In applications where continuous ventilation is necessary for contamination control or to prevent costly shutdowns, standby exhaust (and supply) system capacity should be provided. More than one source of power is desirable. As a general rule, standby ventilation should be provided for facilities (areas) handling radioactive materials. (Also see Paragraph G.4)

J. DUCT DESIGN

1. Ductwork shall be designed in accordance with the methods specified in the ASHRAE Handbook of Fundamentals.

2. For material handling of dust collection, refer to the requirements of the Industrial Ventilation Manual.

3. Duct construction shall conform to the SMACNA Manuals.

4. Test connections for static pressure measurements and the insertion of pitot tubes and/or anemometers shall be provided in the design drawings as required for balancing.

5. Ductwork shall be noncombustible and shall comply with NFPA No. 909-A.

K. FIRE PROVISION

The design shall conform to the NFPA Fire Code. Special consideration shall be given to the shutdown of the various airmoving systems. Each system shall be evaluated separately with careful attention to all pertinent factors. Evaluate such items as containment of radioactive particles, spread of fire, and

removal of smoke and fumes. The system shall prevent the spread of contamination above the limits of 10 CFR 100 for a maximum credible fire as defined in the Project Design Criteria. Where applicable, equipment shall be UL listed.

L. AIR CLEANING

Air cleaning devices and type of air filters to be used shall be per ERDA Appendix 6301, Part I, D., Item 9d.

1. CLEAN ROOMS

The "Class" of clean room per Federal Standard 209 shall be designated in the Project Design Criteria.

M. OUTSIDE AIR INTAKES

Outside air intakes should be located as high as possible above grade and preferably on north or east walls. Where the outside air intake is below 10 feet above grade, a low velocity "drop-out" area shall be considered inside the structure.

N. INSULATION

See Tables I and II under Section D of these criteria.

O. EQUIPMENT SELECTION

1. FANS

a. Fans shall be rated per the AMCA Standard and carry their seal of approval.

b. Where contaminated air is being handled by the fan, the bearings shall be external to the air-stream and the casings shall be air-tight.

c. Each fan-motor-drive assembly shall be assembled at the factory and balanced at operating speed. Test results shall be furnished with the Certified Vendor Information Data. (Not required for small utility fans.)

d. Fan shall be selected at approximately its point of maximum mechanical efficiency. (This is an area of stable operation and best minimizes changes in operating conditions.)

e. The minimum motor size shall be specified and should be conservatively rated with considerations of non-standard air conditions and high ambient temperatures.

f. V-belt drives shall be selected for 120% of rating plus the addition of one extra belt.

g. Axial flow fans require close attention to noise considerations.

2. FILTERS

a. General

A permanently installed means for measuring the differential pressure across each filter stage shall be provided in all filter assemblies 5000 CFM or larger, or where specified. With proper valving and piping, one gage may service several adjacent stages.

b. Filter Banks

Access doors of convenient size shall be provided in the casing and as great a working depth as possible shall be provided for servicing. (Minimum of 3 feet is recommended.)

A prefilter will be provided upstream of the first bank of HEPA filters in an exhaust system. The prefilter efficiency will be determined and specified per ERDA Apendix 6301, Part I,D.

All HEPA exhaust filter installations shall be designed with adequate test ports to permit the initial and periodic testing by DOP (dioctylthalates) test procedure.

3. COILS

a. General

(1) Casings shall be designed to provide a uniform air velocity across the face of the coil.

(2) Casings and piping shall be designed to allow for expansion and contraction to prevent stresses at the coil connections.

(3) Stacked coils shall be supported individually in a structural framework to facilitate individual coil removal without disturbing adjacent coils.

(4) Steam coils shall be factory tested at a minimum pressure of 150 psig and shall have inner steam distributing tubes.

b. Steam Preheat Coils

Steam preheat coils continuously handling 100 percent ouside air shall have a control system that maintains a continuous flow of steam when the temperature is below freezing. The control system shall also prevent overheating in mild weather.

c. Cooling Coils

(1) Provisions shall be made for collecting and removing moisture condensed on cooling coils. Entrained water shall be prevented from being carried down the ductwork.

(2) On direct expansion coils, control shall be provided to prevent the condensed moisture from freezing. Most problems occur at light load.

(3) Maximum face velocity shall be 600 FPM for personnel comfort and 500 FPM for technical or complex application.

4. CONTROLS

a. All heating, ventilating and air-conditioning systems require control. This control shall be automatic unless otherwise specified.

b. Flow controllers should be considered for applications such as laboratories with exhaust hoods where different modes of operation can affect flow conditions.

c. Differential pressure controllers, dampers, and variable volume/pressure fans should be considered when it is necessary to maintain spaces at different static pressures.

d. Control systems should generally be pneumatic except for small installations where there is no suitable air supply. The control air shall be maintained at a dew-point of -40 F measured at atmospheric pressure.

e. Automatic temperature devices for personal comfort shall have a minimum control range between 55 F and 85 F.

5. REFRIGERATION SYSTEMS

The cooling capacity in BTUH of a refrigeration system should be specified in addition to the capacity of the individual components and the responsibility for performance shall rest on one contractor.

P. NOISE

1. Reference Hanford Standard SDC-9.1, Noise Control, and ASHRAE Handbook of Fundamentals.

2. The sound produced by the HVAC system shall not exceed the NC-45 Noise Criteria Curve for normal working areas such as offices and laboratories. For auditoriums or lecture areas the sound level shall not exceed the NC-30 Noise Criteria Curve.

3. In areas of high background noise, no special effort shall be made to reduce the HVAC noise level more than 3 db below that of the background.

4. In areas of low noise level, the possibility of cross-talk between rooms shall be considered and provisions made to prevent same.

Q. BALANCING

The balancing of the air handling system shall be accomplished in such a manner that each space is receiving its designed air supply and proper differential pressures are established between zones. For balancing procedures reference the SMACNA balancing manual or industrial ventilation manual.

Air flow rates should not be restricted to less than the nearest 5 CFM for small flows and 10 CFM for larger flows. A plus or minus 5% variation from desired individual outlet air flow rates is considered a very good balance job, the system design shall accommodate these variations.

SDC-7.2

STANDARD ELECTRICAL DESIGN CRITERIA

FOR

OUTSIDE LIGHTING AND

AERIAL DISTRIBUTION SYSTEMS

Description of Revision Added para. 7.2.1.6 for dry-type transformers & para. 7.2.K.4.e for TV cameras		**HANFORD PLANT STANDARDS** DOE - RICHLAND, WASHINGTON	Number SDC-7.2
Prep. or Rev. by I M McGarva	Orig. Issue Date 10-1-57	ELECTRICAL DESIGN CRITERIA	
Approved R. W. Brown DOE	Date 3-26-81	OUTSIDE LIGHTING AND AERIAL DISTRIBUTION SYSTEMS	Revision No. 16

7.2 OUTSIDE LIGHTING AND AERIAL POWER DISTRIBUTION SYSTEMS

This section of the Design Criteria covers the design of aerial power distribution systems and associated outside street and fence lighting installations, 13.8 kV and under, at Hanford.

A. GENERAL

1. Codes and Standards

a. American National Standards Institute (ANSI) Standard C2.2, Safety Rules for the Installation and Maintenance of Electric Supply and Communication Lines (NBS Handbook H81), National Electrical Safety Code (NESC) shall be the basic code for design and construction of aerial lines at Hanford.

b. Overhead lines shall be designed to meet the requirements for NESC Grade B unless a lower grade is specified in the Supplemental Design Criteria. The assumed conductor loading shall be as specified by NESC for Medium Loading District.

c. Hanford Plant Standards, detailing many types of pole structures, are contained in the Electrical Standards Book. They shall be used in the design of aerial systems where applicable, and are briefly listed as follows:

Basic Distribution Assemblies	Section - Elec. Std. Book
Pin and Insulator Assemblies; Crossarms and Crossarm Assemblies; and Racks	E-1
Clearances	
Clearances Over Roads, Buildings and Other Lines, etc.	E-2
Distribution and Fence Grounding	
Pole Structures; Substation Fence; and Other Fences	E-3
Guying Assemblies	
Concrete Anchor; Horizontal and Down Guy Assemblies	E-4

5000 Volt Distribution Structures	Section - Elec. Std. Book
Three-Phase Tangent Turn, Dead End, Tap and Transition to Underground Structures	E-5
Fence and Street Lighting	
Street Lighting Assemblies; Luminaries; Security Fence Lighting Pole Structures; Combination Lighting and 5000 Volt Distribution Structures	E-6
Aerial Cable and Transformers	
Aerial Cable Tangent, Angle and Tap Structures; One and Three Cluster Mounted Transformers on Poles; Transformer Connections	E-7
13.8 kV Distribution Structures	
Tangent, Turn, Dead End, Tap and Transition to Undergound Structures	E-8
Fire Alarm and Communication	
Box Grounding; Aerial Structures; Cable	E-9
Underground Distribution	
Ducts; Pole Risers; Drains; Marker Post; Direct Burial Details	E-10

d. See also the following sections of Standard Design Criteria.

SDC-7.4 Underground Power Distribution Systems

SDC-7.5 Interior Power and Lighting Systems

SDC-7.7 Communication, Signaling and Control Systems

SDC-7.8 Fire Alarm Systems

2. Soil and Climatic Conditions

a. Hanford soils vary from fine sand to coarse gravel and rock. Sandy areas are common throughout the area. Loose, dry sand should be assumed in the determination of overturning loads for poles and provision of adequate guying unless each location is individually investigated.

b. Extremes of air temperature may be from -20 to 110 F, and the frost penetration may reach 36 inches.

3. Drawings

a. A map or site plan(s) shall be prepared to show all outside electrical work including revisions and additions to existing pole line or underground duct systems. The location of each pole, structure, manhole, vault, etc., shall be shown by coordinates or by stationing. All obstructions and possible interference such as underground pipe lines shall be shown. Hanford Plant Electrical Standard drawings and specifications shall be used where applicable. Detailed construction drawings of special pole structures, manholes, vaults, etc., shall be prepared. Wire and cable schedules, sag and tension data, and other pertinent information shall be included or referenced on the drawings.

b. Plans for electrical systems shall be coordinated with all other maps and drawings of the area to insure non-interference with other electrial work, other services and equipment, or building structures.

c. Existing and proposed new electrical distribution and communication lines and equipment shall be identified and referenced according to their present or probable future operating designations.

d. Electrical distribution, communication, and fire alarm systems shall be coordinated to assure maximum economy in the joint use of pole lines.

e. The location of building services including electric power, communications, and fire alarm shall be clearly shown on the drawings.

B. GROUNDING

1. Ground conditions are generally such that very little conduction is obtained from ground rods during the dry season. For this reason, special consideration shall be given to all grounding installations.

a. Where practicable, ground conductors shall be carried to underground water systems or area grounding systems as shown on Hanford Plant Electrical Standard E-3-4. If no such connection is available, the methods shown on Standards E-3-1 or 3 may be used. See Instruction, DI-E-3-1 to 4.

b. Where equipment on poles (switches, etc.) is operated or accessible from the ground, an equipotential mat shall be provided, as shown on Hanford Plant Electrical Standard E-3-3, to prevent steep potential gradients in the earth.

2. Substation fences and fences enclosing electrical equipment shall be grounded in accordance with Hanford Plant Electrical Standard E-3-10.

3. Metal perimeter and security fences where crossed by aerial power lines shall be grounded to a water pipe or other low resistance ground if a suitable ground is available within 100 feet of the crossing. Where fences are paralleled by a line within a horizontal distance equal or less than the vertical height of the line, or where no suitable ground is available at line crossings, each main gate post shall be grounded to a low resistance ground. Details of the above are covered in Standard E-3-12.

C. DISTRIBUTION VOLTAGES

1. For new construction at Hanford, the distribution and service voltage may be as follows:

   a. 120/240 volt, 3-wire, single-phase, with neutral grounded.

   b. 120/208Y volt, 4-wire, 3-phase, with neutral grounded.

   c. 277/480Y volt, 4-wire, 3-phase, with neutral grounded.

   d. 2400 volt, 3-wire, 3-phase, delta, with neutral grounded through grounding transformer and resistor.

   e. 2400/4160Y volt, 4-wire, 3-phase, with neutral grounded.

   f. 13,800 volt, 3-wire, 3-phase, delta, with neutral grounded through grounding transformer and resistor.

2. For extension to existing distribution systems the voltage and grounding are fixed. See SDC-7.5 for other systems in use at Hanford.

D. CONDUCTORS

1. Open Wire Conductors

   a. Open wire on crossarms shall, in general, be used except where special considerations make it more practicable to use some other type of construction.

   b. Where possible, the phase sequence (A-B-C) of open wire conductors and cables shall be from top to bottom and left to right when facing the source of power.

   c. Conductor clearances shall be according to Hanford Plant Standards E-2-1, 5, and 6.

d. Copper is preferred for overhead line conductors unless otherwise specified in the supplemental design criteria. Medium hard-drawn copper wire is suitable for the majority of requirements, but hard-drawn wire may be used where higher strength is necessary. No. 6 Awg copper is the minimum that may be used for open lines. Other materials which may be considered are as follows:

(1) Copperweld - copper composite conductor may have economic advantages where the span length would be unduly limited by the conductor strength.

(2) Copperweld conductor may be used for street lighting, fire alarm and signal circuits, and lightly loaded distribution lines. Minimum size shall be No. 10 Awg.

(3) ACSR (Aluminum Cable Steel Reinforced) conductor possesses a high strength to weight ratio and is suitable for long span construction.

(4) ACAR and high-strength aluminum conductors may be used where the strength of ACSR is not required.

e. Open-wire line conductor splices shall be of the twisted sleeve or compression type. Self-gripping (automatic) tension splicing sleeves shall not be used.

f. Line conductors shall be secured to pin insulators with soft annealed hand-wrapped wire ties. Each tie should securely bind the conductor to the insulator to resist chafing. The tie shall snugly engage the conductor on each side of the insulator. Composition of ties must be similar to the composition of the conductors. Preformed aluminum armor rods with center marking shall be used for conductor protection at tie points with certain ACSR and stranded aluminum conductors. Applications include (1) single-insulator side-groove tie and double-insulator side-groove tie for use on pin insulators at angles in the line, (2) single-insulator top-groove tie and double-insulator top-groove tie for use on pin insulators tangent in the line, and (3) double-side-groove ties and double-top-groove ties where necessary to provide additional strength and security. The method of tying each conductor shall be illustrated or defined on the drawings and shall include specifications covering composition, grade, size, and length of tie wire.

2. Aerial Cable

a. Aerial cable construction is basically more expensive than open wire but it use may be indicated by the lack of adequate clearance for open lines, safety, regulation or other considerations.

b. Aerial cable shall be located on the pole above communication, signal and fire alarm lines, but below open-wire power lines and series street lighting circuits. If two or more aerial cable circuits are installed on a pole, they shall be arranged vertically according to their voltage with the highest voltage uppermost.

c. Cable rated at 5000 volts shall be used for 2400 and 4160 volt service.

d. See IPCEA Standards Publication No. S-19-81 (NEMA WC-3) Section 4.2 and Appendix K for recommended shielding practice for aerial cables. Stress cones must be provided at all shielded cable terminations.

e. Cables and conductors with polyvinyl chloride insulation or jacket material shall not be installed when the temperature is 15 F or lower.

f. See Hanford Plant Standard E-7-1 for phase identification of aerial cable by means of continuous external ribs.

g. Additional details on the use and procurement of aerial cable may be found in IPCEA Publications S-19-81 and S-61-402, and Hanford Plant Standards HPS-316-E and HPS-318-E, and the Instructions to those specifications.

E. SUPPORTS

Wood poles and wood crossarms are standard and shall be used except in special situations which are subject to individual design.

1. Wood Poles

a. Poles shall be Western Red Cedar cut from live stock and shall conform to ANSI Standard 5.1, Specifications and Dimensions for Wood Poles. All poles shall be air seasoned and butt treated in accordance with the American Wood Preservers' Association (AWPA) Standard C7. Each pole shall be branded or marked as described in ANSI 05.1 as follows:

> The brand or mark shall be placed squarely on the face of the pole and at 10 feet from the butt of poles 50 feet or less in length and at 14 feet from the butt of poles 55 feet or more in length. The face brand shall designate the supplier's code or trade-mark; plant location and year of treatment; species and preservative code; and class and length of pole.

The pole roof and gain shall be brush coated with pentachlorophenol-petroleum solution conforming to AWPA Standards P8 and P9. The top of each pole shall have a

one-way roof cut sloping 30 degrees (120 degrees with pole axis) and the cut surface shall face at right angles to the pole face.

b. The size of poles will be governed by specific use but the following is required:

(1) Poles smaller than Class 4 shall not be used.

(2) Transformer poles, poles at line angles exceeding 30 degrees and dead-end structure poles shall not be smaller than Class 2.

c. The minimum setting depth for poles shall be according to the following:

Pole Length Feet	Setting Depth	Pole Length Feet	Setting Depth
30	5'-6"	65	8'-6"
35	6'-0"	70	9'-0"
40	6'-0"	75	9'-6"
45	6'-6"	80	10'-0"
50	7'-0"	85	10'-6"
55	7'-6"	90	11'-0"
60	8'-0"	95	11'-0"

d. Holes for wood poles shall have reasonably straight sides. Holes shall not be grossly oversize, but shall be sufficiently large to permit use of a tamping bar all around the pole.

e. Backfill around poles in sand and gravel areas shall preferably be compacted by flooding the backfill material as it is placed with copious quantities of water. Where the use of water is impracticable, the backfill shall be placed in six-inch lifts and thoroughly compacted by hand tamping. Surplus excavated material shall be placed around the pole in a cone approximately one foot in height.

2. Crossarms

a. Crossarms shall conform to Hanford Plant Standard E-1-15. The 9-foot, 2-inch arms are for ordinary use. Other sizes are included for use on double-circuit lines and for other special use as specified in the various Hanford Plant Standards.

b. Crossarms shall face each other on alternate spans on level construction.

c. Line deviations for 20 degrees or less may be on a double arm mounted to bisect the angle. Buck arms are required for angles greater than 20 degrees.

d. One-piece steel angle crossarm braces shall be used where the conductors are No. 0 Awg or larger. See Hanford Plant Standard E-1-16 and 17, and E-1-20 for use of triple arms, heavy hardware, etc., where larger conductors are required.

3. Racks

Secondary racks may be used to carry circuits of less than 500 volts between lines and to carry conductors No. 0 Awg and smaller. Other aspects of secondary rack application shall conform to Hanford Plant Standard E-1-5.

4. Insulators

Insulators for supporting power conductors shall be wet process brown porcelain and shall conform to EEI-NEMA standards for the class. Insulators supporting series street light conductors shall be white porcelain. White insulators shall not be used for any other conductors.

F. GUY AND ANCHORS

1. Guys and anchors shall be designed and installed according to Hanford Plant Standard Instructions DI-E-4-1 and DI-E-4-5 to 9 and E-4-1, E-4-5 to 9, inclusive.

2. In order to avoid confusion, guy strand shall be limited to two grades; Siemens-Martin grade for distribution lines, and High Strength grade for communications messenger and 230 kV structures.

G. SWITCHES AND CUTOUTS

Disconnecting switches for the purpose of sectionalizing lines shall be group operated. Where mounted on poles, sectionalizing switches must be equipped with a lockable lever for operation from the ground.

H. LIGHTNING ARRESTERS

Lightning arresters shall normally be provided in primary-voltage systems for distribution transformer installation of a total capacity of 50 kVA or more (unless there are other arresters installed on the line in the immediate vicinity), for all constant current transformers on both the primary and secondary lines, at transitions between open wire and conduit enclosed systems, and between open wire and aerial cable.

I. DISTRIBUTION TRANSFORMERS

1. See Hanford Plant Standard Instruction DI-350-E for standard ratings and tests and Specification HPS-350-E, Outdoor Distribution Transformers, 500 kVA and smaller, 15 kV and under, for procurement specifications.

2. Distribution transformers up to three, 167 kVA are normally cluster mounted on poles. See Hanford Plant Standards E-7-30, E-7-31, and E-7-35 to 40 for 3-phase connections of single-phase transformers.

3. Pad mounted transformer stations are used primarily for heavy loads, i.e., stations of over three 167 kVA transformers. Pad mounted stations require a steel mesh type fence with gates for pedestrian and vehicular access except as in the following paragraph. The area inside the fence should be level and covered with crushed rock to a depth of 4 inches. Steel reinforced concrete transformer pads should extend a minimum of 6 inches above the surfacing.

4. Totally-enclosed, throat-connected transformer stations may be installed on a pad without a fenced enclosure. Steel barricade posts shall be specified for protection in traffic areas.

5. For transformer locations near buildings, see "Recommended Good Practice for Transformer and Switchgear Installations," a publication of the Factory Insurance Association. Fire exposure hazards to buildings and personnel from oil-filled transformers, recommended safe distances from buildings, and fire resistive building construction in the vicinity of transformers are covered. The recommendations in that publication concerning transformers located near building entrances and pedestrian walkways shall be adhered to.

6. Dry-type transformers are available rated up to 5000 kVA; 35 kV and up to 175 kV-BIL. Since they present no danger to the environment or location, they may be mounted on pads outdoors or located in buildings in ventilated enclosures. Dry-type transformers offer the best alternative for phasing out the flammable, toxic, non-biodegradable liquid coolants used in existing liquid filled transformers.

J. SERVICES TO BUILDINGS

1. Service conductors to buildings shall not be less than 14 feet above grade at the point of attachment to the structure. Services over roadways, driveways, or service areas shall not be less than 20 feet above grade at any point.

2. Service drop cable may be used where practicable. See Hanford Plant Standard E-7-1 for phase identification of ribbed service cable. Cable for 480 volt services shall be rated 600 volts, but 300 volt cable may be used for 240 volt services.

3. Drip loops shall be a minimum of 6 inches between service cables and the equipment or conduit entrance cap. Service-entrance cables shall not be connected to the service-drop conductors at a point above the level of the entrance cap.

K. OUTSIDE LIGHTING

1. Breakers controlling all outdoor street and fence lighting circuits in an area should be located in a central location within the secured area.

2. In accordance with the Physical Security Handbook 2401, DOE (MC) Part III-B and Exhibit 2, security fence lighting shall produce a minimum illumination as follows:

	Minimum Footcandles at any Point
Isolated Fenced Boundaries	0.07 with streetlighting or floodlighting luminaries
Pedestrian Entrances - 25 feet inside to 25 feet outside	2.0
Vehicle Entrances - 50 feet inside to 50 feet outside	1.0

Pole Lines for security fence lighting are normally located 10 feet inside the fence line. Details of fence lighting installations are shown on Hanford Plant Standard E-6-1, 2, 3, and 4.

3. Street and walkway lighting shall be provided in areas where there is pedestrian traffic after dark. Lighting levels shall be according to recommendations of the Illuminating Engineering Society for the pedestrian and vehicular traffic density and the following:

4. Scientific research in aeronomy and astronomy is conducted at Hanford utilizing facilities on top of Rattlesnake Mountain. The low stray light environment of the Hanford area, combined with a high percentage of clear nights, make this an ideal location for such research. The site is one of the most desirable for upper atmospheric and astronomical research remaining in the United States. In order to preserve this advantageous environment, the following shall be observed for outdoor lighting.

   a. Lighting for buildings, streets, fences, etc., shall be designed as close to the minimum requirements as practicable.

   b. The required exterior illumination source shall be clear mercury vapor or low-pressure sodium (LPS). Since LPS is a mono-chromatic light source, use should be limited to security and street lighting. Exceptions to this requirement shall be limited to:

(1) Incandescent lamps of no more than 150 watts in single installations such as may be used to illuminate an exterior doorway, doorstep, flight of stairs, etc.

(2) Emergency and warning lights where colored lights traditionally are used.

(3) Portable, temporary lighting systems such as used in fire fighting, rescue work, or other nonroutine situations.

c. All lighting fixtures (with exception of 1, 2, and 3 above) shall be designed and installed so that the total amount of light emitted above the horizontal is as near zero as possible (practicable). Light directing refractors shall be considered to be a light source.

d. Illumination of exteriors of structures shall be permitted only for reasons of building safety or security and shall be held to a minimum to reduce light reflected from walls to sky. Lighting fixtures in such installations shall be positioned to illuminate from the top of the structure downward, rather than from the ground upward.

e. U.S. Government demands for increased nuclear plant security monitoring, has prompted the application of closed circuit TV systems for outdoors surveillance. Modern TV cameras are capable of producing sharp images of subject matter from a field uniformly illuminated at 0.2 footcandle. Visual accuity is dependent upon several factors; costlier cameras and lenses, intensified lighting levels and weather conditions. No definitive lighting criteria has yet been established as a plant standard by DOE. Criterion issued by the operating contractor shall be the basis for lighting design.

SDC-7.4

STANDARD ELECTRICAL DESIGN CRITERIA

FOR

UNDERGROUND POWER DISTRIBUTION SYSTEMS

Description of Revision		HANFORD PLANT STANDARDS DOE - RICHLAND, WASHINGTON	Number
Revised gnd conductor callout, para b.7.a			
Prep. or Rev. by L. N. Jackson	Orig. Issue Date 1-5-59	ELECTRICAL DESIGN CRITERIA	SDC-7.4
Approved R. W. Brown DOE	Date 1/22/82	UNDERGROUND POWER DISTRIBUTION SYSTEMS	Revision No. 15

7.4 UNDERGROUND POWER DISTRIBUTION SYSTEMS

This section of the Design Criteria covers the design and installation of underground power distribution systems and underground services, feeders, etc., 240 volts to 13.8 kV, at Hanford.

A. GENERAL

1. Codes, Standards, and Voltages Used

a. The following shall be considered the basic codes for underground power distribution.

(1) American National Standards Institute, (ANSI) C2, National Electrical Safety Code.

(2) The National Electrical Code, (ANSI) C1.

(3) Hanford Plant Standards for typical elements of underground construction contained in the Electrical Standards Book under Section E-10.

b. Distribution and utilization voltages presently used at Hanford and those preferred for new construction are shown in Section 7.5, of the Design Criteria.

2. Drawings

Drawings for underground distribution systems shall show the location of ducts, manholes, risers, etc., by coordinates or by distance from permanent markers. The elevation of conduits, manhole floors, and manhole covers shall be shown. The slope of each duct section shall be indicated in feet (or inches) per hundred feet of duct length. The total length of each duct run shall be indicated. All special construction details not shown on referenced standards shall be completely detailed. Cable lengths, configuration layouts, connection diagrams, and ground connections shall be included where necessary. Cable terminations and splices shall be shown or referenced to manufacturers' instructions.

3. Soil and Climatic Conditions

a. Soil of the Hanford plant area varies from fine sand to coarse gravel with some large rock. Small trenching machines are ineffective, necessitating the use of backhoe type excavators.

b. The atmospheric temperature may vary from -20 F to 110 F, and the frost penetration may reach 36 inches.

B. UNDERGROUND DUCT SYSTEMS

1. Common Use of Ducts

a. Except under unusual circumstances, power and communication cables shall not be run in common duct and manhole systems, although some of the material in this Criteria applies to underground communication system design.

b. Electric power cables shall not be run in ducts or tunnels with steam, water, or other piping unless the cables are mechanically protected from failure of the piping systems, and unless measures have been taken to assure that the design ambient temperature at the cable locations will not be exceeded.

2. Conduits

a. In general, duct banks shall be rectangular in cross section having one to eight or more separate ducts. Commonly used configurations are shown on Hanford Plant Standards E-10-1, 2, 3 and 21. Banks of more than eight conduits shall conform to the above standards as closely as possible.

b. Permanent underground conduit runs or duct banks shall be concrete encased or suitable for direct burial. Rigid galvanized steel with a bonded PVC or linearized phenolic coating (Ultra-Coat) may be used for direct burial installation without concrete encasement. Nonmetallic ducts or conduits may be installed in duct banks as shown in HPS E-10-21. See SDC-7.5, paragraph D-1-b. See the following paragraph "k" for concrete requirements.

c. Conduit materials for concrete encased ducts shall be rigid galvanized conduit, intermediate metal conduit, Class 2000 bituminized fibre conduit, fiberglass reinforced epoxy duct (FRE) or Schedule 80 PVC conduit. Aluminum conduit shall not be installed below grade.

d. In duct banks for power cables 4-inch minimum and 6-inch maximum diameter conduit shall be used.

e. Other ducts and conduits shall be sized according to NEC rules (Chapter 9, Table 1).

MAXIMUM ALLOWABLE DIAMETER OF CABLES IN CONDUIT OR DUCT

Nominal Normal Size Inches	Cable Diameter - Inches Number of cables with same O.D. 1	2	3	4
2	1.51	0.81	0.75	0.65
2 1/2	1.80	0.97	0.90	0.78
3	2.23	1.21	1.12	0.97
3 1/2	2.58	1.40	1.29	1.12
4	2.93	1.58	1.47	1.27
5	3.68	1.99	1.84	1.60
6	4.42	2.39	2.21	1.92

(1) To find the size conduit required for any number, n, cables of equal diameter, multiply the cable diameter by $\frac{n}{4}$ and use this equivalent diameter in the column for four cables.

(2) To find the size conduit required for a group of cables of unequal diameters, find the equivalent diameter by means of the following equation:

$$d_e = \frac{n_1 d_1^2 + n_2 d_2^2 + - - -}{n_1 + n_2 + - - -}$$

Where n_1, n_2, etc. are the number of cables of diameter d_1, d_2, etc. The required conduit size is then found by using this equivalent diameter in the table under the column for the actual number of cables. See paragraph B-5-e for diameter of cables.

f. Factory made fittings shall be used. Bends shall be designed for the greatest possible radius for a particular design. Five degree couplings may be used with intermediate straight tangents to form long radius bends. Joints in non-metallic conduit should be made and installed according to the manufacturer's instructions. Tools made especially for the purpose must be used for cutting tapered joints. See paragraph B-5-e for minimum bending radii of cables.

g. Duct bank routes shall be governed by economy and expediency. Lengths of runs, interferences and the shortest practicable route shall be considered, as well as future expansion.

h. The recommended maximum number of ducts in a duct bank is twelve. Overcrowding impairs its heat dissipation capabilities and creates congestion in a manhole or building. Duct bank configurations shall regard minimum construction cost, future expansion and supernumerary (extra) conduits.

i. The distribution of cables in manholes is a determining factor in the placement of conduits in a duct bank. Heavily loaded cables should be located in the lower outside ducts while less heavily loaded cables should occupy the center ducts and those nearer the top. This arrangement will allow high tension cables to be relatively protected at the bottom of a manhole and low tension feeders, secondary cables and light service cables which are frequently worked upon, located above in succession.

j. Drainage of all ducts runs must be provided. Ducts shall be sloped a minimum of three inches per 100 feet between adjacent manholes or from a high point in the duct to the manhole openings. Low points in the duct run should be avoided. If such construction is necessary, the low point must be adequately drained. See Hanford Plant Standards E-10-10, 11, and 15 for pole riser and drain details. Ducts shall never be allowed to drain into a building electrical enclosure.

k. Concrete for encasement of ducts shall develop a compressive strength of 3000 lbs in 28 days. A minimum of three inches of concrete shall be placed on all sides of the duct and two inches between individual conduits for unreinforced duct banks. Duct runs shall be of special reinforced design under the following conditions, except that duct banks containing steel conduit will not normally require additional reinforcement.

   (1) Where the top of the conduit is less than 18 inches below the finish grade.

   (2) Where the top of the conduit is less than 42 inches between the bottom of the rail at railroad crossings or bottom of pavement in heavy traffic areas.

   Concrete shall be poured on undisturbed or well-compacted earth, and shall be thoroughly rodded or lightly vibrated to fill all voids. See Hanford Architectural-Civil Standard Specifications HPS-512-AC, Placing Reinforced Concrete, and HPS-510-AC, Batching and Delivery of Concrete.

l. Before cables are pulled in ducts, the ducts shall be prepared by pulling a plug closely approximating the diameter of the conduit through the duct to loosen any burrs and to make certain there are no obstructions. This shall be followed with a wire brush and swab to remove any remaining foreign materials.

m. Duct runs shall be marked with marker posts as shown on Hanford Plant Standard I-5-5. Markers shall be placed at each angle or turn, and approximately 150 feet apart on straight runs.

3. Pole Risers

a. Pole risers shall be IMC or galvanized rigid conduit above grade. The concrete envelope shall terminate one foot above grade. Risers shall be grounded at the pole and unless terminating in a device, shall not terminate less than 15 feet above grade. Risers shall be set out a minimum of 3-1/2 inches from the pole by means of wood blocks or metal brackets. See Hanford Plant Standard E-10-15.

b. Lightning arresters shall be specified where cables connect to aerial conductors. The arrester ground shall be solidly connected to the cable shield with as short and direct a lead as possible. If arresters are used at the other cable end, they should be directly connected to the cable shield. Ground rods should be driven where arresters are used.

4. Manholes and Cable Vaults

a. Manholes shall be located at all junctions, sharp corners, terminations, etc., of duct runs and at strategic locations in longs runs to facilitate pulling of cable. See method of calculation, paragraphs C-1 and 2.

b. Manholes shall be prefabricated type, not smaller than 5'-0" wide by 8'-0" long on the inside, and shall have at least 6 feet clear inside height.

c. Manhole covers shall be round cast iron heavy-traffic type not less than 30 inches in diameter. Covers shall be identified by cast-in lettering "ELECTRICAL". Provide ample clearance under manhole openings to insure unimpeded access and egress. It shall be possible to operate subsurface switches through the opening.

d. Covers shall be set at sufficient height to permit adequate surface drainage away from the manhole.

e. Pulling irons shall be provided in the wall opposite each duct bank entering the manhole.

f. Cable supports shall be specified as required for adequate and neat racking of the cables. Cables shall be bracketed in an orderly manner to permit working on one without disturbing another. Cables entering a manhole from a duct bank shall be staggered to provide fanning out of duct to facilitate training of the cables in the manhole.

g. Lighting shall be provided where low-voltage circuits are available on the basis of one watt per square foot floor area. A convenience outlet shall be installed. Vaporproof fixtures and wiring devices shall be used.

h. Steps are not required in small manholes but should be provided for larger vaults.

i. Floors shall drain into a small sump with open bottom.

j. Each manhole shall be provided with a grounding connection. See paragraph B-7-a.

5. Cables

a. Conductors for all phases, including the neutral and equipment grounding conductor where used, of each circuit shall be installed in the same conduit. Where physical size of the conductors precludes this procedure, the conductors shall be divided in two or more parallel branches and installed so that all conductors of each branch are run in the same conduit. Runs of one single conductor per duct shall not be used, except in very short runs (20 feet or less).

b. Cable for underground distribution shall be single or multiple conductor, and shall conform to the following Hanford Standard Procurement Specifications for 5 and 15 kV cable.

HPS-316-E	Butyl-Rubber-Insulated, Jacketed Cable
HPS-318-E	Cross-Linked-Polyethylene-Insulated Cable (also 600 volt)
HPS-319-E	Ethylene-Propylene-Rubber-Insulated Cable

See IPCEA, S-19-81, NEMA WC3, Part 4, Table 4-1, and Appendix K for recommendations concerning insulation shielding of cables. Shielding is required for single-conductor cables without metallic sheath or armor, and for multiple-conductor cables with nondischarge-resisting jacket, where operating at over 2000 volts. Where multiple circuits pass through a common manhole accessible to personnel, the conductors of those circuits energized at over 600 volts to ground shall be shielded cable. Splices, terminations, and stress cones shall be made according to instructions of, and with materials specified by, the manufacturer of the cable. It should be specified that wire and cable with polyvinyl chloride insulation or jacket shall not be pulled into ducts or otherwise handled when the temperature is 15 F or lower.

c. Cable shall be color coded by means of colored plastic tape applied in bands a minimum of two inches in width at all terminations and splices and in each manhole.

A Phase	- Red
B Phase	- Yellow
C Phase	- Blue
Neutral	- White
Equipment Ground	- Green or Bare

See the paragraphs under B-7 for use of the equipment ground conductors.

d. Lubricants for pulling in cables may be a thick mixture of soap flakes and water, a mixture of soapstone and water, or commercial lubricants as recommended by the cable manufacturer (not petroleum greases).

e. Cables shall not be bent to a smaller radius than shown in the following table when pulling, handling, or racking.

MINIMUM BENDING RADII OF CABLES - SINGLE CONDUCTOR

Cable Diameter Inches	Insulation Thickness 64th In.	Minimum Radius - Multiple of Cable Diameter Non-Shielded	Shielded
1.00 &	0 - 10	4	12
Less	11 - 20	5	12
1.01 to	0 - 10	5	12
2.00	11 - 20	6	12

6. Direct Burial Cables

a. For temporary or remote installation where the cost of ducts is not justified, cables energized at not more than 5000 volts may be directly buried. In accordance with NEC, Section 300-5, 600 volt cable (type UF or other types approved for direct burial) shall be a minimum of 24 inches deep, except that the depth may be reduced to 18 inches where a 2-inch concrete cover, or other equivalent protection, is installed in the trench over the cable(s). Direct burial cable over 600 volts shall be in accordance with paragraph 710-3(b) of the NEC (grounded concentric conductor or conducting sheath). Single conductors are not permitted. NEC Table 710-3(b) requires a minimum depth of 30 inches for cables at circuit voltages 600 to 22kV (5kV), which may be reduced 6 inches for each 2 inches of concrete or equivalent. Cables under roads and railroads shall be in concrete encased ducts a minimum of 42 inches deep, or in heavy-wall steel conduit without encasement a minimum of 36 inches deep. See paragraph B-2-b for concrete encased ducts.

b. Cables shall be embedded in screened sand backfill, and shall be covered with one by eight inch pentachlorophenol-treated boards in the absence of other protective covering. Plastic marking tape shall be placed in the backfill directly above the cables approximately 12 inches below grade. The marking tape shall be six-inch wide, yellow color plastic without printing, Terra Tape as manufactured by the Griffolyn Co., or an approved equal. See HPS E-10-20. Underground runs shall be marked with marker posts as shown on HPS E-10-5.

c. Branch circuit and feeder cable runs shall include an equipment grounding conductor sized in accordance with NEC, Table 250-95.

7. Grounding and Grounding Conductors

a. A grounding conductor shall be included in the concrete duct envelope (not in a duct) and connected to an existing ground, preferably at the power source. Ground conductors shall be interconnected at manholes. Ground conductors for direct burial or encasement in concrete shall be seven (7) strand steel wire, Special Low Carbon Grade, with Class B zinc coating per ASTM A 475, not smaller than 5/8 inch in diameter or Diamond Line Jr. size zinc alloy ribbon (Federated Metals Corp).

b. Where a transformer or bank of transformers supply a single service disconnecting device or group of devices at the same location through an underground duct or cable, the system neutral shall be grounded at the transformer only. This will require the use of an equipment grounding conductor run inside the service conduit with the power conductors.

c. All metallic conduits shall be grounded, preferably at both ends. Metallic conduits shall not be used for grounding conductors.

d. The metallic shield of high-voltage cables shall, in general, be grounded at both ends of the cable and at each splice. Short lengths of cable (for example, a direct feed from an aerial line) may be grounded at only one point. Where grounding conductors are part of the cable assembly, they shall be connected to the shielding at both ends. Grounding connections to cable shields must be made to provide a permanent low resistance junction. In general, the connection shall be soldered at several points. The braid or strap used to bring out the shield connection must be of ample size to carry fault currents.

C. CABLE PULLING TENSION CALCULATIONS

1. Pulling Tension Equations

a. The pulling tension for a given duct section shall be calculated as follows:

(1) For straight ducts

$T = Lwf$ where

T is the pulling tension in lbs,
L is the length of duct in feet,
w is the weight of cable in lbs per ft, and
f is the coefficient of friction which, for well constructed ducts, may be taken as 0.5

(2) For ducts having a curved section

$T = T_2 + T_1 e^{fa}$ where T and f are as above, and

T_2 is the tension for the straight section at the pulling end,

T_1 is the tension for the straight section at the feeding end,

a is the angle of the bend in radians (radian = 57.3 degrees),

e is 2.718 (Naperian log base).

The value of e^x (e^{fa}) is given directly in mathematical handbook tables.

The above equations assume no significant change in elevation of the two ends of the cable. If considerable upgrade or vertical pulls are involved, the weight of the cable in the vertical section must be added to the tension calculated from these equations.

b. The following tensions shall not be exceeded in pulling cables.

(1) Pulling with device attached to strands of copper or aluminum conductors

$Tm = 0.008\ (cm)$ where

Tm is the maximum tension in lbs, and cm is the circular mil area of a single conductor, the total area of the several conductors in a single cable, or the total area of all cables pulled at the same time.

(2) Pulling with basket grip

Tm = 1000 lb for non-leaded cables, but the maximum tension as calculated from equation (1) shall not be exceeded.

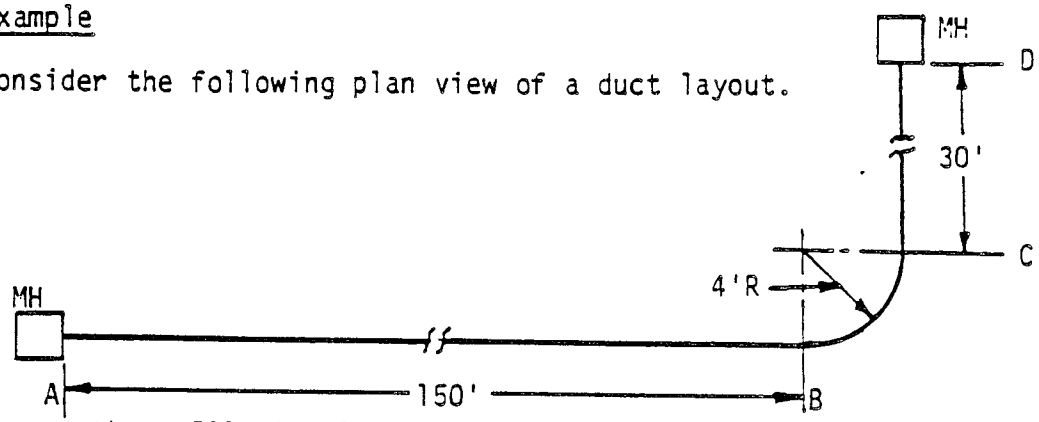
(3) Maximum tension at bends

Tm = 100 R where

R is the radius of curvature of the duct in feet. The maximum tension as calculated from (1) and (2) shall not be exceeded.

2. Example

Consider the following plan view of a duct layout.



Assume three 500 MCM, 500 V, rubber-insulated, non-metallic jacketed cables pulled together. Weight of single cable is 2.2 lbs per foot

Pulling from A to D

Tension at B

$$T_B = Lwf$$

$$= 150 \times 3 \times 2.2 \times 0.5 = 495 \text{ lbs}$$

Tension at C

$$T_C = T_B e^{fa}$$

$$a = 90/57.3 = 1.57 \text{ radians}$$

$$e^{fa} = e^{0.5 \times 1.57} = e^{0.785} = 2.19$$

$$T_C = 495 \times 2.19 = 1084 \text{ lbs}$$

Tension at D

$$T_D = T_C + Lwf$$

$$= 1084 + (30 \times 3 \times 2.2 \times 0.5)$$

$$= 1084 + 99 = 1183 \text{ lbs}$$

total pulling tension required

This value exceeds the allowable 1000 lbs for a basket grip over all three conductors, but the pull could be accomplished with a separate basket grip over each conductor. Or the cables could be pulled with a pulling device attached to the conductor strands because in this case

$$Tm = 0.008\ (cm) = 0.008 \times 3 \times 500{,}000$$
$$= 12{,}000 \text{ lbs}$$

The maximum allowable stress at the bend is

$$Tm = 100\ R = 100 \times 4 = 400 \text{ lbs}$$

This is exceeded by the tension required at C (T_C = 1084 lbs) and therefore the cables could not be safely pulled from A to D.

Pulling from D to A

T_C = 99 lbs
T_B = 99 x 2.19 = 217 lbs
T_A = 217 + 495 = 712 lbs total tension required.

This is satisfactory in all respects. A basket grip or device could be used and the allowable tension at the bend (400 lbs) is not exceeded by the tension at B (217 lbs). A lower tension will always be obtained by placing the let-off reel at the end nearest the bend.

D. CURRENT-CARRYING CAPACITY OF CABLES

In addition to the allowable conductor ampacities, the size of cables is dependent upon three additional factors, (1) the allowable voltage drop, (2) the short circuit current of the system, and (3) the operating conductor temperature, which must not exceed the maximum temperature rating of the cable.

1. Voltage Drop

The voltage drop may be calculated, knowing the current, length, and the a-c resistance and reactance of the conductors. Charts published by cable manufacturers are useful for that purpose.

2. Short Circuit Current

The cable shall be sized to carry safely the short-circuit current of the system. For copper conductors the allowable short-circuit current is:

$$I = 0.0549\ cm\ \frac{1}{T} \quad \text{where}$$

cm is the area in circular mills and

T is the required time in seconds for operation of the circuit breakers. The equation is based on 80 C temperature rise with no heat transfer from the conductors.

See also IPCEA Publication P-32-382, Short Circuit Characteristics of Insulated Cable.

3. Current Ratings of Cables

The maximum continuous ampacities for copper and aluminum solid dielectric insulated conductors shall comply with Section 310-15 of the NEC and the tables as therein described.

SDC-7.5

STANDARD ELECTRICAL DESIGN CRITERIA

FOR

INTERIOR POWER AND LIGHTING SYSTEMS

This Section consists
of 30 pages.

Description of Revision		HANFORD PLANT STANDARDS DOE - RICHLAND, WASHINGTON	Number
General Revisions			
Prep. or Rev. by A. R. Lucchitti	Orig. Issue Date 3-30-77	ELECTRICAL DESIGN CRITERIA	SDC-7.5
Approved R. W. Brown DOE	Date 4/15/86 ~~1-22-82~~	INTERIOR ELECTRIC POWER AND LIGHTING SYSTEMS	Revision No. 25

VE-37 (2-78)

7.5 INTERIOR POWER AND LIGHTING SYSTEMS

NOTE: These criteria are intended for use as data that is supplemental to DOE Order 6430.1 General Design Criteria Manual.

The Safety Analysis of an individual facility may require adherence to other specifications and design criteria, some of which are listed in DOE Order 6430.1. These criteria are not intended to cover all such cases and, where a more stringent specification is invoked, it shall take precedence.

A. SYSTEM VOLTAGE AND SERVICES

1. Systems

a. Utilization voltages (alternating current, 60 Hz) in use at Hanford are as follows. Preferred nominal system voltages as standardized by ANSI C84.1 are shown.

(1) 120/240 volt, 3 wire, single-phase, with neutral grounded.

(2) 240/120 volt, 4 wire, 3-phase, delta, grounded at the 120 volt neutral tap.

(3) 208Y/120 volt, 4 wire, 3-phase, with neutral grounded.

(4) 480 volt, 3 wire, 3-phase, delta, ungrounded.*

(5) 480 volt, 3 wire, 3-phase, delta with 'B' phase grounded.*

(6) 480Y/277 volt, 4 wire, 3-phase, with neutral grounded.

(7) 2400 volt, 3 wire, 3-phase, delta, ungrounded.*

(8) 2400 volt, 3 wire, 3-phase, delta, with neutral established and grounded through resistor and grounding transformer.

(9) 4160Y/2400 volt, 4 wire, 3-phase, with neutral grounded.

(10) 13,800 volt, 3 wire, 3-phase, delta, with neutral established and grounded through resistor and grounding transformer.

(11) 13,800 volt, 3 wire, 3-phase, wye, with neutral grounded.

* Only for extensions in existing areas where these systems are installed.

b. All new 480 volt power system design shall be 480Y/277 volt with grounded neutral.

2. Utilization Requirements

a. A 120/240 volt, single-phase system is ordinarily used for small buildings with fractional horsepower motors, domestic-size water heaters, or other minor heating loads.

b. Three-phase systems at 240 volts shall be used only when the load is predominantly heating. The use of 240 volts to supply motor loads shall be limited to locations where no other service voltage is available and where the total motor load is ten horsepower or less.

c. Four-wire, 208Y/120 volt, three-phase systems may be used for buildings of moderate size where the load is mainly lighting but may include motor loads of not more than a total of ten horsepower.

d. Three-phase power systems of 480, 480Y/277 or 4160Y/2400 volts or a combination of these services shall be employed for buildings which have a number of integral horsepower motors, very large motors, or other heavy power loads. The lighting system may be supplied at 120 or 277 volts.

e. Primary systems of 2400, 4160 or 13,800 volts, depending on the distribution voltage in the area under consideration, shall be used for large industrial or process buildings. Unit type substations and metal-clad switchgear should be used with these voltages. For example, a main 13,800-2400 volt unit substation, usually located outside the building, may supply a main bank of 2400 volt metal-clad switchgear with feeders to 2300 volt motors and 2400-480 volt load-center substations. The final utilization voltages and layout of power systems will be dependent upon the load to be served, the reliability of the service desired, and the relative costs of alternate feeder distribution systems. See Power Systems, paragraphs I-1, 2, and 3 of this Section of the Criteria.

f. The power factor of new facilities with sizable equipment loads shall be not less than 95%. Power factor correction shall be applied at the load. The addition of power factor correction on either new or existing loads shall be reviewed with the on-site electrical utility contractor to determine an effectual means of obtaining the desired result.

3. Building Services

a. Service conductors shall be enclosed in rigid metal, galvanized steel conduit, intermediate metal conduit or other

corrosion resistant ducts from the service connection to the main disconnecting device(s).

b. Services may be overhead or underground depending on cost, occupancy, location, etc.

c. Aerial service conductors shall be a minimum of 14 feet above grade at the point of attachment to the structure. Services over roadways, driveways, or service areas shall be not less than 20 feet above grade at any point. Mast arms attached to low buildings or a pole set adjacent to the structure may be used to meet these requirements. See ANSI C2 for required minimum clearances of conductors over roads, railroads, buildings, etc.

d. Service switches or main circuit breakers shall be located as near as possible to the origin of the service, preferably near an entrance to the building or in an electrical equipment room. The number of service disconnecting devices shall not exceed that permitted by the National Electrical Code (NEC).

e. Service disconnecting switches, where used, shall be heavy-duty, fusible type with interlocking cover, NEMA Type 1. When used with grounded distribution systems, the entrance switch shall be equipped with a grounded neutral bar.

f. Service distribution panelboards shall be equipped with a grounded neutral bar and a ground bar.

B. FEEDERS AND BRANCH CIRCUITS

1. Drawings

a. A one-line diagram shall be shown on the electrical drawings to indicate the rating and interconnection between the service entrance equipment, feeders, distribution panelboards and branch circuit panelboards.

b. All branch circuit wiring shall be clearly shown on the drawings. The method of switching and the outlets which are controlled by switches shall be indicated. The panelboard designation and circuit number shall be shown for each circuit.

2. Design

a. The voltage drop in feeders and branch circuits shall be limited to that permitted by Article 215 of the NEC.

b. Design loads for branch circuits shall be calculated in accordance with Article 220 of the NEC.

c. Conductor sizes for inside electrical wiring shall be selected according to (1) Article 310 of the NEC, (2) the allowable voltage drop as in paragraph (a) above, and (3) demand factors not exceeding those permitted by the NEC.

3. Identification of Equipment

Main service equipment, distribution and branch circuit panelboards, controllers, and switchgear shall be identified after installation by means of engraved plastic nameplates attached to such equipment. See Hanford Plant Standard I-2-7 for nameplate data. Nameplate engraving shall include the equipment designation, voltage, number of phases and the name of the piece of equipment that provides the source of power.

NOTE: Service equipment number designations shall be obtained from the onsite electrical utility contractor.

C. GROUNDING

1. System and Service Grounding

a. A grounding system must be established for each building or substation to maintain ground potential on conductors and apparatus connected to the ground system and to dissipate currents conducted or induced into the ground system. The extent of the grounding system shall be established in accordance with the following and all substations shall be considered to be Category 3 buildings. Buildings at Hanford shall be assigned one of three basic building categories for the purpose of determining the appropriate grounding electrode system in accordance with the following criteria.

Category 1 - Buildings not exceeding 500 square feet of floor area served at less than 150 volts to ground and containing no specialized equipment requiring special grounding considerations.

Category 2 - Buildings exceeding 500 square feet of floor area served at less than 150 volts to ground and containing no specialized equipment requiring special grounding considerations.

Category 3 - Buildings served at more than 150 volts to ground or containing specialized equipment requiring special grounding considerations.

Materials of construction and planned occupancy, except as indicated above, are secondary considerations to those listed.

b. After having established the building category in accordance with the above guidelines, the building grounding electrode system shall be designed in accordance with the following:

- Category 1 Buildings: Category 1 buildings shall utilize an uncoated metal underground water pipe, if available, as the primary grounding electrode. (Underground water piping supplying fire protection systems shall not be utilized as a grounding electrode. See NFPA 24.) If no acceptable water pipe is available, the primary grounding electrode shall be either a concrete-encased electrode or a ground ring as defined in NFPA 70. The primary grounding electrode shall be supplemented by either of the above electrodes or by a made or other electrode as defined by NFPA 70.

- Category 2 Buildings: Buildings in Category 2 shall utilize an uncoated metal underground water pipe, if available, as the primary grounding electrode and a concrete encased electrode as the supplementary electrode. Should no acceptable waterline exist, the concrete encased electrode shall be primary and a ground ring or made or other electrode shall be supplemental.

- Category 3 Buildings: Category 3 buildings shall utilize an uncoated metal underground water pipe, if available, as the primary grounding electrode and a ground ring as the supplemental electrode. Should no acceptable waterline exist, the ground ring shall be primary and a concrete encased electrode shall be supplemental.

c. In systems for buildings in all categories the following shall apply:

- The grounding electrode system shall include all grounding electrodes listed in NFPA 70, 250-81 if such are available. This will include steel reinforcing bars in concrete footings or foundations if it complies with subparagraph (c) of the listed reference. All connections between ground cable, ground rods, steel reinforcing bars and underground water piping shall be made by appropriate exothermic welding. (Connections to water pipe shall be made only after government representative approval.) Connections made by exothermic welding shall be wire brushed immediately after the removal of the mold, and shall be painted with an asphaltic paint for a minimum of 6" on each side of the weld before the weld has cooled.

d. Where an outside transformer or bank of transformers supply a single service disconnecting device or group of devices at the same location through an underground duct or metal enclosed busway, the neutral conductor (where used) shall be grounded at both the transformer and at the service disconnecting device. See HPS E-12-1. If two or more services are fed from the same transformer(s), the neutral shall be grounded at the transformer and at each service disconnecting device or group of devices. The equipment grounding points will then be at the individual service disconnect device(s). Delta-connected, 480 volt, 3-phase systems in some existing Hanford areas have the 'B' phase grounded at the transformers and the 'B' phase conductor must not be grounded at any other point.

e. The ground connections at the transformer and service disconnecting device must be readily accessible.

f. Grounding electrode conductors shall be sized according to the NEC, Table 250-94, but shall not be smaller than No. 6 AWG copper or equivalent, stranded, with green color insulation or bare.

g. Where subject to mechanical injury, the grounding electrode conductor shall be protected in accordance with NEC, paragraph 250-92(a), except that a nonmagnetic material shall be used for the protective enclosure.

h. The service grounding electrode conductor shall be connected to the building ground grid or mat where grids are available.

i. See SDC-7.4 for grounding of underground high-voltage cable systems.

2. <u>Grounding Electrodes</u>

a. The grounding electrode system shall comply with NEC 250-81. Attachment to water piping and ground cables or grids shall be installed per the methods described in paragraphs C1(c) and G6(f). A ground ring of two, 5/8 inch cables in parallel, bonded at intervals of not more than 50 feet, shall be buried at least 2-1/2 feet below grade around the periphery of the building or installation. The ring shall be connected to ground rods at intervals not exceeding 50 feet and at each corner, and shall be connected to all water lines serving the building at two points on each line. For large buildings or installations, cross ties of single cables shall be used to form a grid. The grid spacing shall be 30 to 50 feet and should match the column spacing or multiples of column spacing, to provide a convenient ground point for the columns. Details of building grounding grids are shown on HPS E-12-5. The upper parts of buildings not otherwise directly grounded shall be bonded to the grounding system with grounding cables.

Ground plates shall be installed, when required, in buildings that have concrete walls and floors. The ground plates shall have tapped holes spaced and threaded per NEMA requirements. The ground plates shall be compatible with the type of ground cable used.

b. All underground ground cables shall be 5/8", seven (7) strand steel stranded wire, Special Low Carbon Grade, with Class B zinc coating in accordance with ASTM Specification A 475.

c. Ground rods shall be galvanized steel not less than 5/8 inch in diameter having a minimum of eight feet of length in direct contact with earth. They should be driven at least six feet apart in areas where a number of rods are needed to reduce ground resistance. Resistance to ground shall be measured by the voltohmmeter or Wheatstone bridge methods or by commercial instruments designed for measuring ground resistance. If the measured resistance to ground of a ground rod or rods exceeds 25 ohms, additional rods to a maximum of six shall be installed. Grounding systems for large buildings or substations will require special design depending on location, etc. See reference, paragraph C-4-k.

d. It has been established that concrete below grade is a semi conducting medium somewhat lower than average earth resistivity. The encasement of rod or cable electrodes in concrete develops lower resistance than a similar electrode directly in earth.

Where steel reinforcing bars are installed in concrete footings, an electrical grounding connector shall be bonded to at least 20 feet of one or more bars not less than 1/2 inch in diameter. A minimum length of 20 feet of 5/8", seven (7) strand steel wire per paragraph C2(b) may be substituted. Each "footing electrode" has a resistance equal to or lower than a driven rod of equal depth. The large number of such footings inherent to buildings will provide a net ground resistance considerably lower than normally provided by other made electrode methods.

e. Exposed grounding conductors inside of buildings shall be copper, or other corrosion-resistant metal as permitted by the NEC. Connections between copper and galvanized steel shall be by exothermic weld or compression fittings and shall be exposed and above grade. See paragraph G-6-f. Copper cable used above grade shall not be smaller than No. 6 AWG.

f. For new construction in existing areas having underground copper grounding systems or extensions to buildings with copper grids, it may be preferable to use copper in the new design. The objective is to avoid close proximity of dissimilar metals underground or in wet locations.

g. The installation of a ground mat near stainless steel lines should be avoided. Where establishment of a ground grid near stainless steel piping is necessary, cathodic protection of the stainless steel must be provided.

h. Buried grounding cable shall be protected against all mechanical damage before and during backfill. Backfill material placed within one foot of the cable shall not contain rock larger than two inches in diameter.

3. Equipment Grounding

a. The term equipment shall be understood to mean all exposed metal parts of a wiring system including conduit, raceways, metal armor of cables, cabinets, switch boxes, outlet boxes, motor frames, motor controllers, panelboards, and lighting fixtures.

b. The equipment ground system shall originate at the transformer(s) or the service grounding point. See paragraph C-1-b. The grounding conductor shall in no case be the system neutral or any current-carrying conductor.

c. Metallic raceways may be used for the equipment grounding conductor only in systems of less than 150 volts to ground for circuits (1) rated at less than 60 amperes, and (2) serving single phase motors smaller than 5 horsepower. All raceways shall be grounded.

d. A separate equipment grounding conductor shall be used to ground (1) all equipment operating at over 150 volts to ground, (2) all circuits protected at 60 amperes or more, and (3) all motors 5 hp and larger. The equipment grounding conductor must be run inside the conduit or wiring channel enclosing the power conductors supplying the equipment, or in the case of multiconductor cable, must be located inside the sheath of the cable. Where physical limitations prohibit the use of a larger conduit to include the equipment ground conductor, the ground conductor shall be placed as close to the conduit as possible, preferably strapped to it.

e. All metallic conduits, wiring channels, and the armor of armored cable shall be grounded at each end.

f. Equipment grounding conductors, including all bonds and jumpers associated with the feeder or branch circuit, shall be sized according to the NEC, Table 250-95. Separate equipment grounding conductors shall have a green color insulation in sizes No. 2 AWG and smaller, but may be bare in sizes No. 1 and larger. Grounding conductors installed in conduit may be bare. All grounding conductors, bonds, and jumpers shall be IPCEA, Class B, stranded wire or cable,

except that solid grounding wires where an integral part of NMC, UF, and similar cables, and the metal sheath of MI, MC, ALS, and similar cables, may be used for equipment grounding if in accordance with NEC Table 250-95.

g. Some types of multiconductor power cables are made with two or three grounding conductors placed in the interstices between the larger current-carrying power and neutral conductors. These conductors may be used as the equipment grounding conductor, provided their combined size meets the requirements of NEC Table 250-95.

h. Interlocked armored cable shall be constructed with an integral equipment grounding conductor or conductors. The sheath shall be grounded but it shall not be used as the equipment grounding conductor.

i. In multiconductor cables and cords, the green conductor shall be used as the grounding conductor, and shall not be used for any other purpose except as in the following references. See HPS E-14-5 for color coding of control cable and E-14-8 for color codes for portable cords.

j. Grounding conductors shall be copper or other corrosion-resistant material as permitted by the NEC. Copper wire and cable shall be annealed. In no case shall hard drawn copper wire or cable be used for grounding conductors, bonds, or jumpers.

k. Receptacles that do not have the grounding contact connected to the mounting strap, where used in systems in which the conduit serves as the grounding conductor, shall have a green color bonding jumper connected from the receptacle ground terminal to the box and conduit. A bonding jumper is required by the NEC, paragraph 250-74, for receptacles unless the exceptions to that rule apply. Exception No. 1 to NEC 250-74 shall not apply to the requirement for a jumper as stated in the following paragraph.

l. Grounding-type receptacles, where mounted on flat or raised box covers or in metal partitions by means of the plate fastening screw(s) (strap ears are not fastened to a box), shall have a green bonding jumper connected between the receptacle ground terminal and a grounded box, conduit, or the grounded metal partition framing.

m. All industrial cord- and plug-connected equipment (except electric clocks and soldering irons) used in production facilities, shops, laboratories, etc., shall be grounded by use of three conductor type cord and grounding caps. Portable office equipment (typewriters, calculators, lamps, fans, erasing machines, etc.) used in offices need not be

grounded except as required by the NEC, Section 250-45(b) and (d). Cord-connected, fixed equipment in offices shall be grounded in accordance with NEC 250-45(d). 'Refrigerators' as stated in 250-45(d) shall include water coolers. Cord-connected equipment shall be grounded, where required, by means of a separate grounding conductor (green color) in the cord or cable equal in current-carrying capacity to the largest line conductor. The ground path shall be completed through a separate grounding pole in the plug and receptacle.

n. The ground connection to motors and other equipment shall be attached by means of a solderless terminal (solder lugs shall not be used) fastened to the motor beneath the head of a bolt tapped into the frame. Ground attachment to foot bolts or end bell bolts is prohibited.

o. Plug-in or trolley busways shall have a ground bus, and plug-in or trolley devices shall have contact stabs or trolleys for making contact with the ground bus. The ground bus shall be connected to the grounding conductor at the point of supply and shall make positive electrical contact with the bus enclosure at both ends of the bus run and at intervals of 20 feet or less.

p. In those types of busways where a ground bus is not available, the side rails of the bus enclosure shall have a galvanized or corrosion resistant finish. Both side rails shall be positively connected to the grounding conductor at the point of supply, and care should be taken that an effective electrical connection is made at all splice points along the length of these rails. Connection between rails and the enclosing case of each plug-in device shall be made through attachment clamps.

q. Cranes and hoists shall be grounded in accordance with the NEC, paragraph 610-61. Where positive grounding cannot be attained by crane, hoist or bridge wheels running on tracks, as permitted by the NEC, or by other means, a separate contact conductor and collector shall be provided for equipment grounding.

r. Auxiliary (external) bonding of the enclosures or frames of electrical equipment to adjacent metal members (building steel, machine frames, pipe, etc.) shall be considered where personnel hazards may exist. The requirements are covered in HPS E-12-1 and 2. The bonding conductor shall be sized according to the NEC Table 250-95, but shall not be smaller than No. 6 AWG, stranded copper or other corrosion-resistant metal, and shall have green insulation or be bare.

s. A continuous row of lighting fixtures supplied at less than 150 volts to ground may be considered as one fixture if the mechanical connections between fixtures are such that electrical continuity is assured. Fixtures supplied at over 150 volts to ground shall have a grounding conductor connected to each unit.

4. Static Grounding

a. The column footings of all steel frame buildings and all other metal structures shall be connected to a water line or ground ring. Only galvanized steel cables or ribbon zinc anodes and ground rods shall be used in direct contact with the earth. See exception, paragraph C-2-e.

b. A static grounding system must be provided for steel frame buildings, tanks, etc., and process buildings where hazardous conditions may exist. The main grounding conductors shall be two, 5/8 inch galvanized steel cables laid parallel and bonded together at intervals of not more than 50 feet. The cables shall be buried at least 30 inches deep around the periphery of the building or installations. Metal buildings containing hazards of Class I, Groups A, B, C, and D as defined in Chapter 5 of the NEC, shall have siding and roofing grounded at every fourth panel or sheet, and other building steel such as floor gratings, door frames, railroad track in and adjacent to the building shall be connected to the grounding system.

c. All nonelectrical machinery and equipment located in buildings where flammable gases, solvents, gasoline, metal dust, coal dust, or other flammable material is processed, stored, or otherwise handled must be grounded. This may be accomplished by bonding between several pieces of equipment and making a common connection to a grounded building column or directly to a water main. The main grounding conductor shall be No. 4/0 AWG copper or equivalent. No. 2/0 may be used for branches to large equipment and No. 4 to smaller items.

d. Pipe lines and ducts carrying flammable liquids or vapor must be grounded at points not exceeding 100 feet along the route of the pipe. Where couplings and fittings are not electrically conductive, a bond wire or braid shall be used to jumper such fittings.

e. Flexible grounding cable with a positive clamp attachment must be provided to ground all movable equipment such as railway cars, trucks, etc., which are used in hazardous locations.

f. All gas cylinder manifolds shall be grounded. Manifolded flammable gas cylinder installations shall be provided with a positively grounded aluminum floor plate.

g. See the National Fire Protection Association's Publication No. 77, Static Electricity, for a discussion of the detection and prevention of static charges and suggested methods of grounding.

h. Lightning rods shall be installed on all buildings which contain explosive or easily ignited materials, except as follows:

(1) Where the structure is entirely within the cone of lightning protection afforded by a higher structure such as stacks with terminals or grounded elevated tanks. The zone of protection is usually taken as a cone whose radius is equal to the height of the apex (or a cone generated by the revolution of a 45 degree right triangle).

(2) Tanks or other structures having grounded metal roofs where the roof material is at least 3/16 inch in thickness.

(3) Where the risk from fire instigated by lightning, considering the value of the building and its contents, does not justify the cost of lightning protection.

i. Steel-frame buildings may have air terminals connected to the building steel if such steel is properly grounded and continuous without high resistance joints or if such joints are bonded. For all other construction, the terminals must be connected to ground by means of a separate grounding conductor. Grounding conductors shall be installed on the outside of the building and coursed in the most direct route to ground without sharp bends or loops.

j. For further details concerning lightning protection and installation recommendations, see ANSI C-5.1 (NFPA 78).

k. For further information and details concerning system grounding, equipment grounding, static and lightning protection grounding, and connections to earth, see the Institute of Electrical and Electronics Engineers (IEEE) Standard No. 142, Grounding of Industrial and Commercial Power Systems.

D. WIRING METHODS

1. Rigid Metal Conduit

a. Rigid metal and intermediate metal zinc-coated steel or aluminum conduit shall be used and installed in accordance with Articles 345 and 346 of the NEC, subject to the following requirements and restrictions.

(1) Rigid metal conduit or intermediate metal conduit (IMC) shall be used for all above grade service entrances and in all hazardous locations.

(2) Threadless fittings shall not be used on rigid metal conduit or IMC.

(3) Aluminum conduit shall not be used in poured concrete structures, where encased in concrete, or directly buried in the earth. It may be used to enclose the grounding electrode conductor, on separately derived systems, to prevent the electromagnetic choke effect, associated with ferrous metal conduit, when high current passes through the grounding electrode conductor on a short circuit.

(4) Underground runs of steel conduit shall be encased in concrete except as in the following paragraph b.

b. Rigid galvanized steel conduit with a bonded polyvinyl chloride outer coating or linearized phenolic coating (Ultra Coat) may be used underground without concrete encasement, or in other locations where severe corrosive conditions are present.

(1) The conduit, prior to coating, shall be rigid, galvanized conduit conforming to ANSI C80.1. The PVC coating shall be fused to the surface and shall have a minimum thickness of 40 mils. Coated couplings shall be furnished with each length. Couplings shall have a sleeve extension of one pipe diameter, or two inches, whichever is less. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit. Sleeve thickness shall be not less than the thickness of the conduit coating. The coating of conduit, elbows, and couplings shall have no sags, blisters, lumps, or other surface defects, and shall be holiday-free. It shall be continuous over the entire length of the conduit, and shall be chamfered at the last thread.

(2) Coated steel conduit shall be encased in concrete under roadways and railways.

c. The following nonmetallic conduits shall be used for direct burial service and installed in accordance with NEC Article 347 and Table 300-5.

(1) Bituminous fibre duct, Class 1200, where traffic and/or backfill loads require high mechanical strength. Class 2000 where superior mechanical strength is required to meet unusually severe service conditions. See NEMA Standards Publication No. BC 1-1979.

(2) Fiberglass reinforced epoxy (FRE) duct, sizes 2" to 5", non-watertight type, CSA approved.

(3) Schedule 80 PVC conduit.

(4) High-density polyethylene.

d. The use of rigid nonmetallic conduit and fittings approved for the purpose is limited by the NEC to services of 600 volts potential or less. See NEC Article 347. An equipment grounding conductor shall be included in each nonmetallic conduit having circuit conductors energized at over 50 volts to ground.

e. Conduit risers through concrete slabs or floors shall be rigid metal or IMC. Transitions from plastic conduit runs shall be made under or in the slab or floor. All parts of buried uncoated steel conduit shall be encased in concrete.

f. Only rigid steel conduit or IMC (except aluminum) shall be embedded in masonry or concrete buildings where moisture may be present. See paragraph D-2-a.

g. Conduit runs between areas where an air pressure differential exists shall be sealed at both ends to prevent the flow of air through the conduit and consequent condensation of moisture on the inside surface of the conduit. Commercial duct sealing compounds or expandable silicone foam shall be used for this purpose. This does not apply to runs such as pole risers which may be intentionally ventilated.

h. See SDC 7.4 for use of underground conduit and ducts.

2. <u>Electrical Metallic Tubing (EMT)</u>

a. Electrical metallic tubing may be specified for the following (except services) provided that it is installed in a dry

location and not subject to impact, abrasion or other mechanical injury.

(1) Concealed or exposed wiring in attic, floor joist spaces, walls and ceilings of wood or steel frame buildings.

(2) Concealed or exposed wiring in masonry or concrete buildings provided the location is permanently dry. See the NEC, Article 348.

(3) All wiring in wood frame buildings.

b. Electrical metallic tubing shall not be used for runs from building walls or ceilings to machinery.

c. Indentor type fittings for electrical metallic tubing shall not be used.

3. Flexible Metal Conduit

a. Flexible metal conduit is permitted in lengths of six feet or less only (except as permitted by the NEC Article 645) to make connections to motors or other equipment where the use of rigid conduit is difficult or impracticable.

b. Liquidtight flexible metal conduit and fittings shall be used as above where the wiring is subject to moisture, oil, vapor, acid, etc. The conduit shall have a built-in grounding conductor. Fittings shall be corrosion resistant.

4. Nonmetallic-Sheathed Cable

a. National Electrical Code Type NMC cable may be used for 120/240 volt branch circuits in wood frame buildings. It may be run concealed or exposed provided that no exposure is less than four feet above the floor.

b. A bare or insulated solid grounding conductor shall be included in the cable, complying with the size requirements of the NEC, Article 336.

5. Plug-In Busways

Plug-in busways, trolley ways, etc., should be considered for shops, laboratories and similar areas where the equipment is subject to frequent changes, rearrangement, or expansion.

6. Wireways, Auxiliary Gutters and Busways

a. Where numerous or large conductors must be accommodated, auxiliary gutters or wireways may be used, although the use

of prefabricated trays is preferable where such an installation is practicable. See paragraph 7. Wireways are manufactured in standard sizes with boxes, fittings, transitions, etc., or may be fabricated for the particular application.

b. Wireways, auxiliary gutters, and busways shall be constructed and installed according to Articles 362, 364 and 374 of the NEC.

c. Wireways and auxiliary gutters shall have hinged covers where accessible to unauthorized personnel, where carrying conductors operating at more than 150 volts to ground, and where the wireway is installed seven feet or less above the floor or passageway. The maximum length of an auxiliary gutter shall be 30 feet.

d. Separate wireways or wireway separators fabricated for the purpose shall be used to separate (1) low-voltage signaling, communication, instrument, etc., conductors (2) power conductors operating at less than 600 volts, and (3) high voltage conductors of over 600 volts.

The Safety Analysis of some facilities may require more stringent circuit independence than that described here. Several IEEE standards may be invoked for portions of certain facilities. These standards may include ANSI/IEEE 384-1981, Standard Criteria for Independence of Class 1E Equipment and Circuits, ANSI/IEEE 308-1980, Criteria for Class 1E Power Systems for Nuclear Power Generating Stations, and IEEE 603-1980, Standard Criteria for Safety Systems for Nuclear Power Generating Stations.

e. The sum of the cross-sectional areas of all contained conductors at any point in a wireway or auxiliary gutter shall not exceed 20 percent of the interior cross-sectional area of the wireway. See also NEC, paragraphs 362-5 and 374-5.

7. Cable Trays

Ladders, troughs, channels, and similar supports for cables shall be constructed, designed, and installed in accordance with Article 318 of the NEC, and the requirements of paragraph 318-10 shall be adhered to for cable ampacities.

8. Armored Cable

Armored cable may be used in all sizes and voltage ratings (600 to 15,000 volts) for feeders and branch circuits provided that the cable is located where not subject to mechanical damage or to corrosive fumes or vapor.

9. Mineral-Insulated Metal-Sheathed Cable (Type MI)

MI cable should be considered where special conditions warrant its use, i.e. high ambient, corrosive or radioactive environments.

10. Underfloor Racways

Metal or fiber underfloor wiring systems may be used in large buildings where it is economically justifiable. See the NEC, Articles 354, 356, and 358.

11. Heat and Radiation Resistant Cable

Cables installed in radioactive environments shall be rated for the maximum anticipated exposure. Specially fabricated flexible heat and radiation resistant cables rated up to 1500 F at 600 volts are produced by Boston Insulated Wire and Cable Co. under the "Bostrad" trade name.

Multiconductor cables rated 2 x 10^8 RADS and 90 C operating temperature may be obtained from Rockbestos Products, Cerro Wire and Cable Co. listed under the "Firewall" trade name. Careful consideration shall be given to methods of termination for all conductors located in hot cells.

E. BOXES AND WIRING DEVICES

1. Outlet, Switch, and Junction Boxes

a. Boxes shall be sized and installed in accordance with Article 370 of the NEC.

b. Boxes used with rigid conduit, IMC, or EMT in dry locations may be aluminum, galvanized steel, cast iron, or cast aluminum. Boxes used with nonmetallic sheathed cable may be aluminum or galvanized steel of a type especially designed for the purpose. Aluminum boxes shall not be embedded in concrete.

c. Boxes used in wet locations shall be cast iron with a corrosion resistant finish, stainless steel or fiberglass.

d. Outlet boxes, panels, or other electrical equipment must be located at least 10 feet from safety showers. This does not apply to lighting fixtures or electrical equipment located eight feet or more above the floor.

2. Plugs and Receptacles

a. Receptacles and plugs for 480 volt, three-phase service at Hanford are covered by Hanford Plant Standards E-14-40, 45 and 48. NEMA standard receptacles, connectors and plugs as

shown in NEMA WD1 shall be used for other service (up to 600 volts) as applicable. Receptacles and plugs shall be Specification Grade. Isolated or regulated 120 volt supply for instrumentation power shall have the receptacle and plug equipment as shown on Hanford Plant Standard E-14-35.

b. The selection of receptacles for unusual services such as direct-current, odd frequencies or voltages, or heavy current requirements shall be at the discretion of the designer, but the receptacle types reserved by NEMA or as Hanford Standards shall not be used for such services.

c. Receptacles selected for weatherproof or explosion proof service, and receptacles in busways, baseboard strips, or underfloor duct outlets shall maintain contact configurations identical to the standard receptacle for the particular service.

d. Convenience outlets shall be located not greater than 12 inches above the floor except in shops, laboratories or similar areas where the mounting height shall be four feet above the floor. Mounting height of special purpose receptacles, such as multioutlet assemblies for computer equipment and laboratories, is at the option of the designer and shall be as shown on the drawings. Mounting heights for switches and receptacles in prefabricated metal partitions shall be according to the manufacturer's standard.

e. Metal cover plates for outlet boxes shall be used in industrial buildings. Nonmetallic plates may be used in offices.

3. Switches

a. Local lighting switches for all general uses shall be 20 or 30 ampere, 277 volt, totally-enclosed tumbler switches, specification grade. These switches are rated for full current for tungsten filament or fluorescent lamps, and 80 percent current rating for motor loads.

b. Switches shall be mounted four feet above the floor except for prefabricated metal partitions as in paragraph 2-d above.

c. Switch plates for industrial buildings shall be metal, but may be nonmetallic in offices.

F. PANELBOARDS

1. General

a. A Panelboard Schedule shall be shown on the drawings for each distribution and branch circuit panelboard. The schedule

should include the location and designation of each panelboard with the type, voltage, and current rating of each branch circuit overcurrent device and the branch circuit number.

b. Cable and bus conductors in switchgear and panelboards, and interconnections to such equipment, shall be installed as follows when observed from the front.

A Phase	Front	Left	Top	Upper Front	Upper Front
B Phase	Center	Center	Center	Upper Rear	Lower Front
C Phase	Rear	Right	Bottom	Lower Front	Lower Rear

c. When additions are made to present facilities, panelboards and switchgear shall match and line up with the existing equipment as closely as possible.

2. Types

a. Circuit-breaker panelboards shall conform to Federal Specification W-P-115A, Type 1, Class 1.

b. Panelboards for 208Y/120 or 120/240 volt systems with mains up to 600 amperes may be the plug-in/bolt-in type (such as Square D I-Line) or the bolt-in type.

c. Panelboards for 480Y/277 volts systems with mains up to 600 amperes shall have bolt-in type circuit breakers with interrupting ratings that are greater than the available short circuit current.

d. Panelboards or switchboards for power distribution with mains up to 1200 amperes shall have circuit breakers rated up to 1200 amperes. Interrupting capacity of circuit breakers shall be greater than the available short circuit current.

G. WIRE AND CABLE

1. Building Wire - 600 Volt

a. Building wire shall be in accordance with Hanford Standard E-14-1. Types THW, THWN/THHN, RHW and XHHW are approved in all sizes for all uses. However, Types RHW or XHHW are preferred in sizes No. 1/0 and larger for laboratory and process wiring.

b. Other types of building wire for specific or unusual applications such as high ambient temperature, extra flexibility, special insulation, high current-carrying capacity, etc., may be substituted for the above.

c. The minimum wire size for lighting and power circuits shall be No. 12 AWG. Smaller conductor sizes may be used in certain control cable or low-voltage applications. Wire sizes No. 8 and larger shall be stranded and No. 10 and smaller may be solid or stranded, except that conductors in control cable and grounding conductors shall be stranded. Conductors No. 1 AWG and smaller shall be copper, and No. 1/0 AWG and larger may be copper or aluminum, as specified. Bare grounding conductors shall be stranded, annealed copper.

d. The minimum wire size for interior fire alarm systems shall be No. 14 AWG, stranded. See SDC-7.8 for limited energy system conductor requirements.

e. Wire for use where vibration may be present, in critical circuits, such as metering, relaying, and instrumentation, or where the wire is flexed frequently, shall be stranded (19 or more strands).

2. Multiple Conductor Control Cable - 600 Volt

Multiple conductor cable shall be No. 16 AWG minimum size, 7 or 19 stranded conductor, 600 volt, with PVC, thermoplastic polyethylene, or cross-linked polyethylene insulation conforming to Hanford Standard Specification HPS-314-E, Plastic Insulated Control Cable. Requirements for installation and color coding are covered in Hanford Plant Standard E-14-5.

3. High Voltage Cable

a. Single-conductor cable (5 and 15 kV) shall have ethylene-propylene rubber insulation in accordance with Hanford Standard Specification HPS-319-E. Cross-linked polyethylene or butyl rubber insulated cable may be used if in conformance with ICEA S-68-516 Standards.

b. See SDC-7.2 for use of aerial cable, and SDC-7.4 for underground cable systems in ducts, pole risers, current-carrying capacity, etc. See ICEA Standard S-19-81, Part 4 and Appendix K, for recommended shielding practice for high-voltage cables.

4. Power Circuit Color Coding

a. Power circuit conductor color shall be:

A Phase	Red
B Phase	Yellow or Orange
C Phase	Blue or Black
Neutral	White
Ground	Green or Bare

Pressure-sensitive, colored plastic tape may be used to identify the conductors in lieu of colored insulation. See Hanford Plant Standards E-14-1, E-14-5, and E-14-8 for color codes.

b. The above coding shall be maintained throughout the power systems including service, feeders, and all branch circuits that supply utilization equipment.

5. Underground Installations - Direct Burial

a. Direct-burial cable may be used in lieu of concrete-encased conduit or duct for circuits of not more than 600 volts where the run is not subject to mechanical injury and the load is non-critical. See SDC-7.4 for direct burial requirements and other details. Multiple-conductor, direct burial cable shall contain an equipment grounding conductor in accordance with NEC, Table 250-95.

b. Underground runs of direct burial cable for circuits not over 600 volts shall be a minimum of 24 inches deep, embedded in a sand cushion, and covered with one by eight inch pentachlorophenol-treated boards before backfilling. See HPS E-10-20. Plastic marking tape shall be placed in the backfill directly above the cables approximately 12 inches below grade. The marking tape shall be six-inch wide, yellow color plastic without printing, TerraTape as manufactured by the Griffolyn Co., or an approved equal. Underground runs shall be permanently marked with marker posts in accordance with HPS I-5-5.

6. Splices, Taps, and Cable Terminations

a. Pressure-type, solderless connectors and terminal lugs may be used. Connectors with insulating caps or covers shall be UL approved for the voltage of the system. Connectors shall be installed according to the manufacturer's instructions using the proper tool for the connector terminal. Calibrated tools shall be used for critical circuits such as reactor safety circuits and emergency power circuits.

b. Plastic insulating tape or heat shrinkable tubing, made especially for electrical work, may be used for all splices and taps in circuits up to 600 volts. The thickness of insulating tape shall be at least equal to that of conductor insulation. Where a bolted splice or connection presents an irregular surface, an insulating putty shall be applied to the joints before taping. Molded insulating covers for connectors may be used in place of taping.

c. Manufacturer's instructions and directions must be strictly adhered to for splices, stress cones, and terminations in cables rated above 600 volts.

d. Cable leads that connect to oil-immersed equipment must be treated to prevent capillary seepage of the oil into the cable insulation.

e. Splices and taps in bare grounding conductors and connections to ground rods, where buried in the earth or concrete, may be made as follows. Brazing or thermite welding (Cadweld or Burndy, Thermoweld or equal), or Burndy compression ground taps.

(1) For copper to copper joints, two compression-type copper alloy clamps, a thermite welded connection, or a brazed joint may be specified. A copper or silicon-copper rod is to be used with torch brazing and phosphor-bronze rod with arc welding.

(2) Galvanized steel cables may be connected by two galvanized compression clamps, or a thermite weld connection. Welded connections shall be coated with asphaltic paint for a distance of six inches in each direction, one layer of half-lapped cotton tape shall be applied over the painted area, and the tape shall be completely saturated with asphaltic paint.

(3) For copper to galvanized steel joints, the connection must be made above grade using two compression type clamps or the thermite weld process.

7. Installation of Cables

a. Wires and cables with polyvinyl chloride insulation or jacket shall not be installed or handled when the ambient temperature is 15 F or below.

b. A commercial product made for the purpose, may be used where a lubricant is required for pulling wire or cable in conduit.

c. Refer to SDC-7.4, Section 7.4.C for cable pulling tension calculations.

H. LIGHTING SYSTEMS

1. General

a. Lighting system design shall be based upon minimum maintained intensity levels. The coefficient of utilization for fixtures may be obtained from the Illumination Engineering Society (IES) Handbook, or from manufacturer's specifications. A medium maintenance factor shall be assumed. Spacing of fixtures shall not exceed IES recommendations. Fluorescent lighting shall, in general, be used in offices, shops, and other areas where high intensity,

low brightness lighting is required. Incandescent fixtures may be specified for hallways, service areas, and auxiliary lighting. Mercury vapor, metal halide, or high pressure sodium lighting fixtures may be considered for high-bay industrial areas.

b. Distribution systems at 480Y/277 volts are usually more economical for larger installations and should be used wherever feasible. Switching may be accomplished by contactors, low voltage control systems, or wall switches.

2. Interior Lighting

a. Lighting Levels. In the design of interior lighting systems, non-uniform lighting principles shall be applied, consistent with the lighting conservation policies for existing lighting systems in the Federal Property Management Regulations (FPMR), 41 CFR Subchapter D, Part 101-20.116-2. The 50-30-10 foot-candle illumination standards (for work stations, work areas, and nonworking areas) shall be adhered to in the design of new lighting systems or alterations to existing systems, to the extent feasible. Where higher levels of illumination are determined to be necessary for specialized tasks, or for personnel safety or security reasons, they shall be provided. In these cases, however, the illumination levels should not exceed the applicable recommended levels of the Illuminating Engineering Society (IES), as contained in the latest edition of the IES Lighting Handbook, ANSI/IES RP1, "Practice for Office Lighting," and ANSI/IES RP7, "Practice for Industrial Lighting. Where higher illumination levels are required, consideration shall be given to providing local or task-supplemental lighting to minimize general overhead lighting requirements.

b. Brightness Ratio and Color. In the design of lighting systems of over 50 footcandles, it is necessary to maintain a comfortable luminance balance and avoid excessive reflected glare. These problems and their solution are discussed in the IES Lighting Handbook Reference Volume, Sections 3 and 5. In general, light-colored, mat-finish wall and furniture surfaces should be used.

c. Emergency Lighting. Emergency lighting shall be provided where required for safe egress. Emergency power may be supplied from the area emergency generating and distribution system or from a local generating or battery power source. Battery-operated emergency lights are preferred.

d. Exit Lighting. Exit and emergency lighting systems shall be provided in accordance with NFPA Code No. 101, "Safety to Life from Fire in Buildings and Structures."

e. Exit lighting circuits shall be connected ahead of the main service disconnecting devices unless supplied from battery backup.

3. Fixtures

a. Lighting fixtures shall be completely described in the specifications. Drawings for smaller projects not requiring specifications, shall have material lists or outline specifications wherein the fixtures shall be described. Lighting drawings shall clearly indicate the fixture type by letter designation, wattage, branch circuit, control (subscript lower case letter) and home run.

b. For general requirements, fixtures shall be of standard, high-efficiency commercial grade. Emphasis shall be placed on energy-efficient fixtures, selected on the bases of minimum life-cycle costs and satisfaction of visual task requirements. For fixtures located in high value areas, and in exits, stairways, ramps, elevators, and landings, the diffusers and lenses shall be of noncombustible materials.

c. Careful consideration should be given to the fixture construction so that relamping, cleaning, and other maintenance can be accomplished as easily as possible. Refer to paragraph 410-76 of the NEC for requirement that fluorescent light ballasts shall be installed at least 1-1/2 inches from combustible ceiling materials.

d. Fluorescent lamp ballasts for indoor use shall be Class P (protected). Ballast performance shall meet the requirements of the American National Standards Institute (ANSI) Standard C82.1, Specifications for Fluorescent Lamp Ballasts, Section 4. When operated at normal load in an ambient air temperature of 40 ± 5C, and at rated line voltage and frequency, the maximum temperature rise shall not exceed 65C in the windings and 30C in the capacitor. Ballasts shall be of the high power factor type, and shall operate at a power factor of 90 percent or higher. Ballasts shall have Underwriters' Laboratory, Inc. (UL) approval and shall be listed in the UL Electrical Construction Materials List. They shall be produced by a member of the Certified Ballast Manufacturers Association (CBM), and shall carry the CBM certification label.

e. Fluorescent fixtures shall have shielding louvers or prismatic lenses. Where fixtures are required without louvers or lenses, safety devices or locking lampholders are required to prevent lamps from dropping if loosened from their sockets by vibration or movement. Where subject to possible damage from mechanical equipment, suitable

protective guards shall be installed. Lamp replacement shall be accomplished by positive latching means for louvers or lenses and shall not require the use of tools.

f. Where special conditions may require dimming of fluorescent fixtures, dimming ballasts are required with associated switches. An alternate method would be to switch a group of fixtures to provide the basic minimum lighting level. Refined solid state switching circuitry is currently available for such applications.

g. In an era where cost-consciousness and energy saving is the prevalent topic, every advantage should be taken of the increasing number of new economical watt-saving fluorescent lamps. Savings up to 14% power consumption per lamp without sacrificing lumen output is made possible by their installation.

h. Incandescent fixtures should be equipped with some form of lens, bowl, or other means to diffuse the light.

i. Incandescent lamps shall be rated at 120 volts. All exposed lamps shall be inside frosted. Fluorescent tubes shall be "Standard Cool White" color.

j. Exit lighting fixtures shall have plainly legible letters not less than 3/4 inches wide and 6 inches high. Fixtures shall have red translucent letters in an opaque field.

k. The location of safety showers shall be marked with a vapor-tight industrial fixture with green globe located a maximum of two feet above and three feet from the centerline of the shower head. The fixture shall be Crouse-Hinds V series or Type GRV, Form 100 with screw guard and VN72 green globe or approved equals. The fixtures shall be located for maximum visibility in the area served by the safety shower.

l. The metal parts of fixtures must be connected to the conduit system or to grounding conductors. See paragraph C-3-s.

I. POWER SYSTEMS

1. General

a. Small power loads such as fractional horsepower motors or resistance heaters may be served from a lighting or power panelboard. Loads that include integral horsepower motors or other large loads should be supplied from switchboards, distribution panelboards, or motor control centers. See paragraphs under A-2 of this Criteria.

b. The recommendations as contained in the Institute of Electrical and Electronics Engineers (IEEE) Standard No. 141 "Electric Power Distribution for Industrial Plants" may be used as a reference in the design of power systems.

2. Indoor Transformer, Substation and Power Feeder Distribution Systems

a. Indoor substations must be designed and installed according to Article 450 of the NEC.

b. In general, standard unit substations should be located as near as possible to the center of the loads. Attached switchgear or motor control centers may be utilized. Simple radial distribution systems may be used, or where greater operating reliability is required, loop or network systems may be justified.

3. Switchgear

a. Metal enclosed switchgear for systems 13.8 kV and below shall comply with ANSI C37, Standards for Power Switchgear, ANSI C37.20 Switchgear Assemblies Including Metal-Enclosed Bus, ANSI C5713, Instrument Transformers, and ANSI Z55.1, Gray Finishes for Industrial Equipment.

b. The design and construction of the switchgear shall also comply with the requirements of NFPA 70, National Electrical Code.

c. Electrical equipment shall be constructed in accordance with applicable NEMA standards for interchangeablility and uniformity of manufacture.

d. Institute of Electrical and Electronic Engineers (IEEE) standards shall be used for rating and testing of special equipment not covered by the above referenced codes and standards.

e. Circuit breakers used with metal enclosed switchgear shall have an interrupting rating sufficient for the available short-circuit current of the system. Circuit breakers shall be connected with line terminals to the line and load terminals to the load without exception.

4. Motors

a. The electrical one-line diagram shall show motor horsepower ratings, circuit breaker frame and trip sizes or fused switch and fuse sizes. NEMA sizes for reversing or non-reversing motor controllers shall also be shown. Short circuit studies

shall be made on one-line drawings, however, the data shall not be permanently recorded on the diagram. Feeder sizes, conduit sizes, motor branch circuit sizes, shall not be shown on the one-line diagram. Each motor shall be assigned an individual designation which shall be used to identify the motor wherever it may appear on the electrical drawings. Coordination with other disciplines is imperative.

b. The electrical power and control plans and elevations shall show identified motors in their actual locations and conduit and conductor sizes where a wire run list is not required. All related junction, pull and terminal boxes shall be identified and coordinated throughout the entire set of drawings. Strict adherence to the requirements of Article 430 of the NEC is mandatory.

c. NEMA Standard, general-purpose, squirrel-cage, induction motors shall be specified wherever possible. See NEMA Publication MG-1 for fractional and integral horsepower motor requirements. Special types and enclosures may be used where necessary. Synchronous motors should be considered for larger horsepower requirements. The cycling time of motors should be considered and motors should then be derated as necessary.

d. Motors one-half horsepower and larger shall be three-phase. Motors 1/3 horsepower and smaller may be single-phase, 120 volts. Fractional horsepower motors 1/2 hp or larger shall be three-phase, 460 volt, except that fractional horsepower, capacitor-start motors may be used on single-phase, 240 volt systems in the absence of a 480 volt supply. Three-phase motors rated 1/2 to 10 hp, but not exceeding a total of 10 hp, may be connected to a 208 or 240 volt system if a 480 volt source is not available. Motors rated 220 volts may be connected to 208Y/120 volt systems, but 230 volt motors shall not be used on 208 volts.

5. Motor Controllers

a. Motor controllers, circuit protection, and disconnecting devices shall be designed and installed according to Article 430 of the NEC.

b. Single-phase controllers may be the manual type with overload protection. Individual controllers for three-phase motors to 100 horsepower may be combination magnetic starters with overcurrent protection. Fused disconnect devices (30 ampere) shall be used with motors 3 hp and smaller. Cartridge fuses shall be of the nonindicating and nonrenewable type. Circuit breakers or motor circuit protectors, rated in accordance with the NEC, shall be used with motors 5 hp and larger.

c. Magnetic controllers shall be specified for use with all crane and elevator motors.

d. Motor control overload relays of the manually reset type, may incorporate either the bimetallic or thin-film eutectic alloy heat sensitive elements.

e. Motor control centers should be used in industrial buildings where the localized control of several motors is practicable. Motor control centers shall consist of one or more standardized prefabricated metal sections completely enclosing the control equipment and assembled to provide a dead front unit. Control centers shall be in strict conformance with NEMA Standard No. ICS, Industrial Controls and Systems. Motor Control Centers shall comply with NEMA Class II requirements and shall be provided with Type C wiring. Control devices shall comply with American National Standards Institute (ANSI) Standard C19.

f. Motor starter panelboards may be utilized only where limited space is available.

6. Motor Control Circuits

a. Control circuits shall, in general, be 120 volts a-c, supplied from an individual step-down control transformer connected to the controlled power circuit.

b. Elementary diagrams and connection or wiring diagrams shall be prepared for all motor applications. Wire numbers shall be assigned to each power and control conductor. Where control transformers are used in conjunction with valves, control relays or other devices, careful analysis of the total load shall be made in order to specify the correct size of the control transformer.

7. Marking of Control Circuit Wiring

All conductor marking, except in simple power and lighting systems where the several wire colors provide adequate identification, shall be marked by means of imprinted tubular white or yellow plastic wire markers placed at the conductor terminations. Markers shall be printed on a special typewriter.

8. Indicator Lamps

Colors for remote indicating signal lamps for motors, switchgear and power operated valves are shown on Hanford Plant Standard E-14-10.

9. Power Operated Monorails, Cranes, Hoists, Etc.

In the design of electrically operated mobile equipment, consideration shall be given to adequate personnel protection from energized trolleys and busways. If possible, equipment shall be specified with shielded or covered trolley conductors.

J. HAZARDOUS LOCATIONS AND SPECAL OCCUPANCIES

1. General

Wiring methods for hazardous locations must be in strict accordance with Chapter 5 of the National Electrical Code. See also other NFPA Standards for the hazard classification of specific occupancies and conditions. No exceptions to those regulations will be permitted under any circumstances.

2. Storage of Flammable Solvents in Refrigerators

a. Refrigerators used for the storage of flammable solvents in laboratories, shops, etc., shall be of special design with all internal sparking sources such as lights, switches, thermostat and solenoid either eliminated, removed from the interior storage area, or made explosion proof.

b. Refrigerators located in areas where flammable solvents may be present in the air (Class I, Groups C and D locations) shall have all ignition hazards eliminated, both internally and externally, and shall have the Underwriters' Laboratory approval for use in those locations.

K. STORAGE BATTERIES

1. General

Storage batteries for ordinary applications (control of switchgear, emergency services, telephone exchanges, fire stations, etc.) shall be the lead-acid, lead-calcium, nickel-iron or nickel-cadmium alkali types where economically or otherwise justified. Batteries shall be equipped with hydrogen recombining caps (Hydrocap) where appropriate.

2. Installation

a. Storage battery installations shall conform to the requirements of Article 480 of the NEC. Separate battery rooms or enclosures are preferred for all installations.

b. Wiring for main battery leads shall be red, positive, and black, negative.

c. See IEEE 484 for additional design information.

d. Positive ventilation must be provided at battery locations or in battery rooms. Air shall be exhausted at or near the ceiling. Such ventilation shall be separate from other building ventilating or air conditioning systems and shall be arranged to provide some natural ventilation in the event of failure of the battery ventilation system. A switch and pilot light for the ventilation motor should be located outside the battery room near the entrance, or in the immediate vicinity of unenclosed batteries, but not above the battery.

e. Lighting fixtures over batteries or in battery rooms shall be vaportight and suspended at least two feet below the ceiling.

f. Batteries should be installed on battery racks constructed for the purpose. Adequate clearances must be maintained around the battery for inspection and maintenance.

g. Battery rooms should preferably have concrete floors and a continuous concrete curb on all sides.

h. The walls of battery rooms for lead-acid batteries or other walls adjacent to batteries should be painted with an acid-resistant paint to a height of at least six feet.

L. PROTECTIVE ALARM SYSTEMS

Protective (burglar) alarm systems shall be designed and installed in accordance with DOE (MC) 2401 Security Handbook. All designs shall be reviewed with the DOE-Safeguards and Security Division. See also Hanford Design Criteria Section 7.8, Fire Alarm Systems.

SDC-7.7

STANDARD ELECTRICAL DESIGN CRITERIA

FOR

COMMUNICATION, SIGNALING, AND LOW-VOLTAGE CONTROL SYSTEMS

This Section consists of 6 pages.

DESCRIPTION OF REVISION		HANFORD PLANT STANDARDS AEC – RICHLAND, WASHINGTON	NUMBER
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APPROVED CS Bucholz	DATE 5-15-73	COMMUNICATION, SIGNALING AND CONTROL SYSTEMS	REVISION NO. 8
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7.7 COMMUNICATION, SIGNALING, AND LOW-VOLTAGE CONTROL SYSTEMS

This section covers the general design requirements for all types of communication, low-voltage control, and signaling (except fire alarm) systems. Utility-owned telephone systems are included only to the extent that raceways, outlet boxes, grounding conductor, power receptacles, and space for terminal equipment shall be provided in permanent buildings (see Section C of this criteria). The term 'communication' as used herein includes all other control and signaling systems insofar as this criteria is applicable. These may be radiation alarms, security alarms, intercom systems, sound-powered telephones, etc.

A. GENERAL

1. The following shall be considered the basic codes for communication system design.

   a. The National Electrical Safety Code, ANSI Standard C2.2 (National Bureau of Standards Handbook H81).

   b. The National Electrical Code, particularly Article 800.

   c. Aerial cable messenger attachments to poles are shown on Hanford Standards E-9-25. Use of Figure 8 aerial cable is shown on Standard E-9-30.

2. Other Hanford Standards and Guides which may be applicable to communications system design are as follows:

HPS-359-E	Emergency Audible Alarm Signals
SDC-7.2	Outside Lighting and Aerial Distribution Systems
SDC-7.4	Underground Power Distribution Systems
SDC-7.5	Interior Power and Lighting Systems
SDC-7.8	Fire Alarm Systems

3. Drawings for communication systems shall show the location of poles, ducts, manholes, etc., by coordinates or by distance from

permanent markers. The layout, elevation, slope, and length of ducts shall be shown. All interior circuiting and the number of circuits in each run shall be clearly shown.

4. Except under unusual circumstances, power and communication cables shall not be run in common duct and manhole systems.

5. Telephone and communication cables shall not be run in ducts or tunnels with steam, water, or other piping unless the cables are mechanically protected from failure of the piping systems and unless measures have been taken to assure that the design ambient temperature at the cable locations will not be exceeded.

6. No other communications system wiring shall be installed in raceways in buildings used for telephone wiring.

B. SERVICES

1. The aerial communication services shall be attached to a building as near as practicable to the service pole. The point of attachment shall not be closer than two feet to any electric power or lighting service attachment.

2. A slack span in aerial services to buildings shall be provided. An eyebolt in the building wall shall be specified on which to terminate the cable messenger. Eyebolts shall have a 1-1/2 inch minimum diameter eye and be designed for a lateral load of at least 500 pounds. For drop wire services, a screw eye may be used. The eye shall have a minimum diameter of 1-1/2 inches and the screw shall withstand a lateral pull of 100 pounds.

3. Aerial drop wire or cable services shall be a minimum of 14 feet from grade to the point of attachment to the structure. Services over roadways, driveways, or service areas shall not be less than 20 feet above grade at any point. Mast arms attached to low buildings, or a pole set adjacent to the structure, may be used to meet these requirements. This paragraph does not necessarily apply to utility-owned services.

4. Galvanized, rigid, heavy-wall, steel conduit shall be provided for telephone or other service entrances. Except as below, the service conduit shall be continuous from the point of attachment, through the outside wall, to the terminal or protector box location. In frame buildings where the attic is accessible, a conduit sleeve through the outside wall may be used and a wooden runner installed in the attic to support the telephone drop wire or cable.

5. The conduit size for aerial or underground services is listed in the following table. For aerial services, an entrance cap shall be specified for use on 3/4 and 1 inch conduit. Larger sizes shall have insulated conduit bushings. A No. 12 Awg galvanized pull wire should be provided in all service runs.

Size of Service		Size of Entrance Conduit
Cable Pairs	Drop Wire	Inches
11 & 16	up to 4 pairs	3/4
25		1
50 & 75		1-1/2
100		2

C. TERMINATIONS AND PROTECTORS

1. The following paragraphs apply to all systems using telephone-type conductors. For utility-owned telephone systems, only the necessar space for terminal equipment shall be provided as covered in the following.

2. Utility room(s) should be provided in buildings having a high telephon density for termination of the communication services (telephone, control, alarm, etc.). Utility rooms shall be equipped with 120 volt AC outlets. A 3/4 inch plywood backboard shall be provided on one wall for mounting of equipment.

3. Protectors with fuses must be used where the outside cable is exposed to power-line potentials and where the entering cable conductor are No. 22 Awg or larger. Protectors without fuses may be used if the service cable is not exposed to power-line voltages or the entrance cable conductors are No. 24 Awg or smaller. The metallic shield of service cables, where used, must be grounded.

4. The service entrance cable to protector cabinet run shall be as short as possible.

5. Terminal cabinets shall be located to avoid terminal to outlet runs of over 150 feet.

6. Protectors for one or two individual lines may be installed indoors or outside on the building wall not more than nine feet above the ground. Protectors shall be fused and with surge arrester.

7. For three and four individual lines, a metal box shall be installed inside the building to house individual protector units. Minimum dimensions of the box shall be 10 inches high, 12 inches wide, and 3 inches deep. Box shall have a 1/2 inch plywood backboard and a hinged, latching cover.

8. Cable entrances of five or more lines shall terminate in a fuseless, protected terminal enclosed in a sheet metal housing for indoor installation.

9. Indoor, flush-mounted enclosures for terminals (not required in utility rooms) shall have a hinged, latching cover and a 1/2 inch plywood backboard. The minimum dimensions of the enclosure shall be as follows.

Service Cable Pairs	Box Dimensions - Inches Height	Width	Depth
16 or less	30	18	4
25	36	18	4
50	56	18	4

10. A wood blackboard shall be provided for interior surface-mounted protectors. Overall dimensions shall be 12 inches greater than the protector(s).

11. Terminations of service entrance cable larger than 50 pairs will require special design.

E. GROUNDING

1. Terminals, protector equipment, and metal sheath of cables shall be grounded.

2. The grounding conductor shall be Type TW or THW, green color building wire not smaller than No. 12 Awg stranded copper, and shall be run directly to the grounding electrodes. Mechanical protection shall be provided if required.

3. The ground shall be a cold water pipe, if available, or a galvanized ground rod or rods to provide a resistance to ground of not more than 25 ohms. Underground conductors shall be bare, galvanized wire. Grounding assemblies are shown on Standards E-3-2 and E-3-4. If ground rods are used, a rod(s) separate from those for the power system shall be provided for communications systems, but all grounding systems shall be bonded together.

F. INTERIOR TELEPHONE RACEWAYS, CABINETS, AND OUTLETS

1. Approved raceways shall be provided in permanent buildings for installation of utility-owned telephone wiring and equipment. Raceways

may be rigid conduit, electrical metallic tubing, or other metal, wood, fiber, or plastic raceways designed for the purpose. Where rearrangement or alterations have been made to permanent buildings, or where additional instruments are required, telephone cable without raceways may be installed to branch terminal cabinets and for individual instruments in accordance with the telephone utility practice. However, raceways shall always be installed where mechanical protection is required.

2. Additional raceway capacity shall be provided in all runs of over three circuits on the basis of one spare circuit for each three live circuits.

3. Raceways for telephone or similar wiring shall be sized as follows.

Number of Circuits - 2 Wire	Size of Cable - Pairs	Size Conduit or Equivalent Raceway Size - Inches*
1 to 6	11 & 16	3/4
7 to 10	25	1

* Larger size conduit is required for "key-type" telephone installations.

4. Junction boxes shall be utilized to combine converging raceways. Where several pairs connect to a cable, or where two or more cables are connected to a larger cable, a junction box or telephone cabinet shall be provided according to the following table for installation of connecting blocks by the telephone company.

Number of Cable Pairs in Main Run	Standard Telephone Cabinet Flush	Standard Telephone Cabinet Surface
Less than 7	Use 4-11/16" Outlet Box and Cover	
7 to 25	14 x 18 x 4	12 x 18 x 4

5. Where the telephone wiring is in conduit, EMT, or other raceways, standard outlet boxes shall be specified. Boxes shall be furnished with standard telephone outlet plates. Metallic plates shall have an insulated grommet or bushing. Outlets shall be located within five feet of each instrument location and 18 inches above the floor, unless otherwise specified.

G. RADIO COMMUNICATION

1. Radio transmission equipment shall not be procured, developed, or modified until after a frequency for the intended use has been authorized, or until being assured that the authorization is forthcoming.

2. Requests for a frequency assignment shall be made to the Commission. Generally, 60 days should be allowed for processing the request.

3. Certain frequencies have been designated for AEC use by the Director of Telecommunications Management (DTM). Use of citizen's band frequencies by AEC contractors is not permitted.

4. For detailed information and requirements, see AEC Manual Appendix 0270, Telecommunications Services Handbook, Part IV, Radio Services. All questions concerning radio equipment shall be referred to the Commission.

SDC-7.8

STANDARD ELECTRICAL DESIGN CRITERIA

FOR

FIRE ALARM SYSTEMS

This Specification consists of 7 pages

Description of Revision		HANFORD PLANT STANDARDS DOE - RICHLAND, WASHINGTON	Number
Total rewrite of standard			
Prep. or Rev. by P. A. Smith	Orig. Issue Date 11-01-54	ELECTRICAL DESIGN CRITERIA	SDC-7.8
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STANDARD ELECTRICAL DESIGN CRITERIA

7.8 FIRE ALARM SYSTEMS

A. GENERAL

1. Fire alarm systems shall be designed and constructed in accordance with the latest edition of the following National Fire Codes as issued by the National Fire Protection Association (NFPA), and DOE orders.

   a. NFPA 70 - National Electrical Code

   b. NFPA 72 - Installation, Maintenance and Use of Protective Signaling System

   c. NFPA 72E - Automatic Fire Detectors

   d. NFPA 72G - Installation, Maintenance and Use of Notification Appliances for Protective Signaling Systems

   e. NFPA 72H - Testing Procedures for Local, Auxiliary, Remote Station, and Proprietary Protective Signaling Systems

   f. NFPA 101 - Code for Safety to Life From Fire in Buildings and Structures

   g. NFPA 1221 - Public Fire Service Communication System

   h. 6430.1A - General Design Criteria

   i. 5480.7 - Fire Protection

   j. RLIP 5480.7 - Fire Protection

2. In addition to the above standards fire alarm systems in computer/data processing systems shall be designed and constructed in accordance with the latest edition of Standard for Fire Protection of Department of Energy (DOE) Electronic Computer/Data Processing Systems EP-0108.

3. The word "municipal," as used in NFPA publications and in this Design Criteria shall be construed to refer to a group of manufacturing, warehouse or office buildings which comprise a separate "area" or group of areas at Hanford.

4. New installations and modifications or additions to existing systems shall be of manufacture and type as approved by the Fire Protection Engineering (FPE) staff of each contractor.

5. Components/Equipment installed per this Design Criteria, shall be listed by Underwriters Laboratories Inc. (UL), or approved by the Factory Mutual Systems, where applicable.

6. The designer of a complete fire detection and alarm system is advised to consult the manufacturer's current catalogs for information relevant to proper system design and installation.

7. The fire alarm control panel(s) should be in a convenient location near the building main entrance, shall be readily accessible, and readily visible.

8. It is required to have an authorized installer (regularly in the fire protection system installation business) install the fire alarm system.

9. An acceptance test procedure shall be written for each fire alarm system designed. The design document shall require the installation contractor to perform and document acceptance testing according to the procedure provided, to the satisfaction of the Government's Representatives.

10. For multi-zoned fire detection systems, the Hanford Fire Department (HFD) shall be consulted regarding the separation of zones.

B. RADIO FIRE ALARM REPORTING BOXES

1. The municipal fire alarm boxes for the Hanford Site are radio fire alarm reporting (RFAR) boxes. The boxes are manufactured by the GH Harlow company and are furnished to site projects by the Hanford Site Telecommunications group. RFAR boxes can be used as a street-type, manually operated fire reporting system or as a directly connected, automatically operated auxiliary fire reporting system. The auxiliary-type RFAR boxes can provide 8, 16, 24, 32, 40, and 48 zones for connection to local fire alarm control panels.

2. RFAR box code numbers are assigned by the Hanford Fire Department.

3. RFAR boxes shall be grounded to the building ground grid or by other approved grounding methods with a No. 4 AWG copper wire. The resistance to ground shall not exceed 25 ohms during the dry season. A suitable alternative would be to

connect the RFAR to a grid of two 8 ft ground rods connected with No. 4 AWG wire.

4. The installation of more than one fire alarm control panel reporting a single RFAR box shall be approved by the contractor's fire protection engineer.

5. RFAR antennas are provided by the Hanford Site Telecommunications group. The location of the RFAR box and antenna on the outside of buildings shall be as directed by the telecommunications group. The conduit for the RFAR antenna shall be 3/4 inch IMC or rigid conduit.

6. Conduit entry into the RFAR boxes shall be in the bottom of the RFAR box or within 2 inches of the bottom of the RFAR box. Conduit entries shall be made with watertight connectors.

7. Final wiring connections in RFAR enclosures shall be made by the Hanford Site Telecommunications group.

C. MANUAL FIRE ALARM BOXES

1. Manual fire alarm boxes (pull stations) shall be approved, non-break glass, double-action type. Manual fire alarm boxes shall not be self-restoring.

2. Manual fire alarm boxes (pull stations) shall be located in accordance with NFPA 101 and NFPA 72. In addition, fire alarm boxes (pull stations) shall be installed at each designated and/or emergency building exit or stairwell in multi-story buildings. Buildings requiring protection shall have one box at each floor level. Manual fire alarm box (pull station) coverage shall not exceed 10,000 square feet of floor area.

D. FIRE ALARM CONTROL PANELS (FACP)

1. A Fire Alarm Control Panel (FACP) shall provide the following functions:

   a. Actuating devices to trip the RFAR box shall be provided as required by the operating contractor's FPE.

   b. Operate the fire alarm bells to alert the building occupants. Cycle time of the bells shall have march time of approximately 120 stokes per minute.

   c. Alarm indicators shall reset only when the control panel is reset. There shall be at least one indicator for each floor or each fire zone of the building.

Separate zone messages will be provided for each type of suppression system, detection or alarm system.

d. Future expansion capability (20 percent minimum) shall be provided in accordance with the growth potential of the building.

e. Auxiliary relays with bypass switches shall be provided to control equipment as required by the design.

f. The standby power supply shall be provided as required by the FPE and the NFPA codes.

g. Complete supervision of sprinkler systems including, but not limited to, post indicator valves, sectional sprinkler system control valves, and air pressure for dry systems shall be provided.

h. Terminal blocks for connection of external wiring to the control panel may be included to facilitate field wiring of complex systems.

i. Fire alarm controls shall be housed in key-locked control cabinets. Locks furnished with this equipment shall be Corbin Cabinet Lock, Division of Emhart Corp., Key Cat. No. 60 or others as approved by Hanford Fire Department.

j. Alarm indicator lights shall be visible and identified.

E. SIGNALING DEVICES

1. Local audible fire alarm indicators shall be located in accordance with NFPA 72.

2. Audible indicating devices shall be single-strike chimes or gongs and shall be sufficient in number and intensity to produce a sound level of at least 10 decibels above maximum expected background noise (up to 100 decibels). The audible indicating devices shall provide a march time rate of 120 strokes per minute. When background noise levels normally exceed the 100 decibels in operating conditions, a visual alarm device is needed in addition to the chimes or bells. Any change to the march time rate to accommodate visual alarm devices shall be coordinated through fire protection engineering, but in no case shall the march time rate be less than 60 strokes per minute.

3. A survey shall be made to ensure signals can be heard under normal background conditions in spaces that may be occupied.

This shall be the responsibility of the operating contractor(s) for the building involved.

F. AUTOMATIC FIRE DETECTORS

1. NFPA 72E shall be used for the criteria of the location and installation of fire detectors.

2. Detectors shall be located and installed as required by DOE Order 6430.1A and the FPE for the operating contractor.

G. WIRING

1. Wiring for fire alarm systems shall comply with NFPA 70, NFPA 1221, and the following.

   a. Splices in fire alarm wiring shall be made mechanically strong, by use of pressure-type solderless connections or terminal lugs. Connectors shall be installed according to the manufacturer's instructions and with the proper tool for the connector or terminal.

   b. Conductors for interior, power-limited, auxiliary fire alarm circuits shall be no smaller than No. 16 AWG for single conductors and No. 18 AWG for multi-conductor cables.

   c. Conductors for interior, nonpower-limited, auxiliary fire alarm circuits shall be no smaller than No. 14 AWG.

   d. Terminal ends of approved stranded conductors shall be completed with crimp-on terminal lugs.

   e. Single conductors installed in conduit and panels shall have THHN/THWN insulation.

2. Wiring may be installed in intermediate metal conduit, rigid galvanized steel conduit, electrical metallic tubing, or nonmetallic sheathed cable. Cables may be used without conduit in the concealed spaces in office buildings of 15,000 square feet or less. This installation must be made in accordance with NFPA 70.

3. Electrical power for fire alarm control panels, RFAR boxes and locator lights shall preferably be obtained from separate breakers. The breakers shall be fitted with a suitable guard requiring manual removal before the breakers can be operated. The breakers shall serve the fire alarm equipment only and shall be clearly identified as FIRE

ALARM. The fire alarm power circuits shall be connected to the emergency power sources if available.

4. Wiring shall be identified with wire markers and by color coding. Conductor colors for new installations shall be as shown in the following table. For expansion of existing systems, the conductor color convention previously used shall be maintained. Colored tape, according to the following table, may be used to identify the conductors of existing wiring. The color codes do not apply to shielded or multi-conductor cables.

CIRCUIT	COLOR OF WIRE INSULATION
Initiating device, input to fire alarm panel, detectors, manual pull station etc.	one red and one black
Alarm device, output from fire alarm panel, bells, gongs, strobes	one dark blue and one light blue
supervisory device, input to the fire alarm panel, limit switches, pressure switches, supervisory switches, etc.	one yellow and one tan
Between the fire alarm control panel and RFAR box	Orange
Output from the fire alarm panel to devices other than alarms	Blue or different color from preceding colors.
Incoming power (phase/line) to the fire alarm panel, RFAR box, or indicator light	Black
Incoming power (neutral) to the fire alarm panel, RFAR box, or indicator light	White
Ground wire	Green/Bare
Battery wiring	Brown

5. The ground point for shielded conductors shall be in the fire alarm control panel.

6. Junction box covers associated with fire alarm systems shall be identified by decals or red paint.

7. Relays, switches, pushbuttons, terminals, terminal boards, etc., in the control panels shall be marked and identified, and properly coordinated with the nomenclature on the drawings.

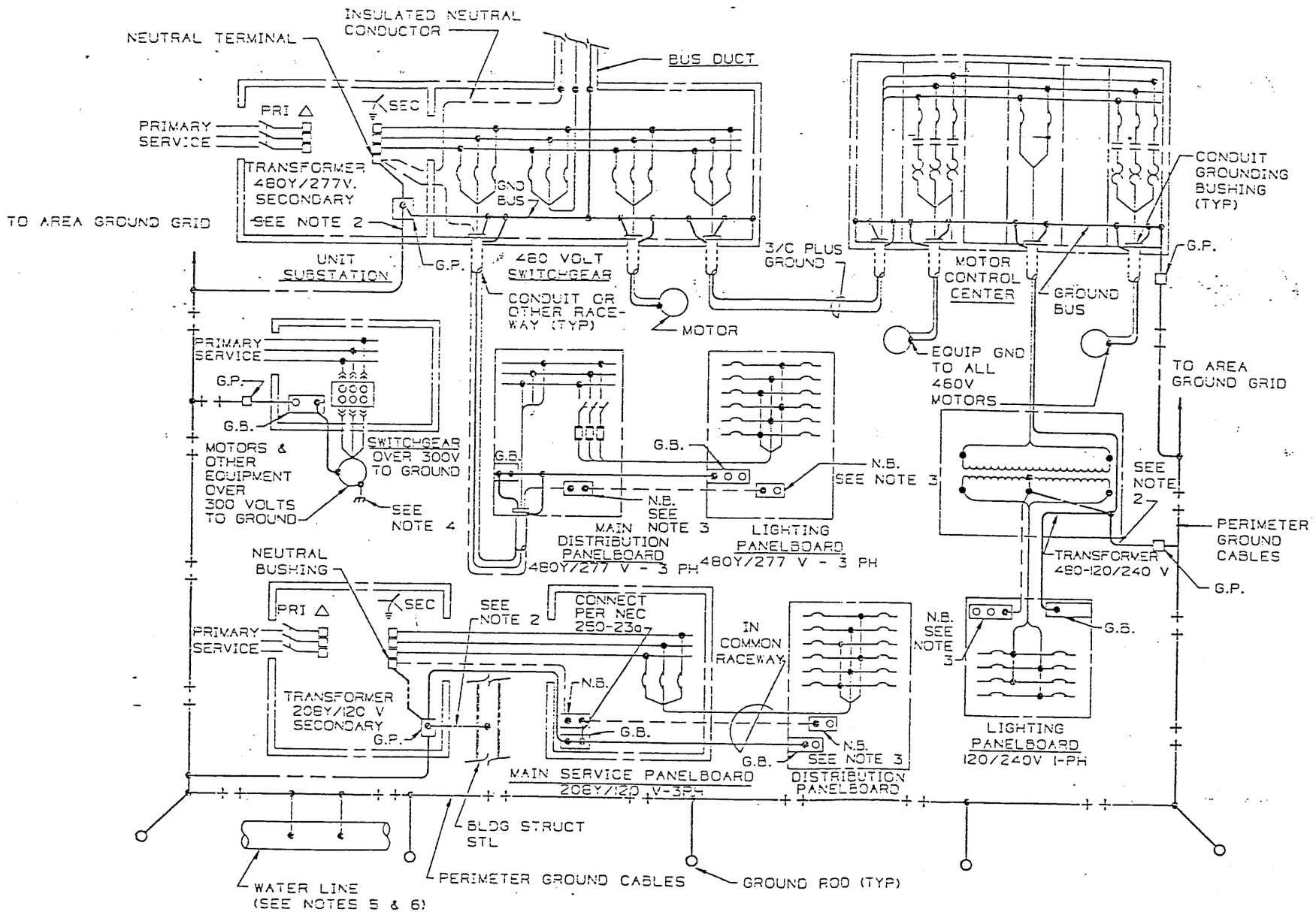
8. New fire alarm wiring between the RFAR box and the fire alarm control panel shall be shielded.

H. GENERAL DESIGN AND INSTALLATION

1. Building layout drawings showing conduit runs with wire counts and size, and device locations with individual device indicating zone (zone data of approvals) shall be provided.

2. Fire alarm control panel point-to-point wiring diagram showing the interconnection wiring in the panel and connecting wiring to the field devices terminals shall be provided.

3. Each alarm initiating/indicating appliance shall be provided with an individual identifier by zone as allowed by the FACP.



NOTES

1. THIS STANDARD SHOWS THE GROUNDING REQUIREMENTS FOR MOST BUILDING ELECTRICAL SYSTEMS. SEE ARTICLE 250 NFPA-70(NEC), FOR ADDITIONAL GROUNDING REQUIREMENTS.

2. THE GROUNDING ELECTRODE CONDUCTOR SHALL BE CONNECTED TO THE GROUNDING ELECTRODE AS CLOSE TO THE TRANSFORMER AS PRACTICABLE.

3. NEUTRAL BARS ON THE LOAD SIDE OF THE SERVICE SWITCH OR PANELBOARD SHALL BE INSULATED FROM GROUND.

4. THE SYMBOL ⏚ ON THIS STANDARD INDICATES POINTS WHERE AUXILIARY BONDING TO ADJACENT METAL PARTS MAY BE REQUIRED FOR PERSONNEL SAFETY. SEE HPS E-12-2 FOR DETAILS.

5. SEE HPS E-12-5 FOR TYPICAL BUILDING GROUND GRIDS.

6. A BRONZE GROUND CLAMP MAY BE USED, IN LIEU OF A WELDED CONNECTION, TO CONNECT A GROUND CONDUCTOR TO A WATER LINE IF THE CONNECTION IS MADE ABOVE GROUND.

LEGEND

—+—+—	BURIED GROUND CABLES
—·—·—	GROUNDING ELECTRODE CONDUCTOR GREEN INSULATED (OR MARKED GREEN OR BARE - NFPA-70(NEC), TABLE 250-94
———	EQUIPMENT GROUNDING CONDUCTOR GREEN INSULATED OR BARE - NFPA-70(NEC) TABLE 250-95
– – – –	NEUTRAL CONDUCTOR - WHITE INSULATED
G.P.	GROUND PLATE
G.B.	GROUND BAR - NOT INSULATED
N.B.	NEUTRAL BAR - SEE NOTE 3

DESCRIPTION OF REVISION		HANFORD PLANT STANDARDS DOE - RICHLAND, WASHINGTON	NUMBER
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PREP OR REV BY: E. R. Snowhite	ORIG ISSUE DATE: 11-20-62	ELECTRICAL STANDARD	
APPROVED: R.W. Brown DOE	DATE: 4/15/86	TYPICAL ELECTRICAL SYSTEM GROUNDING FOR BUILDINGS	REVISION NO: 3