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ENGINEERING CHANGE NOTICE

1. ECN 647029

Proj. ECN

2. ECN Category (mark one) Supplemental [ ] Direct Revision [X] Change ECN [ ] Temporary [ ] Standby [ ] Supersedure [ ] Cancel/Void [ ]	3. Originator's Name, Organization, MSIN, and Telephone No. James A. Tuck, Equipment Engrg., S0-08, 373-5755	4. USQ Required? [X] Yes [ ] No TF-96-690, Rev. 2.	5. Date 29 September 1998
	6. Project Title/No./Work Order No. Project W-420/ R4044	7. Bldg./Sys./Fac. No. see Block 13a.	8. Approval Designator ESQ
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) HNF-SD-W420-CDR-001, Rev. 0	10. Related ECN No(s). n/a	11. Related PO No. n/a

12a. Modification Work	12b. Work Package No.	12c. Modification Work Complete	12d. Restored to Original Condition (Temp. or Standby ECN only)
[ ] Yes (fill out Blk. 12b) [X] No (NA Blks. 12b, 12c, 12d)	N/A	n/a Design Authority/Cog. Engineer Signature & Date	n/a Design Authority/Cog. Engineer Signature & Date

13a. Description of Change — 13b. Design Baseline Document? [X] Yes [ ] No

Replace the entire text of the affected document with the attached, complete Revision 1 of HNF-SD-W420-CDR-001.

SUMMARY OF CHANGE: Affected document has been updated to reflect changes in Authorization 8asis (8IO) and project scope, and to incorporate comments from TWRS Operations and Engineering and additional information obtained from walkdowns of the affected facilities. Affected facilities are: 244-A DCRT, 244-BX DCRT, 244-S DCRT, 244-TX DCRT, 244-CR Vault, and the 296-P-16 exhauster on Tanks 241-C-105 & -106.

14a. Justification (mark one)

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

14b. Justification Details

Revision 1 of Project W-420 Conceptual Design Report (CDR) is necessary to reflect new TWRS Authorization Basis (BIO and TSRs) and current scope of project as documented in HNF-SD-W420-FDC-001. Document revision is covered under USQ Screening #TF-96-0690, Rev. 2 (categorical exclusion); this CDR revision does not affect equipment design details prior to release of field installation drawings or ECNs. Design verification per HNF-PRO-445. This ECN will not change collective dose - no impact on rad. sources, contam. control, or shielding. - J.T.

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

See also attached distribution sheet.

JA Tuck S0-08 (1) KE Carpenter R3-47 (1)

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RELEASE STAMP

DATE: NOV 06 1998 STA: 4 HANFORD RELEASE ID: 2

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): 647029

16. Design Verification Required	17. Cost Impact — ENGINEERING		17. Cost Impact — CONSTRUCTION		18. Schedule Impact (days)	
[X] Yes	Additional [ ]	$	Additional [ ]	$	Improvement [ ]	N/A
[ ] No	Savings [ ]	$ N/A	Savings [ ]	$ N/A	Delay [ ]	

19. 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 13. Enter the affected document number in Block 20.

SDD/DD	[ ]	Seismic/Stress Analysis	[ ]	Tank Calibration Manual	[ ]
Functional Design Criteria	[ ]	Stress/Design Report	[ ]	Health Physics Procedure	[ ]
Operating Specification	[ ]	Interface Control Drawing	[ ]	Spares Multiple Unit Listing	[ ]
Criticality Specification	[ ]	Calibration Procedure	[ ]	Test Procedures/Specification	[ ]
Conceptual Design Report	[ ]	Installation Procedure	[ ]	Component Index	[ ]
Equipment Spec.	[ ]	Maintenance Procedure	[ ]	ASME Coded Item	[ ]
Const. Spec.	[ ]	Engineering Procedure	[ ]	Human Factor Consideration	[ ]
Procurement Spec.	[ ]	Operating Instruction	[ ]	Computer Software	[ ]
Vendor Information	[ ]	Operating Procedure	[ ]	Electric Circuit Schedule	[ ]
OM Manual	[ ]	Operational Safety Requirement	[ ]	ICRS Procedure	[ ]
FSAR/SAR	[ ]	IEFD Drawing	[ ]	Process Control Manual/Plan	[ ]
Safety Equipment List	[ ]	Cell Arrangement Drawing	[ ]	Process Flow Chart	[ ]
Radiation Work Permit	[ ]	Essential Material Specification	[ ]	Purchase Requisition	[ ]
Environmental Impact Statement	[ ]	Fac. Proc. Samp. Schedule	[ ]	Tickler File	[ ]
Environmental Report	[ ]	Inspection Plan	[ ]	NONE	[X]
Environmental Permit	[ ]	Inventory Adjustment Request	[ ]		[ ]

20. 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
n/a	n/a	n/a

21. Approvals

	Signature	Date
Design Auth. RW Reed	for RE Larson per Telecon James A. Tuck	30 Sep. 98
Stack Mon. Cog. Eng. TD Kaiser	Terry D Kaiser	9/30/98
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SST Cog. Mgr. RE Larson	for RE Larson per Telecon, James A Tuck	30 Sep. 98
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ECN Orig. JA Tuck	James A. Tuck	30 Sep. 98
Other GM Crummel	G M Crummel	9/30/98

	Signature	Date
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Environ.		
Other		

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

FDH Environmental Compliance [signature] 11/5/98

S

Project W-420 Stack Monitoring System Upgrades Conceptual Design Report

James A. Tuck
for: Numatec Hanford Corp., Richland, WA 99352
U.S. Department of Energy Contract DE-AC09-96RL13200

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Key Words: Double Contained Receiver Tank, DCRT, record sampler, CAM, continuous air monitor, particulate, effluent, primary ventilation, upgrades, primary confinement, Safety Class, NESHAP, Tank Farms, alpha, beta, gamma, emitters, radiation, radioactivity

Abstract: This document describes the scope, justification, conceptual design, and performance of Project W-420 stack monitoring system upgrades on six NESHAP-designated, Hanford Tank Farms ventilation exhaust stacks.

11/6/98
Release Approval Date

DATE: HANFORD RELEASE ID: 2
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RECORD OF REVISION	(1) Document Number HNF-SD-W420-CDR-001	Page 1

(2) Title
Project W-420 Stack Monitoring System Upgrades Conceptual Design Report

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr. Date
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1 RS	Complete document revision, per ECN 647029.	James A Theis	Scott E. Cazyk 9/30/98

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UNITS

A	Amperes (electrical current, or rated capacity)
AWG	American Wire Gauge
Btu	British thermal units (energy, English system of units)

CFM	cubic feet per minute, or ft^3/min
cm	centimeters (linear measure, metric units, =0.01 m)
ft	feet (linear measure, English units)
ft^3	cubic feet (volume measure, English units)
ft/min	feet per minute (velocity, English units)
ft^3/min	cubic feet per minute (volume flow rate, English units)
gal	gallons (volume measure, English units)
kW-hr	kilowatt-hours (energy)
m	meters (linear measure, metric units)
m^3	cubic meters (volume measure, metric units)
m/s	meters per second (velocity, metric units)
m^3/s	cubic meters per second (volume flow rate, metric units)
mi/hr	miles per hour (velocity, English units)
mm	millimeters (linear measure, metric units, =0.001 m)
mrem	millirems (radiation)
mSv	milli-Sieverts (radiation; 1 mSv = 100 mrem)
SCFM	cubic feet per minute (ft^3/min), corrected to standard conditions
VAC	Volts - Alternating Current
yd^3	cubic yards (volume measure, English units)

ACRONYMS

A/E	Architect-Engineer
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BIO	Basis for Interim Operation (part of TWRS Authorization Basis; HNF-SD-WM-BIO-001)
CAM	Continuous Air Monitor
CASS	Computer Automated Surveillance System
CDR	Conceptual Design Report
CFR	Code of Federal Regulations
CM	Construction Management
DCRT	Double Contained Receiver Tank
DOH	Washington State Department of Health
EDE	Effective Dose Equivalent
FDC	Functional Design Criteria
FM	Factory Mutual
GEMS	Generic Effluent Monitoring System
HPT	Health Physics Technician
JSA	Job Safety Analysis
LCCA	Life-Cycle Cost Analysis
LCO	Limiting Condition of Operation (i.e., a type of TSR)
NEC	National Electrical Code (NFPA 70)
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NOC	Notice of Construction
PEDE	Potential Effective Dose Equivalent
SSC	System, Structure, or Component
SST	Single-Shell Tank
TMACS	Tank Monitoring and Control System

TSR	Technical Safety Requirements (part of TWRS Authorization Basis; HNF-SD-WM-TSR-006)
TWRS	Tank Waste Remediation System (Tank Farms)
UL	Underwriters Laboratory

TRADEMARKS

Eberline	Registered trademark and subsidiary of Thermo Instrument Systems, Inc., Santa Fe, NM.
G2™	Registered software trademark of Gensym Corporation, Cambridge, MA.
HSL	Registered trademark of Hilti® Corp., Tulsa, OK.
Kwik-Bolt II	Registered trademark of Hilti® Corp., Tulsa, OK.
Nelson® Stud	Registered trademark of TRW Inc., Nelson Stud Welding Division, Elyria, OH.

1.0 INTRODUCTION AND SCOPE

Project W-420, "Stack Monitoring System Upgrades", will upgrade six 200 Area Tank Farm stacks to meet the National Emission Standards for Hazardous Air Pollutants (NESHAP), Title 40, CFR, Part 61, Subpart H, requirements. Replacement Generic Effluent Monitoring Systems (GEMS) will be fabricated and installed to upgrade the exhaust monitoring capabilities in the Hanford Site 200 East and 200 West Tank Farms. The purpose of the following conceptual design report (CDR) is to define the scope, justification, conceptual design, methods of performance, basic requirements, cost estimate, schedule, and work breakdown for the Project W-420 stack monitoring system upgrades.

Project W-420 will upgrade the monitoring systems on the following exhaust stacks:

- 296-A-25, 244-A Double Shell Receiver Tank (DCRT) and Annulus Stack
- 296-B-28, 244-BX DCRT and Annulus Stack
- 296-C-05, 244-CR Vault Ventilation Stack
- 296-P-16, 241-C-105 and -106 Primary Tank Exhauster Stack
- 296-S-22, 244-S DCRT and Annulus Stack
- 296-T-18, 244-TX DCRT and Annulus Stack

These facilities are described as follows:

- Four Double Contained Receiver Tanks (DCRTs), which are small (approx. 16,300 to 31,000 gal, or 62 to 117 m^3) tanks used for transferring liquid radioactive wastes. These facilities are designated as 244-A, 244-BX, 244-S, and 244-TX. They are normally maintained in an empty state (except for the non-pumpable heel), and only contain waste when a transfer is in progress. Some of these DCRTs will be used for saltwell pumping through 2004, and could be used for waste retrieval through 2024. Upgrades to their stack monitoring systems will support these missions.

- The 244-CR Vault is now used primarily as a DCRT for transferring liquid radioactive wastes from the 241-C Tank Farm. There are four tanks in the vault, of which two are isolated and inactive and one is used as a drain tank. The fourth is a 15,000 gal (57 m^3) tank which is in active service. The 244-CR Vault may be used to support saltwell pumping through 1999 and may be used for waste retrieval through 2018. Upgrading the stack monitoring system will support this mission.

- The P-16 exhauster is used to maintain the waste temperature in Tanks C-105 and C-106 within TSR limits. In 1999, Tank C-106 will have a separate exhauster installed and the waste will be partially retrieved, decreasing the heat load in the tank. The P-16 exhauster will remain in service indefinitely as a backup ventilation system. Upgrading the stack monitoring system will support this mission.

The basic intent of the upgrades will be to replace existing stack monitoring systems with systems that are fully compliant with current regulatory and authorization basis (AB) requirements, and to preserve any existing facility or equipment functions that may be affected in the process. The upgraded systems will meet the requirements stated in the Functional Design Criteria (FDC) document for the project (Tuck 1998); applicable codes, standards, and other requirements documents are also referenced in Section 6.0, below. Justification for the upgrades is explained in Sec. 2.0, below. The efforts necessary to implement the Project W-420 stack monitoring system upgrades will include:

- Preparation of procurement specifications,
- Procurement of new stack monitors and associated probes,
- Preparation of the installation design, including modification of the existing stacks as necessary,
- Removal and disposal of the existing stack monitors and any removed stack sections,
- Installation of the stack monitors, stack probes, and sample transport piping, including necessary modifications to the existing stacks,
- Installation of work platforms to provide for equipment monitoring and access to the sample probe locations for operations and maintenance workers, and
- Completion of electrical interfaces with existing alarms and interlocks.
- Preparation of JCS work packages for the installation and testing of new equipment and modifications to existing equipment and facilities.
- A complete turnover package, upon completion of the installation, including facility drawings or drawing revisions, training, operating, maintenance, and functional test procedures, commercial grade item dedication forms, and vendor information files.

2.0 JUSTIFICATION

Stack monitoring requirements for radionuclides are based on the potential for radionuclide emissions for that release point. If it is determined that an exhaust stack has the potential (i.e., with no emission control device in place) to provide an Effective Dose Equivalent (EDE) of greater than 0.1 mrem/yr to any member of the general public, then monitoring must be performed in accordance with NESHAP (40 CFR 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities"). Those stacks whose effluents could exceed 0.1 mrem/yr are considered "designated", and those that will not are considered "non-designated".

Compliance with NESHAP regulations required assessment and upgrade of those emission points which have the potential to exceed the specified limit of 0.1 mrem/yr. An assessment for each stack in the 200 Area Tank Farms was performed and is updated periodically, with the results documented in HNF-SD-WM-EMP-031, *Tank Farm Stack NESHAP Designation Determinations* (Crummel 1997). A history of revisions and anticipated future updates to this document are summarized in its current revision (Rev. 3A). There are currently nine NESHAP-designated stacks in Tank Farms. Of these, three already have compliant stack monitoring systems. The remaining six designated stacks will be upgraded by Project W-420 with new stack monitoring systems in accordance with the requirements in NESHAP, Title 40, CFR, Part 61, Subpart H. The six stacks are listed in Sec. 1.1, "Scope" (above).

Tables 2-1 through 2-6 contain information from Rev. 3/3A of HNF-SD-WM-EMP-031 (Crummel 1997) on the total Potential Effective Dose Equivalents (PEDEs) for the six stacks and the individual radionuclides which provide greater than one percent of the total PEDE for each stack. These are estimated quantities; the actual radionuclide content, as well as the relative percentages of the various species, will vary with the type of waste being transferred.

TABLE 2-1. PEDE for Stack 296-A-25 (244-A DCRT)

Stack: 296-A-25 @ 244-A DCRT			
Radionuclide	Emitter Type	% PEDE	PEDE (mrem/yr) *
Cs-137	beta-gamma	71.1%	0.08
Pu-239/240	alpha	23.5%	0.02
Am-241	alpha	2.8%	<0.01
Pu-238	alpha	1.1%	<0.01
Others (<1%)	N/A	1.5%	<0.01
Total	N/A	100%	0.106

TABLE 2-2. PEDE for Stack 296-B-28 (244-BX DCRT)

Stack: 296-B-28 @ 244-BX DCRT			
Radionuclide	Emitter Type	% PEDE	PEDE (mrem/yr)
Cs-137	beta-gamma	37.6%	0.975
Am-241	alpha	37.4%	0.969
Pu-239/240	alpha	10.6%	0.275
Sr-89/90	beta-gamma	9.0%	0.233
I-129	beta-gamma	4.3%	0.111
Others (<1%)	N/A	1.1%	0.027
Total	N/A	100%	2.590

TABLE 2-3. PEDE for Stack 296-C-05 (244-CR Vault)

Stack: 296-C-05 @ 244-CR Vault			
Radionuclide	Emitter Type	% PEDE	PEDE (mrem/yr)
Sr-89/90	beta-gamma	82.3%	154.00
Am-241	alpha	10.6%	19.80
Pu-239/240	alpha	4.8%	8.93
Cs-137	beta-gamma	1.6%	2.92
Others (<1%)	N/A	0.7%	1.35
Total	N/A	100%	187.0

TABLE 2-4. PEDE for Stack 296-P-16 (241-C-105 & -106)

Stack: 296-P-16 @ Waste Tanks 241-C-105/106			
Radionuclide	Emitter Type	% PEDE	PEDE (mrem/yr)
Pu-239/240	alpha	42.4%	0.71
Cs-137	beta-gamma	39.2%	0.66
Sr-89/90	beta-gamma	8.3%	0.14
Am-241	alpha	5.9%	0.10
I-129	beta-gamma	3.5%	0.06
Others (<1%)	N/A	0.7%	0.01
Total	N/A	100%	1.68

TABLE 2-5. PEDE for Stack 296-S-22 (244-S DCRT)

Stack: 296-S-22 @ 244-S DCRT			
Radionuclide	Emitter Type	% PEDE	PEDE (mrem/yr) *
Sr-89/90	beta-gamma	46.1%	0.44
Cs-137	beta-gamma	35.4%	0.33
Am-241	alpha	17.1%	0.16
Others (<1%)	N/A	1.4%	0.01
Total	N/A	100%	0.95

TABLE 2-6. PEDE for Stack 296-T-18 (244-TX DCRT)

Stack: 296-T-18 @ 244-TX DCRT			
Radionuclide	Emitter Type	% PEDE	PEDE (mrem/yr)
Pu-239/240	alpha	55.5%	0.21
Cs-137	beta-gamma	23.8%	0.09
Am-241	alpha	20.6%	0.08
Others (<1%)	N/A	<0.1%	<0.01
Total	N/A	100%	0.38

3.0 DESIGN DESCRIPTION

The *Functional Design Criteria for Project W-420 Stack Monitoring Upgrades*, HNF-SD-W420-FDC-001, defines the design criteria to which the GEMS must conform. A summary of the work to be performed is shown in Table 3-1.

TABLE 3-1. Project W-420 Upgrade Overview

FACILITY	STACK NUMBER	REMOVE EXST STACK MONITOR, AND INSTALL NEW SYSTEM	REMOVE EXISTING STACK	REMOVE EXISTING CONCRETE PAD	STACK MODIFICATIONS	INSTALL CONCRETE PADS	INSTALL WORK PLATFORM
244-A	296-A-25	Y	Y	Y	R	Y	Y
244-BX	296-B-28	Y	Y	N	R	Y	Y
244-CR	296-C-05	Y	N	Y	M	Y	Y
244-S	296-S-22	Y	Y	N	R	Y	Y
244-TX	296-T-18	Y	Y	N	R	Y	Y
241-C	296-P-16	Y	Y	N	R	Y	Y
NOTES:	Y = YES N = NO	M = MODIFY EXISTING STACK R = REPLACE STACK					

3.1 GENERIC EFFLUENT MONITORING SYSTEM

A GEMS will be installed at each exhaust stack to monitor and trend the concentration of radioactive materials released to the environment. The system will extract a representative sample; measure and totalize stack velocity and flow rate; measure, control, and totalize sample flow rates; and monitor the sample flow to determine air emissions. Each system will contain the following equipment as required for the individual stack:

- Equipment Cabinets,
- Stack Flow Instrumentation, including Calibration Ports on Stack,
- Sample Collection System,
- Particulate Record Sampler,
- Particulate Beta-Gamma Continuous Air Monitor (CAM),
- Particulate Alpha CAM (where existing; see Sec. 3.1.6),
- Sample Flow Instrumentation,
- Data Collection System, and
- Vacuum System.

The GEMS, and specifically all parts of the system in contact with the stack exhaust and sample streams, will meet the Ignition Control Set #2 requirements of Technical Safety Requirement (TSR) AC 5.10 in HNF-SD-WM-TSR-006.

Procurement of the GEMS for Project W-420 will be based on an existing specification (White 1995) which established requirements for the design, fabrication, inspection, testing, and shipment of the system. This specification is being revised to reflect changes in the TWRS Authorization Basis and Project W-420 functional design criteria, and to meet stack-specific requirements for this project. The following provides a general overview of the equipment and details of the various components. In general, the GEMS consists of in-stack sample probes, instrument cabinets that house associated electronics and sampling systems, and in-stack instrumentation (temperature and flow).

3.1.1 INSTRUMENT CABINETS

The air sampling and monitoring system will be provided in two separate cabinets: a sampling cabinet and an electronics cabinet. The cabinets will be weatherproof and maintain a controlled environment as required for equipment and instrumentation.

The sampling cabinet contains the equipment to collect the air sample from the stack, including the record sampler and CAM remote in-line sample head. It will be mounted adjacent to the exhaust stack at or near the sample probe location. This locates the sampling cabinet as close to the sample source as practical to minimize the loss of sample particles in the sample transport line between the probe assembly and the record sampler.

The electronics cabinet contains the support equipment for the sampling system, including the CAM unit, instrumentation, vacuum system controls, and data collection system. This cabinet, and the vacuum pumps, will be provided by the vendor on a stack monitoring equipment skid with a weather shield. The skid will be located as close as practical to the stack.

The following data displays will be provided at the local cabinets:

- Stack flow rate,
- Stack gas temperature,
- Individual sampler or monitor flow rate,
- Pressure differentials across CAM and record sampler filters,
- Cabinet temperature,
- Stack and sample flow totals, in standard units,
- Flow and radiation count totals,
- Cabinet general trouble indication(s), signified by amber light, for conditions such as high cabinet temperature that are adverse to system function, and
- Other indications and readouts as determined appropriate by the vendor, with customer approval. An alarm for high radiation, consisting of a ringing bell and rotating red beacon, will be located on top of the electronics cabinet.

3.1.2 STACK FLOW INSTRUMENTATION

Airflow sensing probes will be provided to monitor stack flow rate. The probes will be mounted on removable flange assemblies to allow removal for inspection and maintenance. The sensing probes will be positioned perpendicular to the direction of flow and will be self-averaging pitot type probes. In addition to the pitot-type probe used to measure flow rate, a temperature probe will also be installed in the stack to provide temperature information necessary to correct the flow rate to standard conditions. The airflow sensing probes and temperature probes will be designed based on the stack-specific requirements in the procurement specification.

The airflow sensing probes will be positioned in each stack in accordance with the appropriate 40 CFR 60, Appendix A method. Airflow sensing and sample probes will be located in the same plane for Stacks 296-C-05 and 296-P-16 as these stacks are greater than 12 in. (30 cm) diameter. Stack velocity will be measured downstream from the sample probes for Stacks 296-A-25, 296-T-18, 296-B-28, and 296-S-22 because these stacks are less than 12 in. (30 cm) diameter and locating both probes in the same sample plane would block a significant portion of the cross section and could cause inaccurate measurements.

Calibration ports are necessary to facilitate periodic flow rate verification. The ports will be positioned in accordance with the appropriate 40 CFR 60, Appendix A method, to prevent encountering obstructions from other probes. Calibration ports will be provided on new Stacks 296-A-25, 296-B-28, 296-P-16, 296-S-22, and 296-T-18. For stack 296-C-05, modifications to the existing stack will be made to add the necessary calibration ports.

3.1.3 SAMPLE COLLECTION SYSTEM

The transport piping and sample collection probes for sampling particulate radionuclides will be designed and fabricated by the GEMS vendor in accordance with requirements stated in a procurement specification. The probes will be mounted on removable flange assemblies to allow for inspection and maintenance. An approved shrouded probe design will be used.

Sample collection probes will be positioned in each stack in accordance with American National Standards Institute (ANSI) N13.1 (new draft revision, expected to be released in 1999) and 40 CFR 60, Methods 1 and 1A. The sample extraction location will be qualified according to the performance criteria specified in PNL-10148 (PNNL 1994). Qualification of the sample location for the new stacks can be done by mocking up the stack in the shop and performing the test prior to delivery. For the stacks being modified, the test will need to be performed after stack modifications have been performed.

The sampling cabinets will be mounted directly on the work platforms adjacent to the exhaust stacks. This design will provide physical support for the cabinets and minimize the loss of particulate in the sample lines by assuring sample lines are as short as practical, the number of bends is minimized, and horizontal runs of sample lines are avoided. The sampling cabinet will be heated to maintain the electronics at the proper operating temperature and to prevent condensation from forming in the sample lines. In the sampling cabinet, the sample flow stream will be split, with one stream supplying the record sampler and the other supplying the in-line beta-gamma sample head. The flow rate of each sample stream will be controlled separately.

In those cases (e.g., 244-TX) where an alpha CAM is required, either a second sample collection probe or a second splitter will be provided to supply a separate, additional sample stream for the alpha CAM. Additional flow controls will be provided as well. Provision for an alpha CAM is also discussed in Sec. 3.1.6, below.

The sample transport lines will be recombined in the sampling cabinet and routed to the vacuum system. Sample return piping will be provided from the vacuum system to return the extracted sample to the stack. The return line will enter the stack at a location above (i.e., downstream of) the sample collection and flow sensing probes. The size of the return line for each stack will be determined during final design [normally 1/2 in. (12 mm)].

The sample transport and return lines will be provided with a sufficient number of isolation valves to isolate the cabinets from the stack air stream and support routine maintenance, and will have test ports to enable pressure leak testing following maintenance. Low point drains will be provided, as necessary. All sample transport and return lines located outside will be insulated and heat traced, using self-regulating heat trace, to maintain the sample stream above temperatures at which condensation begins to occur.

The sample probe, sample transport piping, sample return piping, and fittings will be fabricated from 304, 304L, 316, or 316L stainless steel. All tubing will be seamless construction with material composition per American Society for Testing and Materials (ASTM) A269.

3.1.4 PARTICULATE RECORD SAMPLER

The particulate record sampler will be located in the sampling cabinet. The particulate record sampler collects a sample of particles onto a standard 47 mm membrane filter paper for future radionuclide analysis at a laboratory. A record sampler is required to comply with 40 CFR 61, Subpart H, which states that all radionuclides which could contribute greater than 10% of the potential effective dose equivalent for a release point shall be measured.

Performance of the particulate record sampler will be verified and documented by (in order of preference): 1) a field acceptance test, 2) laboratory wind tunnel testing, or 3) a verified model (PNNL 1994). Performance requirements for the record sampler and sample probe will be consistent with the project FDC and will be implemented in a procurement specification.

3.1.5 PARTICULATE BETA-GAMMA CONTINUOUS AIR MONITOR

The criteria for requiring an on-line beta-gamma CAM is the graded approach to the application of sampling and monitoring outlined in PNL-10148 (PNNL 1994). This graded approach is reproduced below in Table 3-2 where it can be seen that real-time monitoring (i.e., a CAM) is required for PEDEs greater than 1.0 mrem/yr. As Tables 2-1 through 2-6 show, the PEDEs for stacks in the scope of Project W-420 range from 0.38 to 187.0 mrem/yr, with a majority exceeding 1.0 mrem/yr. In addition, there is a TWRS authorization basis requirement in the BIO and TSRs (ref. LCO 3.1.4) for operable stack CAMs and CAM interlock systems on all six stacks in the project scope.

TABLE 3-2. Graded Monitoring Approach (PNNL 1994).

POTENTIAL EFFECTIVE DOSE EQUIVALENT CATEGORY	REQUIRED MONITORING AND SAMPLING ANALYSIS PROCEDURES	POTENTIAL EFFECTIVE DOSE EQUIVALENT RANGE (mrem/yr)
1	Continuous extractive sampling for a record of emissions and in-line, real-time monitoring with alarm capability; consideration of separate accident monitoring system.	>1.0
2	Continuous extractive sampling for record of emissions, with retrospective, off-line periodic analysis.	>0.1 and ≤1
3	Periodic confirmatory extractive sampling and off-line analysis.	>0.001 and ≤0.1
4	Annual administrative review of facility used to confirm absence of radioactive materials in forms and quantities not conforming to prescribed specifications and limits.	≤0.0001

Whether an alpha or beta-gamma CAM is used on a given stack, or a combination of both types, should be based on the nature of the expected stack emissions. For five of the six stacks within the scope of Project W-420, the majority of the total PEDE is contributed by beta-gamma emitters. Based on this, a beta-gamma CAM will be required for the following stacks: 296-A-25, 296-B-28, 296-C-05, 296-P-16, and 296-S-22. However, to comply with the project intent to preserve or replace any existing equipment functions, and to provide flexibility for process changes, a beta-gamma CAM will be installed on all six stacks, including Stack 296-T-18.

The particulate beta-gamma CAM provides near real-time detection of radionuclides in the stack air stream, and provides a signal to the interlock that shuts down the fan automatically upon detecting high stack radiation. This is the primary system safety function. The CAM will be an Eberline model AMS-4. The AMS-4 CAM is preferred because it is supported by extensive, documented onsite testing, as well as spare parts inventories and existing onsite procedures for calibration, maintenance, and operation. Alternatively, a different unit having equal or better performance features may be substituted, subject to TWRS Operations and Engineering approval, provided the unit has been tested per the requirements in ANSI N42.18 and the test results are supplied.

The CAM remote in-line sample head will be located in the sampling cabinet. The counting electronics will be located in the electronics cabinet. A local alarm on top of the electronics cabinet will be provided for stack high radiation. The alarm includes a ringing bell and rotating red beacon. Auxiliary contacts will be provided for two remote indicators, if desired; one for high radiation and one for CAM failure.

3.1.6 PARTICULATE ALPHA CONTINUOUS AIR MONITOR

It is recommended (but not required) that alpha CAMs be used on those stacks where >50% of the PEDE comes from alpha emitting radionuclides. In such cases, an alpha CAM would prevent a large release of predominantly alpha emitting materials from going undetected until the periodic record sample is analyzed. Reviewing Tables 2-1 through 2-6, stack 296-T-18 shows a contribution of over 75% of its total PEDE from alpha emitters, and would therefore be recommended for an alpha CAM. Stack 296-T-18 is presently monitored for particulate alpha activity, while the other five stacks are not. This stack will be provided with a particulate alpha CAM, in addition to the beta-gamma CAM, to comply with the project intent to preserve or replace any existing equipment functions. The additional CAM unit will require a separate sample stream, to be provided by a second splitter in the sample collection system.

For the remaining stacks, less than 50% of the PEDE is contributed by alpha emitters. However, during future waste retrieval campaigns which will involve sludge transfers, it is anticipated that the relative contribution of alpha emitters to the total PEDE may increase for some stacks. It is therefore planned to make a provision in all the GEMS designs for later addition of alpha CAMs if warranted.

3.1.7 SAMPLE FLOW INSTRUMENTATION

Instrumentation will be provided to record and control the record sampler and CAM flow rates, including provisions for totalizing the flow between filter changes. An adjustable alarm set point for sample low flow rate will be provided. The CAM low flow alarm is a system safety function. Auxiliary contacts will be provided for remote indication, if desired, when sample flow rate deviates beyond required tolerances.

3.1.8 DATA COLLECTION SYSTEM

The Data Collection System will provide local indication of stack flow rate, stack temperature, record sampler pressure drop, record sampler flow rate, totalized stack flow, and totalized record sampler flow (i.e., since the last filter change-out). The beta-gamma monitor CAM flow rate will also be indicated.

The Data Collection System will have a standardized communications interface for the transfer, on command, of measured values. The Data Collection System will have the capability of storing a limited quantity of data, in a form that is accessible from a remote data transfer link (for future use; not in the scope of this project). The record sampler flow readings and total flow, the stack flow readings and total flow, and the date and time of the starting and ending data points will be the minimum information transferred.

The GEMS design will include dedicated, double-throw contacts for the purpose of connecting to the Tank Monitoring and Control System (TMACS). As a minimum, dedicated alarm contacts will be provided to indicate each of the following conditions: high stack radiation (or fan shutdown), CAM failure, low sample flow, and single vacuum pump failure. The Data Collection System will also include provision for a digital communication port for future TMACS connection.

3.1.9 VACUUM SYSTEM

The vacuum system will be located, with the electronics cabinet, on the vendor-supplied skid. The system provides a steady, non-pulsing, vacuum source over a range of operating conditions from the maximum and minimum design values of the samplers based on the required collection efficiency. Two vacuum pumps will be provided for redundancy. The two pumps will be capable of automatic change-over, and sized such that each pump can support the required loads.

The vacuum pumps will be rated for outdoor service. They will be located outside, with a sun shade and rain cover. The vacuum pumps will be located, plumbed, and wired for ease of maintenance.

Each particulate sampling line will have its own flow regulation. The vacuum supply to each sample line will be adjustable and automatically regulated so that individual sample flow rates will be maintained. Sample flow controls and instrumentation will be located all or in part in the electronics cabinet. Valves will be provided so that components can be individually isolated for maintenance.

The individual vacuum exhaust lines will be combined into a single return manifold. The combined return manifold will be connected by field piping to the stack downstream of the sampling and velocity probes. The sample return line will be located entirely outside.

3.2 STACKS

An analysis was performed to determine the ability of the existing stacks to accept the required probes. The decision to use an existing stack configuration or to replace or modify a stack is based on the ability to provide satisfactory locations for sample and flow sensing probes. The locations for the sample extraction and flow sensing probes have been chosen in accordance with ANSI N13.1 (new draft revision), the appropriate 40 CFR 60 Appendix A method, and PNL-10148 (PNNL 1994). An existing stack can be used when the probe mounting location(s) satisfy the applicable criteria. New stack extensions, modifications to existing stacks, or replacement stacks are specified when the existing probe locations do not satisfy the applicable requirements. Appropriate modifications are described for each stack.

The locations for flow sensing probes were chosen to satisfy the requirements of the appropriate 40 CFR 60 method, Method 1 for stacks greater than 12 in. diameter, and Method 1A for stacks less than 12 in. diameter. Following installation in the field, an initial stack flow sensor verification test will be performed in accordance with 40 CFR 52 Appendix E. When practical, flow sensing probes are located in the same plane as the sample probes.

The locations for sample probes were chosen in accordance with the guidance of ANSI N13.1 and the requirements of the appropriate 40 CFR 60 Appendix A method. In general, these locations must not exhibit angular or cyclonic flow and must provide acceptable uniformity of contaminant mixing. Specific performance criteria for sample extraction locations are provided by PNL-10148 (PNNL 1994).

Testing (shop or field) will be performed to qualify the sample extraction locations according to the performance criteria of PNL-10148 (PNNL 1994). The velocity profile at the sample location will be measured in accordance with 40 CFR 60 Appendix A, Method 1, Section 2.4, "Verification of the Absence of Cyclonic Flow". Satisfactory contaminant mixing will be demonstrated in accordance with the methods described in PNL-10148 (PNNL 1994), Section 3.3, "Methods for Qualifying the Sample Extraction Location".

An assumption has been made that locating sample probes in accordance with the ANSI N13.1 and 40 CFR 60 Appendix A will result in sample locations that satisfy performance criteria of PNL-10148 (PNNL 1994). The validity of this assumption will be demonstrated by shop or field testing. When the existing sample locations are in accordance with ANSI N13.1 and 40 CFR 60 Appendix A, the sample location will be qualified by field testing after performance of any additional stack modifications.

As mentioned previously, the decision to replace or modify a stack is based on the ability of the stack to provide satisfactory probe locations. An assumption has been made that the existing stack heights provide adequate dilution and dispersion. It was not within the scope of Conceptual Design for Project W-420 to verify that existing stacks satisfy requirements for dilution and dispersion of contaminants. Therefore, the original stack height will be used as the minimum height for new stack upgrades.

Estimated stack discharge velocities for the upgraded systems are tabulated below for purposes of designing the GEMS or selecting components. These are based on averaged recent stack flow measurements of the existing systems; standard deviations for these measurements are on the order of 10-20% of the average. Because major portions of these systems (existing fans, ductwork, filter trains, etc.) will not be modified by Project W-420, it is expected that the flow rates will not be significantly changed. ASHRAE (1993) provides recommended guidelines for stack flow velocity and stack height to minimize such problems as downwash along the stack, poor effluent dispersion, or rainwater intrusion under certain conditions. These guidelines must also take into consideration such factors as undesirable stack noise levels, facility occupancy, wind speed, terrain, and the air flow patterns around adjacent buildings. The average measured stack flows tabulated below are close to, or within, the ASHRAE guidelines, and will be considered acceptable based on past operating experience.

TABLE 3-3. Project W-420 Upgrade Estimated Stack Flow Velocities

STACK		NEW STACK? (Y/EXST)	NOMINAL DESIGN CAPACITY, CFM (1)	AVERAGE MEASURED FLOW RATE, CFM (2)	DIAMETER OF STACK, IN.	EXPECTED FLOW VELOCITY, FT/MIN (4)
FACILITY	STACK NUMBER					
244-A	296-A-25	Y	150	161	6/4 (3)	1850
244-BX	296-B-28	Y	125-250	203	6/4 (3)	2330
244-CR	296-C-05	EXST	4200	3550	18	2010
241-C	296-P-16	Y	7000	3276	16	2350
244-S	296-S-22	Y	165	148	6/4 (3)	1700
244-TX	296-T-18	Y	125-250	266	6/4 (3)	3050

NOTES:
(1) NOMINAL DESIGN FLOW RATES AS DOCUMENTED ON EXISTING PLANT DRAWINGS.
(2) AVERAGE OF MOST RECENT MEASURED FLOW RATES FOR EXISTING SYSTEM.
(3) STACK DIAMETER WILL BE 6 IN., WITH A 4-IN. DIAMETER DISCHARGE ACHIEVED BY MEANS OF A 6 X 4 BELL REDUCER ON TOP OF STACK.
(4) EXPECTED FLOW VELOCITY BASED ON AVERAGE MEASURED FLOW RATES AND NEW STACK SIZE; UPGRADED SYSTEMS WILL USE EXISTING FANS AND FILTER TRAINS, AND ARE EXPECTED TO PRODUCE SIMILAR FLOW RATE WITH THE NEW OR MODIFIED STACK.

Several of the existing stack designs utilize flow straightening vanes because the stacks have tangential inlets which tend to induce swirling. An assumption has been made that flow straightening vanes will not be required with the new stack extensions. However, removable spool pieces will be provided to allow installation of flow vanes if testing indicates unacceptable flow conditions at the sample extraction location.

3.3 UTILITIES

Electrical power for the stack monitors will be provided from the same panel boards that supply the existing stack monitors. Existing conduit will be utilized to the maximum extent practical. All electrical materials and equipment will be UL or FM tested, with labels attached, for the purpose intended, whenever such products are available. Installation methods will be in accordance with manufacturer instructions, NFPA 70, and with other applicable requirements. A 30 A, 120 VAC, single phase power supply will be required for the stack monitors. The single feed connects with a power distribution fuse block on the electronics and vacuum system skid supplied by the stack monitor vendor. Distribution from the skid to the sample cabinet and the electronics cabinet will be performed through minimal runs of galvanized rigid steel (or flexible seal tight) conduit.

3.4 WORK PLATFORMS

Work platforms will be provided for routine access to the sample cabinets. The work platforms must have guardrails and toe boards that conform to 29 CFR 1910.23(c), and ladders that conform to 29 CFR 1910.27. Conceptual Design allows for a 60 degree pitch for the ladders. A safety chain or gate will be provided at the access to the platform.

3.5 DETAILED INSTALLATION DESCRIPTIONS (BY FACILITY)

3.5.1 STACK 296-A-25 (244-A DCRT)

- **General**

  The site is easily accessible for staging and placement of concrete or equipment. A crane can be employed from outside the facility fence. Dome loading controls must be observed, as appropriate. The facility is a radiologically controlled area, requiring protective clothing (e.g., "whites") for personnel access. Prior to pouring the concrete pads, it will be necessary to relocate the existing stack monitoring cabinet or to install a temporary "construction" stack monitoring system (see Sec. 4.6 for further discussion).

- **Stack**

  The existing sample and velocity probe locations for Stack 296-A-25 do not satisfy the criteria of 40 CFR 60 Appendix A, Method 1A. The existing stack is a single piece, 4-in. (10 cm) diameter, 9.5 ft (2.9 m) tall construction with a velocity probe at the 5 ft (1.5 m) level, and a sample probe at the 8 ft (2.4 m) level.

  A new stack will be constructed of 6 in. (15 cm) steel pipe with a 6 x 4 in. reducer at the top of the stack. This will provide an estimated stack discharge velocity of 1850 ft/min (9.4 m/s), based on average measured stack flows of 161 ft^3/min (0.076 m^3/s) for the existing stack and system. The sample probe will be located at the 6.42 ft (2.0 m) height, and the velocity probe located at the 9.08 ft (2.8 m) height. Total stack height will increase to 11 ft (3.4 m). The new stack includes a spool piece section to allow installation of a flow straightening vane if necessary, a 3-in. (7.6 cm) flange connection for the sample probe at the 6.42 ft (2.0 m) height, a 1 in. (25 mm) sample return connection located 15 in. (38 cm) from the top of the stack, and 1-in. (25 mm) connections for mounting temperature and velocity probes at the 9.08 (2.8 m) height. Two 1-in. (25 mm) stack flow calibration ports will also be installed.

- Concrete

One new equipment pad approximately 5 ft (1.5 m) by 12 ft (3.7 m), 6 in. (15 cm) thick, will be located adjacent to the existing ventilation equipment pad. Estimated quantity of concrete required is 1.5 yd^3 (1.15 m^3). Two legs and the ladder of the work platform will be anchored to the new pad and the other two legs will be anchored to the existing pad. The skid containing the electronics cabinet and vacuum system will be mounted to this new equipment pad with ten concrete anchors [5/8 in. (16 mm) diameter bolts].

- Excavation

Excavation of soil will be required for placement of new equipment support pads. Installation will also require excavation and removal of an existing 5 ft (1.5 m) by 3 ft (0.9 m) concrete pad which interferes with the proposed new equipment pad. There will be no excavation work for electrical and instrumentation conduits. Existing conduit and trenches will be used.

- Utilities

Power will be supplied from Panel Board A, located in the instrument building. The existing 30 A two-pole breaker in circuits 17 and 19 will be replaced with a 30 A single-pole breaker in circuit 17 to provide power to the cabinet. Circuit 19 in the Panel Board will become a spare. The conductor used will be 3 conductor, 10 AWG, THWN copper wire. The wire will be run in new 3/4 in. (20 mm) galvanized rigid steel conduit run along the outside of the instrument building to the stack monitor equipment skid.

- **Work Platform**

A work platform approximately 3 ft (0.9 m) high will be installed to allow for routine access to the sampling cabinet. The platform dimensions will be approximately 4.33 ft (1.3 m) by 3.33 ft (1.0 m) and will be constructed of square tubular steel, angle iron, metal deck grating, and a ladder with handrails. Steel safety rails with a safety chain will be provided. The platform will be mounted on the mobile exhauster skid with a small concrete footing to be added off the skid for anchoring the ladder.

- **Modifications to Existing Equipment**

Alarms, indications, and interlocks associated with the existing GEMS will be replaced with alarms and indications provided locally on the new instrument cabinets. The planned modifications, as well as the alarms, indicators, and recorders that will be disconnected, removed, or relabeled, will be similar to those identified for Stack 296-T-18 (Table 3-4).

- **Disposal of Equipment and Material**

  Installation of the new monitoring system and stack will require removal and disposal of the following equipment:

  - the exhaust unit enclosure assembly,
  - 12 ft (3.7 m) of 1/2 in. (12 mm) sample piping,
  - 12 ft (3.7 m) of 1 in. (25 mm) sample return piping,
  - 9.5 ft (2.9 m) of 4-in. (10 cm) diameter exhaust stack, and
  - one isokinetic sample probe and flange assembly.

  The stack, sample probe, sample transport piping, and portions of the exhaust unit enclosures have the potential for low levels of radioactive contamination. Removal of the existing stack monitor pad and excavation for the new pad will require disposal of approximately 54 ft^3 (1.5 m^3) of potentially contaminated dirt and concrete.

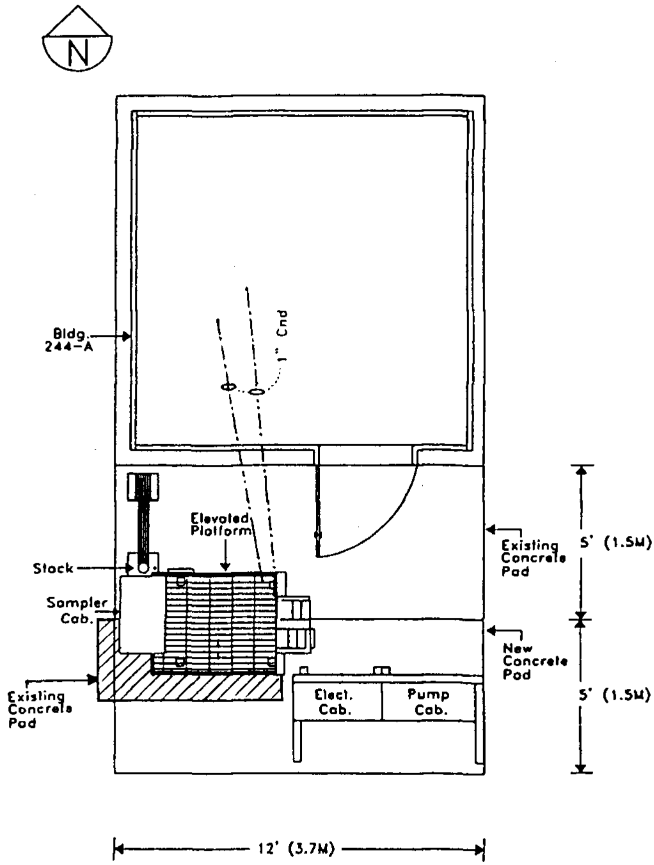


FIGURE 3.5.1-1. 244-A DCRT GEMS Upgrade - Plan View of Equipment Layout

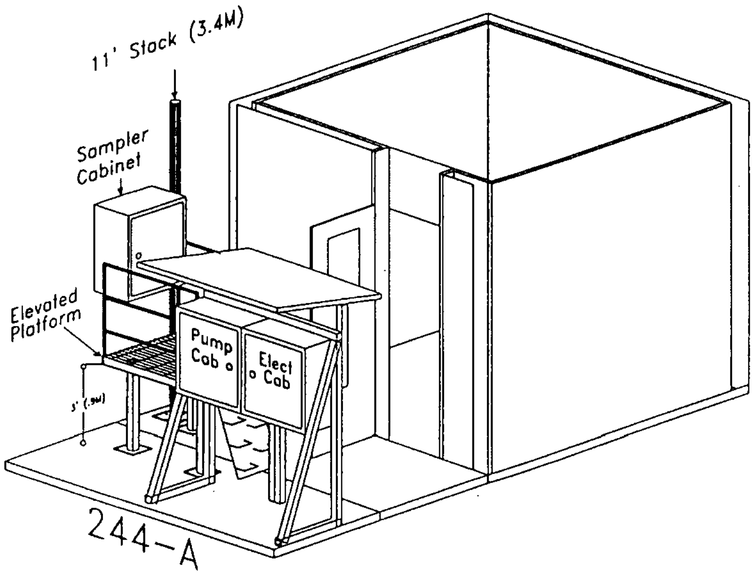


FIGURE 3.5.1-2. 244-A DCRT - Elevation View of Upgraded Facility

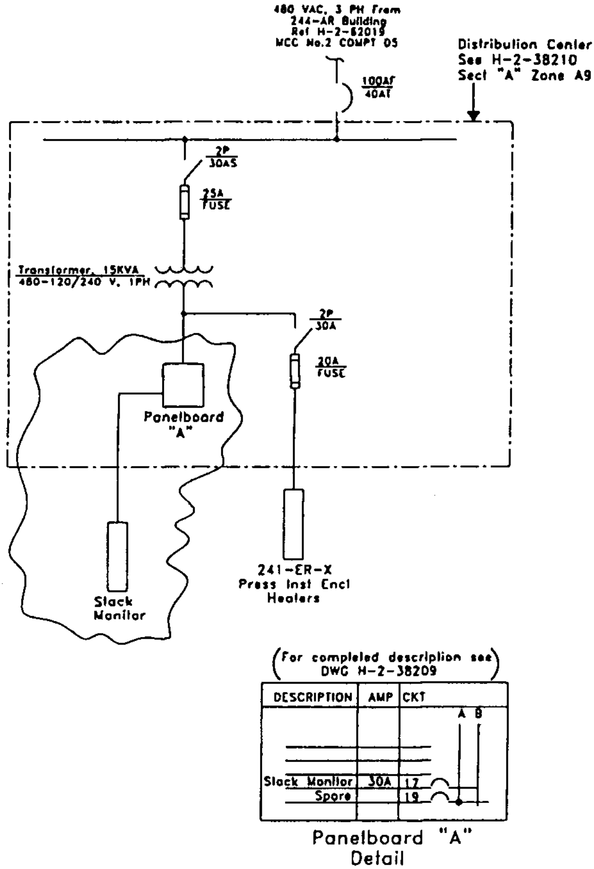


FIGURE 3.5.1-3. 244-A DCRT GEMS Upgrade - Electrical One-Line
(Example; actual installation may differ, depending on field conditions)

3.5.2 STACK 296-B-28 (244-BX DCRT)

- **General**

The site is easily accessible for staging and placement of concrete or equipment. A crane can be employed from outside the facility fence. Dome loading controls must be observed, as appropriate. The facility is a radiologically controlled area, requiring protective clothing (e.g., "whites") for personnel access.

- **Stack**

The existing sample and velocity probe locations for Stack 296-B-28 do not satisfy the criteria of 40 CFR 60 Appendix A, Method 1A. Therefore, the existing 6-in. (15 cm) diameter, 11 ft (3.4 m) long stack and air straightening vane and pitot tube assembly (Air Monitor Fan-E) will be removed and replaced with a new stack. It is possible to only remove a portion of the stack and install a new extension, but this option would preclude conducting qualification testing in the shop, which is 'highly desired over field testing.

The new stack will be constructed of 6 in. (15 cm) steel pipe with a 6 x 4 in. reducer at the top of the stack. This will provide an estimated stack discharge velocity of 2330 ft/min (11.8 m/s), based on average measured stack flows of 203 ft^3/min (0.096 m^3/s) for the existing stack and system. The sample probe will be located at the 6.42 ft (2.0 m) height, and the velocity probe located at the 9.08 ft (2.8 m) height. Total stack height will be 11 ft (3.4 m). The new stack includes a spool piece section to allow installation of a flow straightening vane if necessary, a 3 in. (7.6 cm) flange connection for the sample probe at the 6.42 ft (2.0 m) height, a 1 in. (25 mm) sample return connection located 15 in. (38 cm) from the top of the stack, and 1-in. (25 mm) connections for mounting temperature and velocity probes at the 9.08 ft (2.8 m) height. Two 1-in. (25 mm) calibration ports will also be installed below the sample probe location and below the velocity probe location.

- **Concrete**

New equipment pads will be provided for the skid and work platform that will be installed. Estimated quantity of concrete required is 1.25 yd^3 (1.0 m^3). The skid containing the electronics cabinet and vacuum system will be mounted to this new pad with ten concrete anchors [5/8 in. (16 mm) diameter bolts]. The pad for the skid will be approximately 6.5 ft (2.0 m) by 3.5 ft (1.1 m), 6 in. (15 cm) thick, and located 3 ft (0.9 m) off the north side of the existing instrumentation building. The second pad will be approximately 7 ft (2.1 m) by 3 ft (0.9 m) and will be located immediately to the north of the existing ventilation equipment pad. Two legs and the ladder of the work platform will be anchored to the new pad and the other two legs will be anchored to the existing pad.

- **Excavation**

  Excavation will be required for placement of new equipment support pads. A steel post embedded in concrete (part of a ladder storage rack), adjacent to the facility fence, is an interference that will need to be removed or relocated prior to pouring the pads. There will be no excavation work for electrical and instrumentation conduits. Existing conduit and trenches will be used.

- **Utilities**

  Power will be supplied from a panel board located in the motor control center in the instrument building. The existing 15 A single pole breaker in circuit 18 will be replaced with a 30 A single pole breaker to provide power to the cabinet. Circuits 15, 17, 20, and 24 in the Panel Board will become spares. The conductor used will be 3 conductor, 10 AWG, THWN copper wire. The wire will be run in new 3/4 in. (20 mm) galvanized rigid steel conduit run along the outside of the instrument building to the stack monitor equipment skid.

- **Work Platform**

  A work platform approximately 3 ft (0.9 m) high will be installed to allow for routine access to the sampling cabinet. The platform dimensions will be approximately 4.17 ft (1.3 m) by 3.33 ft (1.0 m) and will be constructed of square tubular steel, angle iron, metal deck grating, and a ladder with handrails. Steel safety rails with a safety chain will be provided.

- **Modifications to Existing Equipment**

  Alarms, indications, and interlocks associated with the existing GEMS will be replaced with alarms and indications provided locally on the new instrument cabinets. The planned modifications, as well as the alarms, indicators, and recorders that will be disconnected, removed, or relabeled, will be similar to those identified for Stack 296-T-18 (Table 3-4).

- **Disposal of Equipment and Material**

  Installation of the new monitoring system and stack extension will require removal and disposal of the following equipment and material:

  - the exhaust unit enclosure assembly,
  - 8 ft (2.4 m) of 1/2 in. (12 mm) sample piping,
  - 12 ft (3.7 m) of 1 in. (25 mm) sample return piping,
  - 11 ft (3.4 m) section of 6-in. (15 cm) diameter exhaust stack,
  - an air straightening vane and pitot tube assembly (Air Monitor Fan-E), and
  - two isokinetic sample probe and flange assemblies.

  The stack section, sample probes, sample transport piping, and portions of the exhaust unit enclosures have the potential for low levels of radioactive contamination. Excavation for the new equipment pad will require disposal of approximately 34 ft^3 (1.0 m^3) of potentially contaminated dirt. This material will be appropriately segregated and packaged for burial.

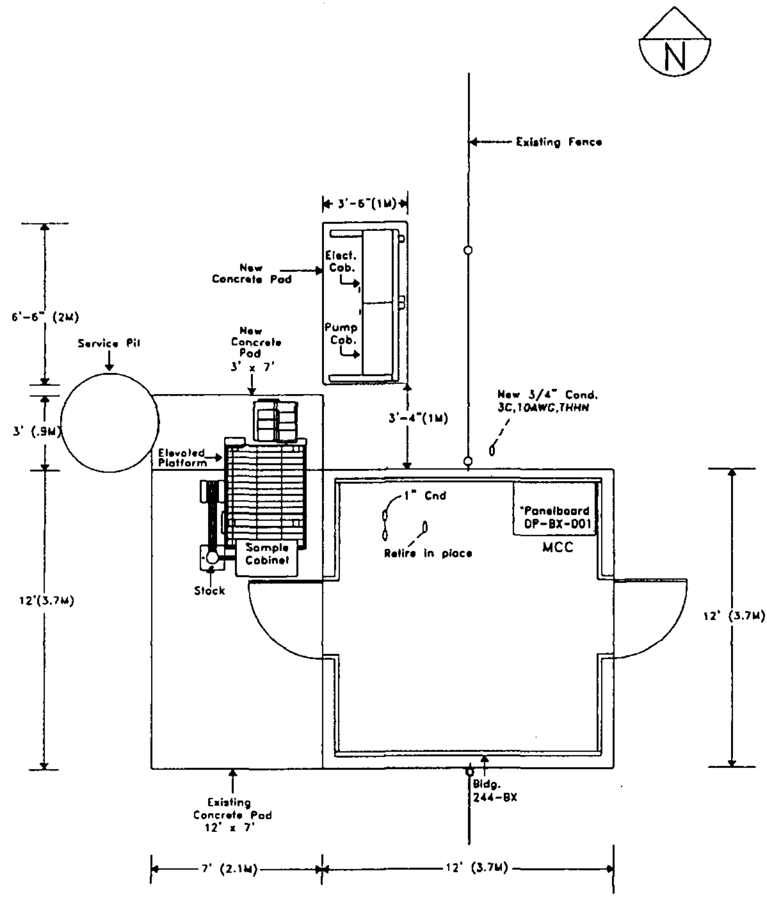


FIGURE 3.5.2-1. 244-BX DCRT GEMS Upgrade - Plan View of Equipment Layout

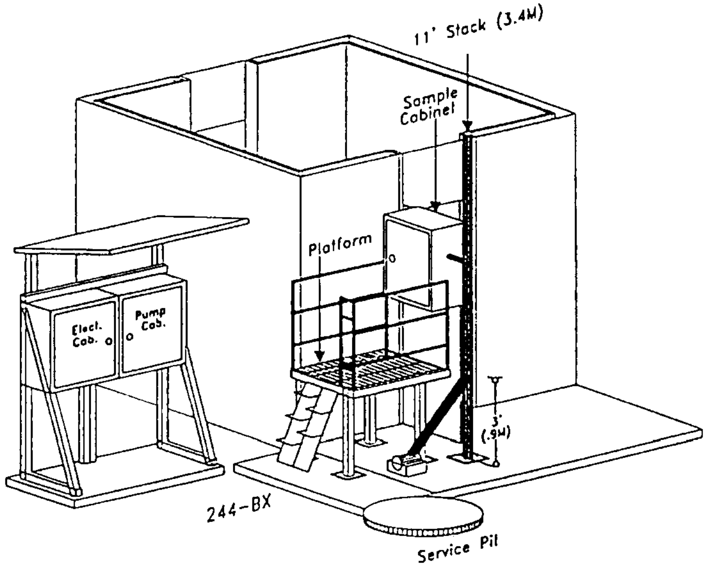
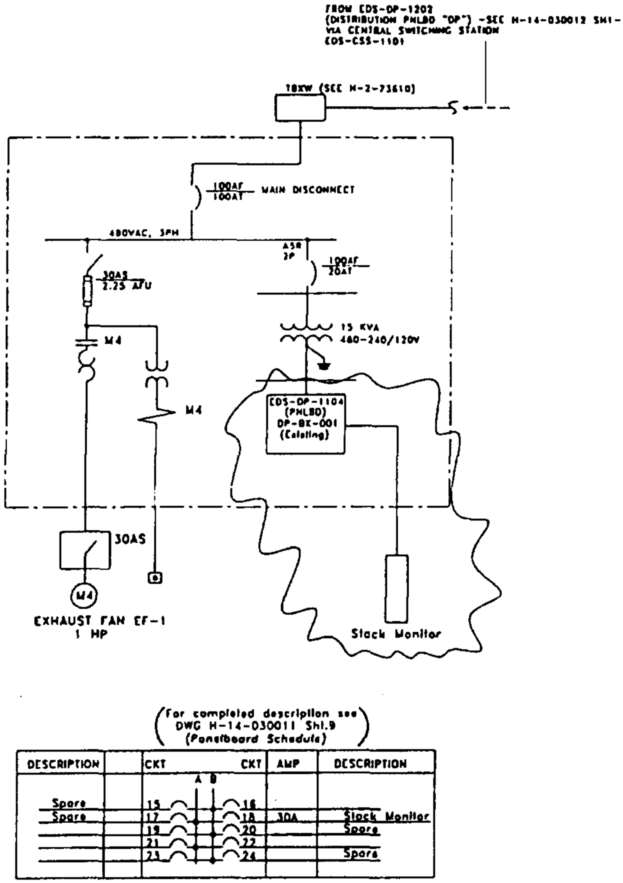


FIGURE 3.5.2-2. 244-BX DCRT - Elevation View of Upgraded Facility



Panelboard DP-BX-001
Detail

FIGURE 3.5.2-3. 244-BX DCRT GEMS Upgrade - Electrical One-Line
(Example; actual installation may differ depending on field conditions)

3.5.3 STACK 296-C-05 (244-CR VAULT)

- **General**

The site is easily accessible for staging and placement of concrete or equipment. A crane may be employed either inside or outside the facility fence; planning for crane placement must consider potential interferences due to existing power lines and the four guy wires that support the stack. Dome loading controls must be observed, as appropriate. The facility is a radiologically controlled area, requiring protective clothing (e.g., "whites") for personnel access. Prior to pouring the concrete pads, it will be necessary to relocate the existing stack monitoring cabinet or to install a temporary "construction" stack monitoring system (see Sec. 4.6 for further discussion).

- **Stack**

The location of the existing stack monitor probe assembly in Stack 296-C-05 satisfies the criteria of 40 CFR 60, Appendix A, Method 1 for sampling and velocity measurement location. Therefore, the new monitoring system will utilize the existing stack and probe mounting flange. The velocity probe will utilize the existing flange while a new flange will be provided to locate the sample probe inlet in the same plane as the velocity probe. The centerline of the velocity probe flange will be located at a height of 17 ft (5.2 m) in an 18-in. (46 cm) diameter stack which provides greater than 7 duct diameters downstream from nearest flow disturbance (stack inlet). Note that the actual location of the sample probe flange will depend on the final probe design which positions the probe inlet somewhere below the flange.

The existing pitot tube and flow switch located on the stack at a height of 6 ft (1.8 m) will be removed and the hole plugged. Modifications to the stack will be made to provide calibration ports and a connection for the sample return line, located above the flow sensing and sample collection probes.

The existing stack and system will provide an estimated stack discharge velocity of 2010 ft/min (10.2 m/s), based on average measured stack flows of 3550 ft^3/min (1.675 m^3/s).

- **Concrete**

A new equipment pad will be provided for the electronics cabinet and vacuum system skid. Estimated quantity of concrete required is 2.5 yd^3 (1.9 m^3). The pad will be approximately 8 ft (2.4 m) by 12 ft (3.7 m), 6 in. (15 cm) thick, and located directly adjacent to the existing stack. The existing stack monitor pad will be removed. The skid will be mounted to this new pad with ten concrete anchors [5/8 in. (16 mm) diameter bolts]. All four legs of the work platform will be anchored to the new equipment pad, and a small concrete footing will be installed to anchor the platform ladder.

- **Excavation**

  Excavation will be required for placement of new equipment support pads. Additional excavation may be necessary to remove or reroute two existing buried electrical conduits and a 3/4-in. pipe in the vicinity of the stack. The existing stack monitoring cabinet pad will be buried approximately 8 in. below grade and will be left in place. There will be no excavation work for new electrical and instrumentation conduits. Existing conduit and trenches will be used.

- **Utilities**

  Power will be supplied from Lighting Panel LA located in the 271-CR instrument building. A 30 A single-pole breaker will be installed to provide power to the cabinet. The conductor used will be 3 conductor, 10 AWG, THWN copper wire. The wire will be run in conduit from the Panel Board to the stack monitor equipment skid.

- **Work Platform**

  A work platform approximately 12.67 ft (3.9 m) high will be installed to allow for routine access to the sampling cabinet. The platform dimensions will be approximately 4.17 ft (1.3 m) by 4.83 ft (1.5 m) and will be constructed of square tubular steel, angle iron, metal deck grating, and a ladder with handrails. Steel safety rails with a safety chain will be provided.

- **Modifications to Existing Equipment**

  Alarms, indications, and interlocks associated with the existing GEMS will be replaced with alarms and indications provided locally on the new instrument cabinets. The planned modifications, as well as the alarms, indicators, and recorders that will be disconnected, removed, or relabeled, will be similar to those identified for Stack 296-T-18 (Table 3-4).

- **Disposal of Equipment and Material**

  Installation of the new monitoring system will require removal and disposal of the following equipment and materials:

  - the exhaust unit enclosure assembly,
  - 24 ft (7.3 m) of 3/4 in. (20 mm) sample piping,
  - 6 ft (1.8 m) of steel pipe support, an airflow switch,
  - 6 ft (1.8 m) of 1/2 in. (12 mm) flex conduit with 14 AWG wire, and
  - one isokinetic sample probe and flange assembly.

  The sample probe, sample transport piping, and portions of the exhaust unit enclosures have the potential for low levels of radioactive contamination. Excavation for the new pad will require disposal of approximately 42 ft^3 (1.2 m^3) of potentially contaminated dirt and concrete.

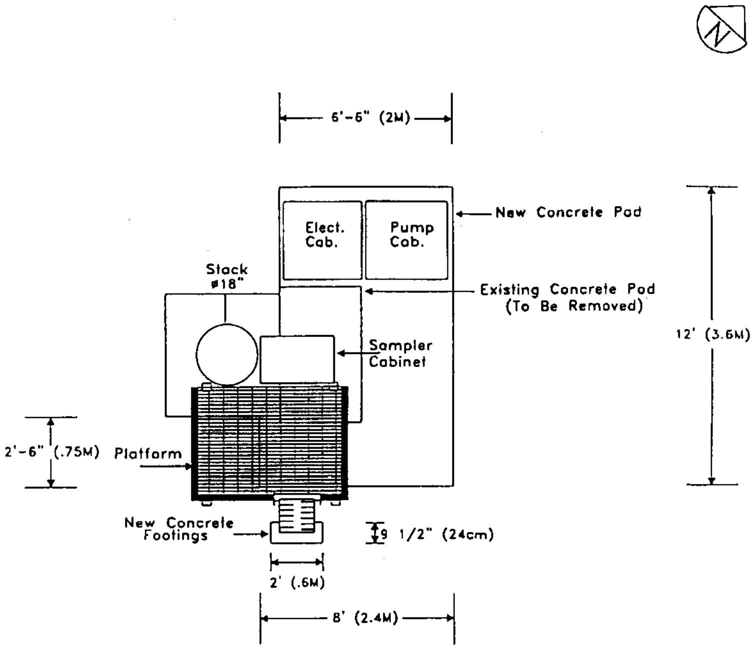


FIGURE 3.5.3-1. 244-CR Vault GEMS Upgrade - Plan View of Equipment Layout

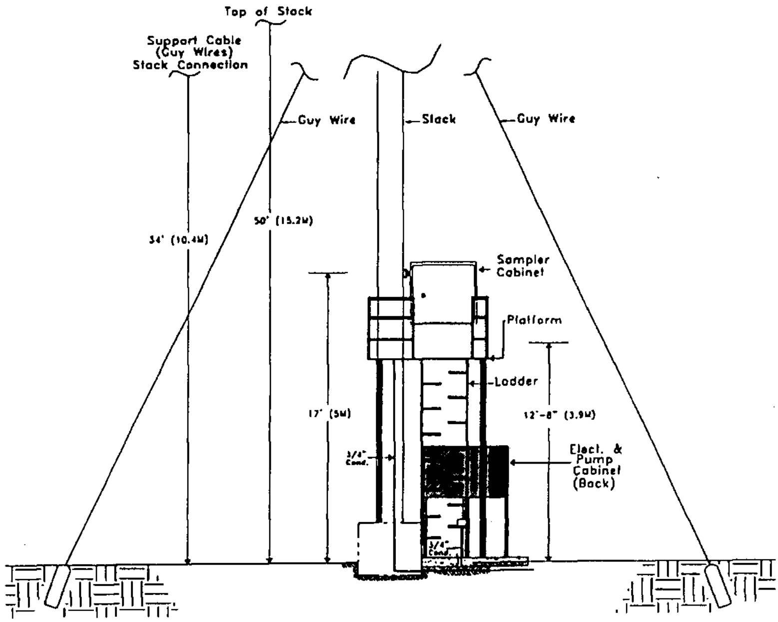


FIGURE 3.5.3-2. 244-CR Vault GEMS Upgrade - Elevation View of Modified Stack

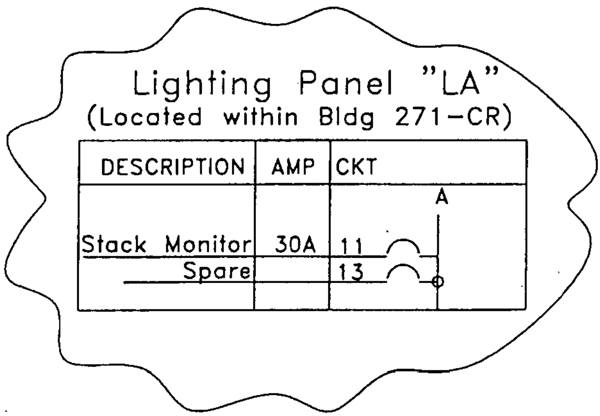


FIGURE 3.5.3-3. 244-CR Vault GEMS Upgrade - Electrical One-Line
(Example; actual installation may differ depending on field conditions)

3.5.4 STACK 296-P-16 (241-C-105 and -106 PRIMARY TANKS)

- **General**

The site is accessible for staging and placement of concrete or equipment. The facility is a radiation contamination area, requiring protective clothing (e.g., "whites") for personnel access. Vehicles and cranes must be employed inside the facility fence, due to the location of the exhauster, and must be regulated for use in a radiologically controlled area. Dome loading controls also apply to the crane and other vehicles used in the facility (see Sec. 5.8.2).

- **Stack**

The location of the existing stack monitor probe assembly in Stack 296-P-16 satisfies the criteria of 40 CFR 60, Appendix A, Method 1 for sampling and velocity measurement location. However, the stack is small enough that it would be most cost effective to replace the stack entirely rather than to try and add additional instrument ports in the field. The centerline of the sample probe flange is located at a height of approximately 7 ft (2.1 m) in a 16-in. (41 cm) stack which is 5.25 duct diameters downstream from the nearest flow disturbance (stack inlet) and 2.25 diameters upstream from the nearest flow disturbance (stack outlet). Design changes to the stack will be made to provide calibration ports and a connection for the sample return line. The existing stack is fabricated from 11 gauge carbon steel sheet metal which will be used for the replacement stack. Note that the actual location of the sample probe flange will depend on the final probe design which positions the probe inlet somewhere below the flange.

The new stack will provide an estimated stack discharge velocity of 2350 ft/min (11.9 m/s), based on average measured stack flows of 3276 ft^3/min (1.546 m^3/s) for the existing stack and system.

- **Concrete**

A new concrete pad will be provided for the electronics cabinet and vacuum system skid. Estimated quantity of concrete required for the new pad is 0.75 yd^3 (0.6 m^3). The pad will be approximately 6.5 ft (2.0 m) by 3.5 ft (1.1 m) and located directly adjacent to the existing exhaust unit.

- **Excavation**

Excavation will be required for placement of new equipment support pads. There will be no excavation work for electrical and instrumentation conduits. Existing conduit and trenches will be used.

- **Utilities**

Power will be supplied from the existing stack monitor disconnect switch on the exhauster skid. The existing 20 A fuses will be replaced with a 30 A fuses, or the disconnect switch will be replaced if needed (pending field verification of model and availability of fuses). Line AS-1 and the neutral line AS-N will be run to the stack monitor, while line AS-2 will be removed. Lines HT-1 and HT-N for exhauster heat trace will remain the same. The conductor used will be 3 conductor, 10 AWG, THWN copper wire. New above ground galvanized rigid steel conduit will be installed for the short run from the existing disconnect switch to the skid containing the electronics cabinet and vacuum system.

- **Work Platform**

  A work platform approximately 6.17 ft (1.9 m) high will be installed to allow for routine access to the sampling cabinet. The platform dimensions will be approximately 4.17 ft (1.3 m) by 4.83 ft (1.5 m) and will be constructed of square tubular steel, angle iron, metal deck grating, and a ladder with handrails. Steel safety rails with a safety chain will be provided. The platform will be mounted with the front two legs on the mobile exhauster skid, the back two legs on the existing concrete pad, and a small concrete footing off the existing pad for anchoring the ladder. The platform and ladder will need to be located to provide ample clearance from an existing, 2 ft by 2 ft concrete pad adjacent to the exhauster, which supports an electrical breaker for the exhauster.

- **Modifications to Existing Equipment**

  Alarms, indications, and interlocks associated with the existing GEMS will be replaced with alarms and indications provided locally on the new instrument cabinets. The planned modification, as well as the alarms, indicators, and recorders that will be disconnected, removed, or relabeled, will be similar to those identified for Stack 296-T-18 (Table 3-4).

- **Disposal of Equipment and Material**

  Installation of the new monitoring system will require removal and disposal of the following equipment:

  - the exhaust unit enclosure assembly,
  - 5 ft (1.5 m) of 3/4 in. (20 mm) sample piping,
  - 5 ft (1.5 m) of 1/4 in. (6 mm) sample piping,
  - 10 ft (3 m) of 1 in. (25 mm) sample return piping,
  - one isokinetic sample probe and flange assembly, and
  - 10 ft (3 m) of 16-in. (41 cm) diameter exhaust stack.

  The stack sample probe, sample transport piping, and portions of the exhaust unit enclosures have the potential for low levels of radioactive contamination. Excavation for the new equipment pad will require disposal of approximately 27 ft^3 (0.8 m^3) of potentially contaminated dirt. This material will be appropriately segregated and packaged for burial.

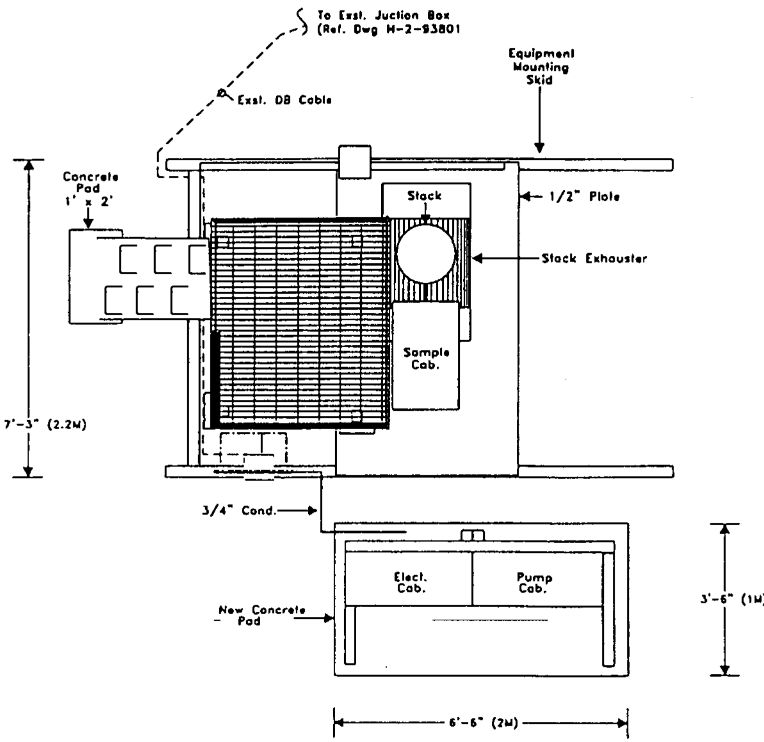


FIGURE 3.5.4-1. 241-C-105 & -106 Exhauster GEMS Upgrade - Plan View of Equipment Layout

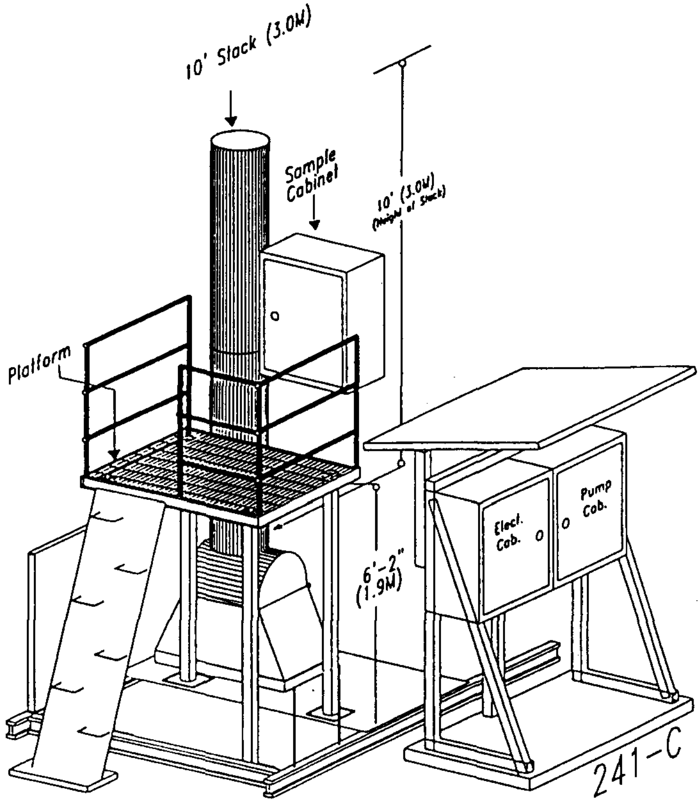


FIGURE 3.5.4-2. 241-C-105 & -106 Exhauster - Elevation View of Upgraded Facility

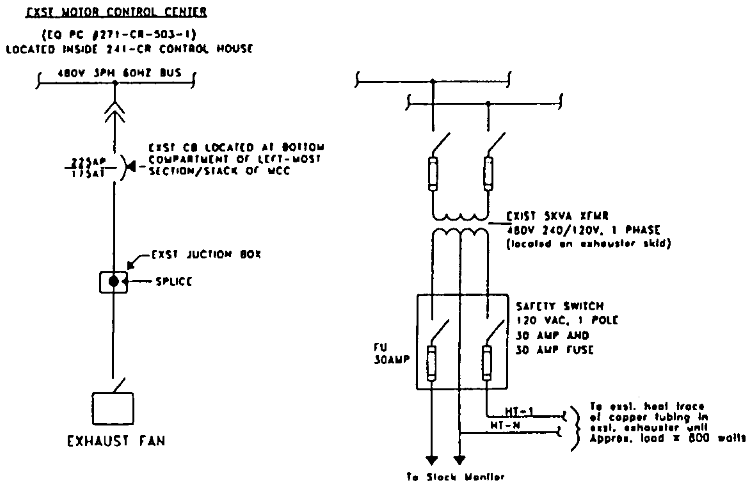


FIGURE 3.5.4-3. 241-C-105 & -106 Exhauster GEMS Upgrade - Electrical One-Line
(Example; actual installation may differ, depending on field conditions)

3.5.5 STACK 296-S-22 (244-S DCRT)

- **General**

The site is accessible for staging and placement of concrete or equipment. The facility is a radiologically controlled area, requiring protective clothing (e.g., "whites") for personnel access. Vehicles and cranes must be employed inside the facility fence, due to the location of the 244-S building, and must be regulated for use in a radiologically controlled area. Dome loading controls must be observed, as appropriate.

- **Stack**

The existing sample and velocity probe locations for Stack 296-S-22 do not satisfy the criteria of 40 CFR 60, Appendix A, Method 1A. Therefore, the existing 6-in. (15 cm) diameter, 11 ft (3.4 m) long stack and air straightening vane and pitot tube assembly (Air Monitor Fan-E) will be removed and replaced with a new stack. It is possible to only remove a portion of the stack and install a new extension, but this option would preclude conducting qualification testing in the shop, which is highly desired over field testing.

The new stack will be constructed of 6 in. (15 cm) steel pipe with a 6 x 4 in. reducer at the top of the stack. This will provide an estimated stack discharge velocity of 1700 ft/min (8.6 m/s), based on average measured stack flows of 148 ft^3/min (0.070 m^3/s) for the existing stack and system. The sample probe will be located at the 6.42 ft (2.0 m) height, and the velocity probe located at the 9.08 ft (2.8 m) height. Total stack height will be 11 ft (3.4 m). The new stack includes a spool piece section to allow installation of a flow straightening vane if necessary, a 3 in. (7.6 cm) flange connection for the sample probe at the 6.42 ft (2.0 m) height, a 1 in. (25 mm) sample return connection located 15 in. (38 cm) from the top of the stack, and 1-in. (25 mm) connections for mounting temperature and velocity probes at the 9.08 ft (2.8 m) height. Two 1-in. (25 mm) calibration ports will also be installed below the sample probe location and below the velocity probe location.

- **Concrete**

One new equipment pad approximately 7 ft (2.1 m) by 5 ft (1.5 m) and 6 in. (15 cm) thick will be located immediately to the west of the existing ventilation equipment pad. Estimated quantity of concrete required for the new pad is 1 yd^3 (0.8 m^3). Two legs and the ladder of the work platform will be anchored to the new pad and the other two legs will be anchored to the existing pad. The skid containing the electronics cabinet and vacuum system will be mounted to the existing ventilation equipment pad with ten concrete anchors [5/8 in. (16 mm) diameter bolts].

- **Excavation**

Excavation will be required for placement of the new equipment support pad. A 1-in. carbon steel pipe, apparently a drain from the stack, may need to be rerouted or removed to avoid interference with the new pad and equipment. There will be no excavation work for electrical and instrumentation conduits. Existing conduit and trenches will be used.

- **Utilities**

  Power will be supplied from Panel Board B located in the instrument building. The existing 15 A single-pole breaker in circuit 17 will be replaced with a 30 A single-pole breaker to provide power to the cabinet. Circuits 18, 19, and 20 in the Panel Board will become spares. The conductor used will be 3 conductor, 10 AWG, THWN copper wire. The wire will be run in existing conduit P-20 to the extent possible, and in new 3/4 in. (20 mm) galvanized rigid steel conduit run along the outside of the instrument building to the stack monitoring equipment skid.

- **Work Platform**

  A work platform approximately 3-ft (0.9 m) high will be installed to allow for routine access to the sampling cabinet. The platform dimensions will be approximately 4.17 ft (1.3 m) by 3.33 ft (1.0 m) and will be constructed of square tubular steel, angle iron, metal deck grating, and a ladder with handrails. Steel safety rails with a safety chain will be provided.

- **Modifications to Existing Equipment**

  Alarms, indications, and interlocks associated with the existing GEMS will be replaced with alarms and indications provided locally on the new instrument cabinets. The planned modifications, as well as the alarms, indicators, and recorders that will be disconnected, removed, or relabeled, will be similar to those identified for Stack 296-T-18 (Table 3-4).

- **Disposal of Equipment and Material**

  Installation of the new monitoring system and stack extension will require removal and disposal of the following equipment:

  - the exhaust unit enclosure assembly,
  - 12 ft (3.7 m) of 1/2-in. (12 mm) sample piping,
  - 12 ft (3.7 m) of 1-in. (25 mm) sample return piping,
  - 11 ft (3.4 m) section of 6-in. (15 cm) diameter exhaust stack,
  - an air straightening vane and pitot tube assembly (Air Monitor Fan-E), and
  - three isokinetic sample probe and flange assemblies.

  The stack section, sample probes, sample transport piping, and portions of the exhaust unit enclosures have the potential for low levels of radioactive contamination. Excavation for the new equipment pad will require disposal of approximately 27 ft^3 (0.8 m^3) of potentially contaminated dirt. This material will be appropriately segregated and packaged for burial.

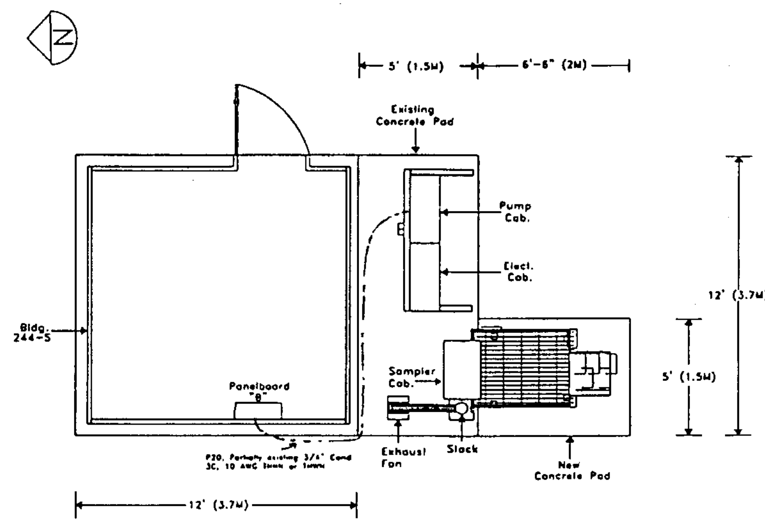


FIGURE 3.5.5-1. 244-S DCRT GEMS Upgrade - Plan View of Equipment Layout

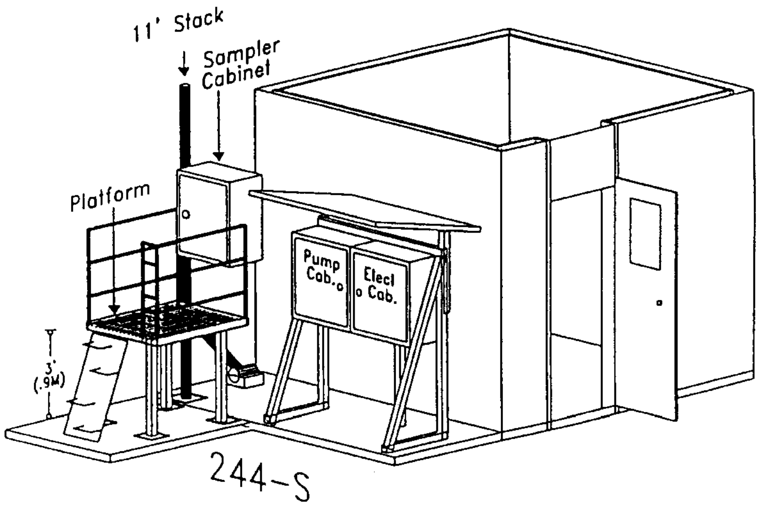
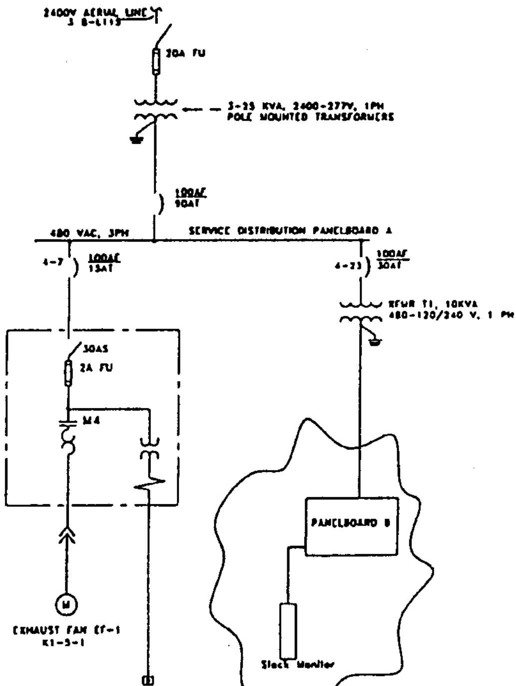


FIGURE 3.5.5-2. 244-S DCRT - Elevation View of Upgraded Facility



(For completed panel description see DWG H-2-71092)

DESCRIPTION	AMP	CKT	CKT	AMP	DESCRIPTION
Stack Monitor	30A	17	18		Spare
Spare		19	20		Spare

Panelboard B
Detail

FIGURE 3.5.5-3. 244-S DCRT GEMS Upgrade - Electrical One-Line
(Example; actual installation may differ, depending on field conditions)

3.5.6 STACK 296-T-18 (244-TX DCRT)

- **General**

The site is easily accessible for staging and placement of concrete or equipment. Vehicles and cranes must be employed inside the facility fence, due to the location of the 244-TX building, and vehicles must be regulated. Dome loading controls must be observed, as appropriate. This facility is considered "clean and stable", and requires no protective clothing (e.g., "whites") for personnel access. The "clean and stable" status does not apply during activities involving excavation or movement of soil.

- **Stack**

The existing sample and velocity probe locations for Stack 296-T-18 do not satisfy the criteria of 40 CFR 60 Appendix A Method 1A. Therefore, the existing 6-in. (15 cm) diameter, 11 ft (3.4 m) long stack and combination air straightening vane and pitot tube assembly (Air Monitor Fan-E) will be removed and replaced with a new stack. It is possible to only remove a portion of the stack and install a new extension, but this option would preclude conducting qualification testing in the shop, which is highly desirable over field testing from a cost perspective.

The new stack will be constructed of 6 in. (15 cm) steel pipe with a 6 x 4 in. reducer at the top of the stack. This will provide an estimated stack discharge velocity of 3050 ft/min (15.5 m/s), based on average measured stack flows of 266 ft^3/min (0.126 m^3/s) for the existing stack and system. The sample probe will be located at the 6.42 ft (2.0 m) height, and the velocity probe located at the 9.08 ft (2.8 m) height. Total stack height will be 11 ft (3.4 m). The new stack includes a spool piece section to allow installation of a flow straightening vane if necessary, a 3 in. (7.6 cm) flange connection for the sample probe at the 6.42 ft (2.0 m) height, a 1 in. (25 mm) sample return connection located 15 in. (38 cm) from the top of the stack, and 1-in. (25 mm) connections for mounting temperature and velocity probes at the 9.08 ft (2.8 m) height. Two 1-in. (25 mm) calibration ports will also be installed below the sample probe location and below the velocity probe location.

- **Concrete**

New equipment pads will be provided for the electronics and vacuum system skid and for the work platform that will be installed. Estimated quantity of concrete required for the new pad is 1.25 yd^3 (1.0 m^3). The cabinet pad will be approximately 6.5 ft (2.0 m) by 3.5 ft (1.1 m), 6 in. (15 cm) thick, and located 3 ft (0.9 m) off the west side of the existing instrumentation building. The skid containing the electronics cabinet and vacuum system will be mounted to this new pad with ten concrete anchors [5/8 in. (16 mm) diameter bolts]. The second pad will be approximately 7 ft (2.1 m) by 3 ft (0.9 m) and will be located immediately to the west of the existing ventilation equipment pad. Two legs and the ladder of the work platform will be anchored to the new pad and the other two legs will be anchored to the existing pad. Refer to Figures 3.5.6-1 and 3.5.6-2.

- **Excavation**

  Excavation will be required for placement of new equipment support pads. A buried 3/4-in. electrical conduit, emerging adjacent to the stack, may need to be rerouted to avoid interference with the new pad and equipment. There will be no excavation work for new electrical and instrumentation conduits. Existing conduit and trenches will be used.

- **Utilities**

  Power will be supplied from a panel board located in the motor control center in the instrument building. The existing 15 A single-pole breaker in circuit 18 will be replaced with a 30 A single-pole breaker to provide power to the cabinet. Circuits 20, 22, and 24 in the Panel Board will become spares. The conductor used will be 3 conductor, 10 AWG, THWN copper wire. The wire will be run in new 3/4 in. (20 mm) galvanized rigid steel conduit run along the outside of the instrument building to the stack monitor equipment skid.

- **Work Platform**

  A work platform approximately 3 ft (0.9 m) high, will be installed to allow for routine access to the sampling cabinet. The platform dimensions will be approximately 4.17 ft (1.3 m) by 3.33 ft (1.0 m) and will be constructed of square tubular steel, angle iron, metal deck grating, and a pitched ladder with handrails. Steel safety rails with a safety chain will be provided.

- **Modifications to Existing Equipment**

  Installation of the new air sampling and monitoring system will require modification of alarms, indications, and interlocks associated with the existing air monitoring system. Alarms, indicators, and recorders will be disconnected, removed, or relabeled. Contacts for exhaust fan shutdown interlocks will be disconnected and jumpered.

  Alarms and indications for the new air sampling and monitoring systems will be provided locally on the instrument cabinets. Auxiliary contacts will be provided for remote indications, one for high radiation, one for CAM failure, and, if desired, one for sample flow rate deviation beyond required tolerances.

  Existing alarms, indications, and interlocks associated with Stack 296-T-18 (244-TX) are identified in Table 3-4, below.

TABLE 3-4. Existing Stack 296-T-18 (244-TX DCRT) Remote Alarms, Indications, and Interlocks

DESCRIPTION	LOCATION
ALARMS	
RA-244-TX-2, High Beta Gamma Exhaust Stack	Building 242-T
RA-244-TX-2A, High Beta Gamma Exhaust Stack	244-TX Instrument building
PA-244-TX-3, Exhaust Stack Sample Pump	Building 242-T
PA-244-TX-3A, Exhaust Stack Sample Pump	244-TX Instrument building
RA-244-TX-4, Beta Gamma System Fail Exhaust Stack	Building 242-T
RA-244-TX-4A, Beta Gamma System Fail Exhaust Stack	244-TX Instrument building
RA-244-TX-7, High Alpha Exhaust Stack	Building 242-T
RA-244-TX-7A, High Alpha Exhaust Stack	244-TX Instrument building
RA-244-TX-8, Alpha System Failure Exhaust Stack	Building 242-T
RA-244-TX-8A, Alpha System Failure Exhaust Stack	244-TX Instrument building
INDICATIONS	
Pen Recorder RR-244-TX-1	244-TX Instrument building
Pen Recorder FR-244-TX-1	244-TX Instrument building
CASS INDICATIONS AND ALARMS	
CASS Index Number 1047, High Beta Gamma Exhaust Stack	
CASS Index Number 1050, Beta Gamma System Fail Exhaust Stack	
CASS Index Number 1065, High Alpha Exhaust Stack	
CASS Index Number 1066, Alpha System Failure Exhaust Stack	
INTERLOCKS	
Exhaust Fan Shutdown on High Radiation or CAM Interlock System Failure	Local; BIO and TSR Requirement

- **Disposal of Equipment and Material**

Installation of the new monitoring system and stack extension will require removal and disposal of the following equipment and material:

- the exhaust unit enclosure assembly,
- 12 ft (3.7 m) of 1/2 in. (12 mm) sample piping,
- 12 ft (3.7 m) of 1 in. (25 mm) sample return piping,
- 11 ft (3.4 m) section of 6-in. (15 cm) diameter exhaust stack, an air straightening vane and pitot tube assembly (Air Monitor Fan-E), and
- three isokinetic sample probe and flange assemblies.

Portions of the above equipment have the potential for low levels of radioactive contamination. Excavation for the new equipment pad will require disposal of approximately 27 ft^3 (0.8 m^3) of potentially contaminated dirt. This material will be appropriately segregated and packaged for burial.

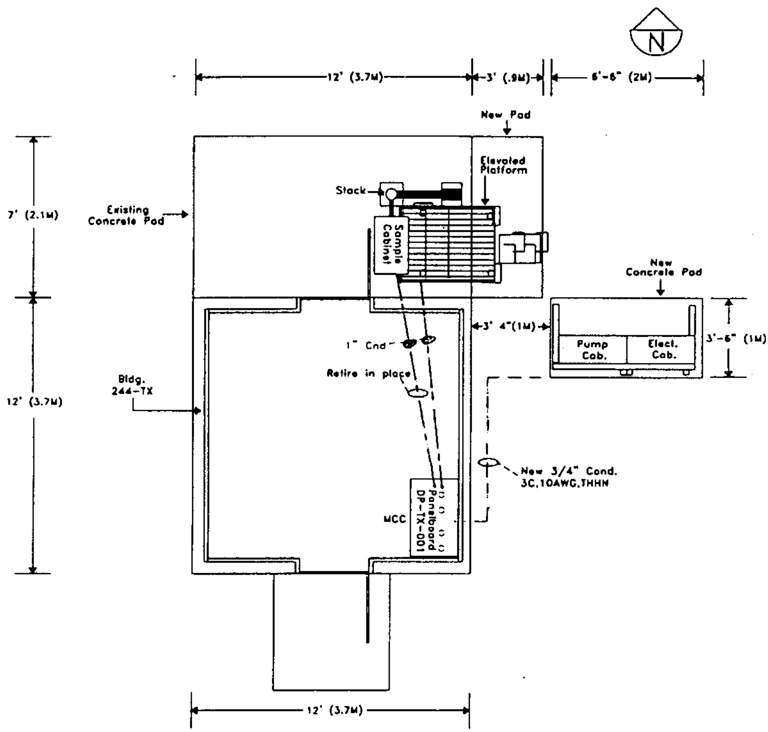


FIGURE 3.5.6-1. 244-TX DCRT GEMS Upgrade - Plan View of Equipment Layout

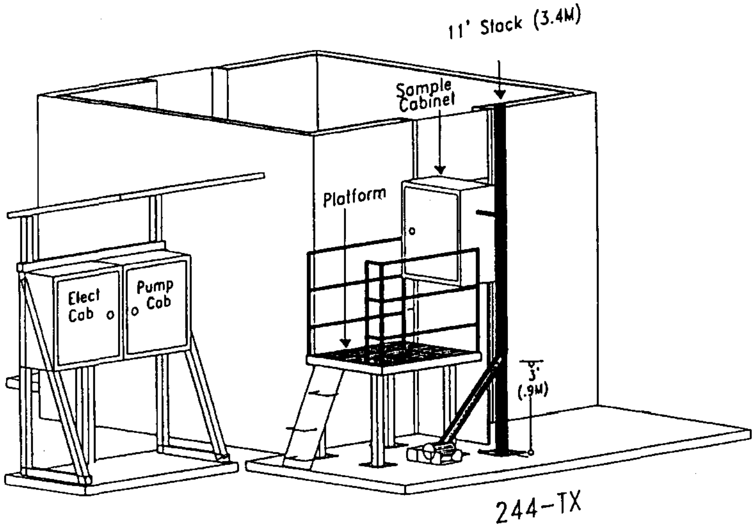
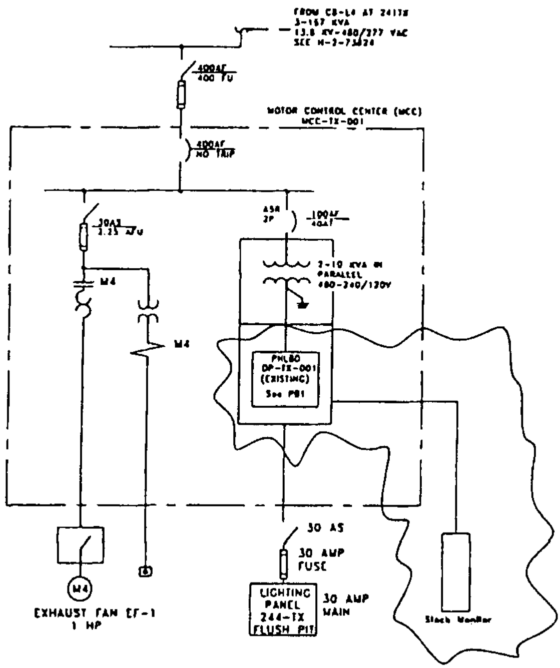


FIGURE 3.5.6-2. 244-TX DCRT - Elevation View of Upgraded Facility



(For completed description see DWG H-2-85316 (Panelboard Schedule))

CKT	AMP	DESCRIPTION
B		
18	30A	Stack Monitor
20		Spare
22		Spare
24		Spare

Panelboard DP-TX-001
Detail

Note:
Clouded section of drawing represents modification to existing equipment, remaining equipment is existing.

FIGURE 3.5.6-3. 244-TX DCRT GEMS Upgrade - Electrical One-Line
(Example; actual installation may differ, depending on field conditions)

4.0 METHODS OF PERFORMANCE

4.1 ARCHITECT-ENGINEER WORK

An Architect-Engineer (A/E) will provide engineering during the definitive design and construction, prepare design media, and may participate in vendor site qualification testing for this project. The A/E will provide assistance during installation, startup, and performance of post-installation testing, including the initial stack flow sensor verification in accordance with 40 CFR 52, Appendix E.

4.2 CONSTRUCTION MANAGEMENT CONTRACTOR

The construction management (CM) contractor will remove the existing air monitoring systems and stack sections. The CM contractor will perform site installation of the new GEMS, including installation of new stack sections, sampling probes, electrical components, cabinets, and maintenance access platforms, field installation of wiring and piping between major subassemblies, and field connection of electrical service and signal lines. Modifications to existing stacks will be performed as required by design media prepared by the A/E or project office.

4.3 PROJECT OFFICE

The project office will provide overall project management during design, procurement, and construction of the project, and will provide (or make arrangements for) safety support, permitting support, procurement services, and operations support during installation. The project office will perform all startup testing including the initial stack flow sensor verification test. Operations support will be provided by the Operations contractor, and will include such actions as isolating and tagging out existing equipment, new electrical and sampling line tie-ins, Health Physics Technician (HPT) support, and Quality Assurance support. Disposal of solid waste will also be supported by the Operations contractor.

4.4 PROCUREMENT STRATEGY

Major system components will be procured by the project office, with assistance as needed from the A/E or CM contractor. The project office will be responsible for preparing the procurement specification for the GEMS and provide procurement services for the entire project. The existing Procurement Specification WHC-S-0400 (White 1995), will be modified as necessary and used for procurement of the new systems. The GEMS vendor will be responsible for design and fabrication of all sampling and monitoring equipment including the sample probes. The new stack may be fabricated onsite by the CM contractor, may be provided by the GEMS vendor, or another vendor may be used.

For Stacks 296-A-25, 296-B-28, 296-P-16, 296-S-22, and 296-T-18 that are to be completely replaced, the A/E will prepare drawings and procurement specifications for the project office to procure the new stacks.

4.5 SHUTDOWN OF EXHAUSTERS

Each exhauster in this study can be shut down for varying lengths of time for the installation of the new stacks and GEMS. It has been assumed that all the exhausters will be able to be shut down for a sufficient time without the need for installing a temporary ventilation system. Current allowed shutdown conditions are shown below.

4.5.1 STACKS 296-A-25, 296-B-28, 296-C-05, 296-S-22, AND 296-TX-18

The ventilation systems on the DCRTs and 244-CR Vault are required to be in operation for either of two conditions per OSD-T-151-00011, *Operating Specifications for the Saltwell Receiver Vessels*: 1) Waste material surface temperature in DCRT is ≥ 140°F, and 2) Waste being transferred into the DCRT is ≥ 140°F. OSD-T-151-00015, *Unclassified Operating Specifications for Miscellaneous Facilities*, requires that the cell (annulus) pressure in 244-CR Vault be kept negative with respect to atmosphere to provide contamination control. Per the TSRs, active ventilation is also required at all times when the facilities contain waste or are involved in a transfer (see Sec. 5.6, below). These requirements and the conditions in these facilities do not routinely allow shutdown of the ventilation systems for several weeks at a time. Shutdown times will be minimized by design and planning, and will be scheduled to limit adverse impacts on saltwell pumping and other Operations activities. Limitations on down time will be especially critical in the case of 244-CR.

4.5.2 STACK 296-P-16

The 296-P-16 stack is associated with the cooling and flammable gas dilution of SSTs C-105 and C-106 in the 241-C Tank Farm. Plant operating procedures include provisions for shutting down the P-16 exhauster and ventilating the tanks passively or using an alternative exhauster. Passive ventilation (i.e., atmosphaeric breathing) is adequate to prevent an unsafe accumulation of flammable gases in the tank vapor space. However, a shut down of active ventilation results in a gradual heating of the waste, eventually exceeding established operating temperature limits for Tank C-106. This temperature rise is reversible by restoring active ventilation.

According to the cognizant engineer of the 241-C Tank Farm the exhauster could probably be down for several weeks without exceeding a temperature limit (Jones 1996). During an exhauster outage in 1992, an average temperature increase of 1°F every 3.5 days was observed. Based on this and a normal maximum temperature of 160°F with the exhauster operating, it would take over a year for the tank to reach its safety limit of 300°F. A recent engineering evaluation (Bevins 1998) concluded, based on a review of thermal analyses and other data, that active ventilation of Tank C-106 can be shut down for at least 126 days before the tank reaches the established operating limit of 205°F for tank temperature. Tank C-106 contains the majority of the heat content of the two tanks and has a separate exhauster, 296-C-006, installed for waste retrieval. Operation of the new exhauster for Tank C-106 will allow the P-16 exhauster to be shut down for a longer time period. This exhaust system is scheduled for hot testing in October 1998.

4.6 CONSTRUCTION STACK MONITORING

In some or all cases, there may be a need to operate the affected facilities during the course of the Project W-420 upgrades, i.e., following the initial site preparation and concrete pouring, and prior to final installation activities, testing, and turnover for operation. In most cases, it is expected that the initial site preparation and concrete pouring can be performed without disrupting operation of the existing exhauster and stack monitoring system.

However, in two of the facilities (244-A and 244-CR), the existing stack monitoring cabinets are located where the new concrete pads are to be poured. The cabinets are resting directly on the soil, or on some form of dunnage. In these cases, a construction stack monitoring system will be required. This may consist of relocating the existing cabinet and rerouting the sampling line, or it may require installing a special, temporary system.

Once a given facility is ready for installation of its new stack or stack modification, the exhauster will be taken out of service until the new system is installed and ready for testing and turnover for operation. This phase of the upgrade for each facility will need to be coordinated with ongoing waste transfers and other activities that may require an operable ventilation system. The duration of outages will be minimized to the extent practical, by a combination of design features and work planning.

5.0 GENERAL REQUIREMENTS

5.1 SAFEGUARDS AND SECURITY

Upgrades by Project W-420 will be performed within the security fences of the 200 East and 200 West Areas. Existing safeguards and security measures will not be impacted by this project and new measures beyond current practice will not be required.

5.2 HEALTH AND SAFETY

Removal of the existing air monitoring systems and stack extensions has the potential to expose workers to low levels of radiation and loose surface contamination. General area radiation levels and loose surface and airborne contamination levels will be determined by the HPT. Appropriate work practices, administrative measures, and controls will be implemented based on the requirements of the *Hanford Site Radiological Control Manual* (DOE 1996).

Routine construction hazards will exist during performance of this project. Removal and replacement of the stack extensions will require the use of a crane. Hazards may include dropping of a stack extension caused by crane failure, operator error, or rigging failure. In some cases, work will be performed greater than 6 ft (1.8 m) above the ground. In this case, appropriate fall prevention devices and procedures will be used.

Hazards associated with construction activities will be considered and mitigated to the extent practical. The contractor industrial safety and health program will be used to control industrial work hazards. All reasonable precautions will be taken to protect the safety and health of personnel including regular safety inspections by safety personnel and management. A Job Safety Analysis (JSA) will be prepared to identify all possible hazards and means to mitigate potential accidents. The JSA will be prepared in accordance with HNF-PRO-79, *Pre-Job Safety Planning* and HNF-SD-WM-HSP-002, *Tank Farm Health and Safety Plan*. All site and contractor health and safety programs will comply with 10 CFR 1910, *Occupational Safety and Health*, and 10 CFR 1926, *Construction Safety*.

5.3 DECONTAMINATION AND DECOMMISSIONING

The existing air monitoring systems at each of the six stacks will be removed and disposed of appropriately. The sample probes, sample transport piping, and portions of the exhaust unit enclosures have the potential for low levels of radioactive contamination. Stack emission records will be reviewed to determine the level of contamination that may be present. Portions of the system, such as the cabinets, are not likely to be contaminated and may be possibly disposed of as normal industrial waste.

The project will provide for temporary storage, segregation, packaging, transportation, and disposal of solid waste in accordance with applicable regulations and site policies and procedures, including TO-100-052. Excavated soil and equipment or materials that have potentially contacted the tank waste must be segregated and packaged as mixed waste, unless specifically approved as "low-level" waste in accordance with TO-100-052. It is expected that minimal decontamination will be required. The specific equipment and material that will be removed for disposal from each location is identified in Section 3.5.

5.4 MAINTENANCE AND OPERATION REQUIREMENTS

The sampling cabinet will be accessed on a routine basis for change out of record sampler filter papers. Filter paper change out will occur at a biweekly frequency. Typical time to change out the filter, download data, and perform routine checks will be approximately one hour.

The sample probe will be accessed on a recommended six-month schedule for inspection per PNL-10148 (PNNL 1994). However, the Conceptual Design Report (CDR) authors believe this recommendation can be relaxed once some experience is gained with the system. The non-erosive and non-corrosive nature of the stack stream will cause minimal, if any, degradation of the sampling probe.

The air monitoring and sampling systems will be designed to provide adequate space for removal and replacement of individual instruments and equipment. Components will be selected and installed to minimize the maintenance effort. System design will allow adjustments, maintenance, calibration, and testing to be performed to the greatest extent possible with standard tools and test equipment.

The vendor will identify the necessary standard tools and test equipment and provide any required special tools unique to the vendors' equipment. The vendor will also provide a description of recommended spare parts and instructions for operation, calibration, and maintenance of the new systems.

5.5 AUTOMATIC DATA PROCESSING AND TELECOMMUNICATIONS

The GEMS Procurement Specification (White 1995) calls for the seller to propose various data logging systems for use in the GEMS and to obtain buyer approval for the final choice. The buyer will then verify compatibility of the logging system with the existing host computer system. The existing host computer system uses Gensym G2™ software to communicate with external systems. The data logging system will have a standardized method of communicating with a host computer (i.e., RS-232-C, RS-485, RS-449, etc.) for the transfer, on command, of recorded data values.

The data logging system will record the following information:

- Stack volumetric flow rate, and total flow,
- Volumetric flow rate and total flow for the record sampler and CAM sample streams,
- Stack gas temperature, and
- CAM reading.

Project W-420 will not provide any telecommunications systems or devices.

5.6 SAFETY CLASSIFICATION

Safety classifications are identified for those Systems, Structures, or Components (SSCs) important to safety so that appropriate efforts will be placed on design, procurement, construction, testing, operation, maintenance, and modifications. Safety classification is established in accordance with site procedure HNF-PRO-704, *Hazard and Accident Analysis Process* through analysis of the safety function, failure modes, and consequences of failure of a SSC. HNF-SD-W420-FDC-001 states that the overall GEMS design will be general service; the stack CAM and associated interlock to shut down the fans on high stack radiation are Safety Class, along with those components whose failure would result in an immediate loss of CAM interlock function. As part of definitive design, the GEMS will be evaluated on a component level and additional portions may be evaluated as Safety Class.

The TWRS Safety Equipment List (SEL) (Jensen 1998) classifies the existing ventilation stack CAM interlock systems on all of the stacks in the Project W-420 scope as Safety Class. This classification, on a system level, is based on current TWRS authorization basis which credits these systems with mitigating a spray leak within the associated structure (BIO Sec. 5.3.2.20). The safety function of the CAM interlock is to shut down the exhaust fan upon detecting increased levels of radiation in the stack air stream, indicative of a filter breach which may be the result of wetting of the filter media by waste aerosols. The CAM interlock thus prevents a continued unfiltered release of radioactive materials to the atmosphere. The TWRS SEL also provides a safety classifications on a major component level.

Ventilation Stack CAM Interlock Systems support a TSR (LCO 3.1.4), which requires them to be operable at all times when the associated ventilation system is running. Ventilation, in turn, is credited in the current TWRS authorization basis with preventing a flammable gas deflagration (BIO Sec. 5.3.2.14). As such, active ventilation (e.g., P-16 exhauster) is required to operate at all times on Tanks 241-C-105 and -106 except for brief outages necessary for maintenance (ref. LCO 3.2.2).

Active ventilation is also required on all DCRTs including 244-CR Vault whenever they contain waste, or when they are physically connected to an active waste transfer route (ref. LCO 3.2.4). In the case of DCRTs (not including 244-CR), however, the small rate of air exchange provided by the weight factor (level indicating) dip tubes is considered sufficient to prevent the accumulation of flammable gases in the tanks; the dip tubes, not the actual ventilation systems, are credited with this safety function. In the case of 244-CR Vault, the 296-C-05 ventilation system is credited with this safety function and must operate at all times when the facility contains waste or is involved in a waste transfer.

5.7 ENVIRONMENTAL COMPLIANCE

The design, procurement, construction, and acceptance of Project W-420 will be governed by the applicable Federal, State, local, and site codes and regulations current at the time. The purpose of Project W-420 is to bring the stack monitoring into compliance with 40 CFR 61 Subpart H for identified stacks.

For National Environmental Policy Act (NEPA) purposes, installation of the GEMS is covered by the Waste Tanks Safety Program Environmental Assessment for which a Finding of No Significant Impact was signed on February 25, 1994 (Swan 1995).

5.8 PERMITS

Applicable Federal, State, and Hanford Site permits are discussed. All permits will be prepared and submitted to the appropriate regulatory agency by the Operations contractor (LMHC).

5.8.1 STATE AND FEDERAL PERMITS

The following State and Federal permits may be required for Project W-420. This information was obtained from an *Environmental Requirements Checklist* (Swan 1995) conducted by LMHC. If the checklist determined that a certain permit is not required, then it is not listed here.

- **Notice of Construction - WAC 246-247-060**

  If modification to an existing emission source could cause an increase in the rate of emissions of radionuclides, then a Notice of Construction (NOC) is required by the Washington State Department of Health (DOH). There is no potential for increased emissions associated with operation of the new GEMS. However, the Project W-420 upgrades will involve modifications to existing stacks and emission monitoring equipment, and potential waste streams during construction and demolition activities. Therefore, an approved NOC will be required which is in preparation.

- **Dangerous Waste Permit - WAC 173-303, 40 CFR 264, 265, and 270**

  Management of dangerous waste generated during project activities is required in accordance with the general provisions of WAC 173-303-200. Suspect waste materials, such as equipment or rags, should be managed as dangerous waste until confirmed by sampling and analysis. Waste designation can be based on process knowledge or from the results of sample and analysis. A review copy of the Project W-420 design package will be sent to the appropriate LMHC organization for review and possible inclusion in the Site-Wide Hanford Facility RCRA Permit.

5.8.2 HANFORD SITE PERMITS

- **Excavation Permits**

  An excavation permit for each area of work will be required prior to the start of construction. The permit will describe the area to be excavated, the allowed method(s) of excavation, and the necessary precautions to be taken. The excavation permits will be prepared in accordance with Chapter 5.17 of HNF-IP-1266, *Tank Farms Operations Administrative Controls*, and documented in the installation work packages.

- **Dome Loading Assessments**

  A dome loading assessment will be required prior to the start of construction within each of the affected facilities, in accordance with Chapter 5.16 of HNF-IP-1266. The assessment will cover both permanent and temporary (e.g., crane and vehicle) loads on or near underground tanks, and will be documented in the relevant work package(s).

5.9 UNCERTAINTIES

- Other upgrades planned under Project W-314, "Tank Farm Upgrades", for the facilities in this CDR are uncertain at this time and, therefore, future interfaces and avoidance of interferences must be closely monitored.

- The existing stack flow profiles had not been characterized at the time of this CDR. In order for detailed design to proceed, stack flow profiles should be taken to assure that sample and velocity probes will be able to be located appropriately.

- The vendor design of the GEMS has not been finalized and changes in configuration could affect the equipment layouts proposed in this CDR.

- In stacks with a diameter of 18 in. (46 cm) or more, it may be necessary to use two velocity probes perpendicular to each other in order to measure the flow velocity with the required accuracy. This is dependent upon the flow profile determined from stack characterization prior to detailed design.

- Currently, 244-TX is in a radiological buffer ("clean and stable") area and, therefore, has fewer radiological control requirements than the other locations which are in contamination areas. If this situation changes, the cost of construction at 244-TX could go up and the cost estimate would need to be adjusted.

- Exhauster shutdown time for the 296-P-16 stack needs to be confirmed.
- Currently the design of the GEMS contains no air conditioning units for the cabinets. Some reviewers have questioned whether they will be needed. If air conditioning units are added and this in turn causes the power requirements to be increased, then the current electrical power supplies may be inadequate. In addition, the addition of air conditioning units would increase the cost of an individual GEMS unit.
- Downtime is a potential issue at all of the facilities (see Sec. 4.5), especially in the case of 244-CR Vault. Construction planning and required outages must carefully integrated with interim stabilization (saltwell pumping) and waste transfers.

In all cases, appropriate contingency has been provided to cover these uncertainties.

6.0 REFERENCES

6.1 DOE AND SITE DOCUMENTS OR PROCEDURES

Bevins, R. R., 1998, *Project W-320 Safety Class and Safety Significant Equipment Engineering Evaluation*, HNF-2050.

Crummel, G. M., 1994, *Tank Farm Stack Sampling System Configuration and Efficiency Study*, WHC-SD-WM-ES-291, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Crummel, G. M., 1997, *Tank Farm Stack NESHAP Designation Determination*, HNF-SD-WM-EMP-031, Rev. 3/3A, Lockheed Martin Hanford Corporation, Richland, Washington.

DOE, 1989, *General Design Criteria*, DOE 6430.1A, U.S. Department of Energy, Washington, D.C.

DOE, 1996, *Hanford Site Radiological Control Manual*, DOE/RL-96-109, U.S. Department of Energy, Richland, Washington

HNF-IP-0842, Vol. IV, Sec. 3.11, *Replacement Item Evaluation and Commercial Grade Item Dedication and Upgrade.*

HNF-IP-1266, *Tank Farms Operations Administrative Controls.*

HNF-PRO-79, *Pre-Job Safety Planning.*

HNF-PRO-97, *Engineering Design and Evaluation.*

HNF-PRO-704, *Hazard and Accident Analysis Process.*

HNF-SD-WM-BIO-001, Rev. 0-I, *Tank Waste Remediation System Basis for Interim Operation.*

HNF-SD-WM-HSP-002, Rev. 3, *Tank Farm Health and Safety Plan.*

HNF-SD-WM-TSR-006, Rev. 0-L, *Tank Waste Remediation System Technical Safety Requirements.*

Jensen, C. E., 1998, *TWRS Facility Safety Equipment List*, HNF-SD-WM-SEL-040, Lockheed Martin Hanford Corp., Richland, Washington.

Jones, J.M., 1996, *104/105/106-C and 244-CR Exhauster Shutdown Times*, Record of Conversation, 96RL0308, ARES Corporation, Richland, Washington.

OSD-T-151-00011, *Operating Specifications for the Saltwell Receiver Vessels*, Lockheed Martin Hanford Corporation, Richland, Washington.

OSD-T-151-00015, *Unclassified Operating Specifications for Miscellaneous Facilities*, Lockheed Martin Hanford Corporation, Richland, Washington.

PNNL, 1994, *Functional Requirements Document for Measuring Emissions of Airborne Radioactive Materials*, PNL-10148, Pacific Northwest National Laboratories, Richland, Washington.

Swan, R.J., 1995, *Environmental Requirements Checklist for the Gaseous Effluent Monitoring Systems*, Internal Memo 01810-95-RJS-042, Westinghouse Hanford Company, Richland, Washington.

TO-100-052, *Perform Waste Generation, Segregation, and Accumulation*, Lockheed Martin Hanford Corporation, Richland, Washington.

Tuck, J. A., 1998, *Functional Design Criteria for Project W-420, Stack Monitoring Upgrade*, HNF-SD-W420-FDC-001, Rev. 1, Numatec Hanford Corporation, Richland, Washington.

White, W.F., 1995, *Procurement Specification for the Generic Effluent Monitoring System*, WHC-S-0400, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

6.2 INDUSTRY CONSENSUS CODES, STANDARDS, OR RECOMMENDED PRACTICES

ANSI N13.1-1969 (reaffirmed 1983; new revision to be released in 1998/1999), *Guide to Sampling Radioactive Materials in Nuclear Facilities*, American National Standards Institute.

ANSI N42.18-1974, *Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents*, American National Standards Institute.

ASHRAE, 1993, *ASHRAE Fundamentals Handbook*, American Society of Heating, Refrigeration, and Air-Conditioning Engineers.

ASME AG-1b-1997, *Code on Nuclear Air and Gas Treatment*, American Society of Mechanical Engineers.

ASME B31.1-1992, *Power Piping*, American Society of Mechanical Engineers.

ASME NQA-1-1994, *Quality Assurance Program Requirements for Nuclear Facilities*, American Society of Mechanical Engineers.

ASTM A269, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*, American Society for Testing and Materials.

Factory Mutual Engineering and Research (FM).

NFPA 70-1996, *National Electrical Code (NEC)*, National Fire Protection Association.

NFPA 77-1993, *Recommended Practice on Static Electricity*, National Fire Protection Association.

Nichols, M. D., 1994, *National Emission Standards for Hazardous Air Pollutants - Alternative Method Using Shrouded Probe Accepted by the EPA*, Letter from EPA to R. F. Pelletier, Dept. of Energy, 21 November 1994.

Underwriters Laboratories, Inc. (UL)

6.3 CODE OF FEDERAL REGULATIONS (CFR)

10 CFR 1910, *Occupational Health and Safety*

10 CFR 1926, *Construction Safety*

40 CFR 52 Appendix E, *Performance Specifications and Specification Test Procedures for Monitoring Systems for Effluent Stream Gas Volumetric Flow Rate*

40 CFR 60 Appendix A, *Test Methods*

40 CFR 61 Subpart H, *National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities*

6.4 WASHINGTON ADMINISTRATIVE CODE

WAC 246-273, *Radiation Protection - Air Emissions*

6.5 FACILITY DRAWINGS

NOTE: The following drawings are listed for reference purposes only, and are not necessarily all affected by the Project W-420 upgrades.

H-2-35769, *Heating and Ventilating Details and Electrical Diagrams - Mobile Exhaust Unit* (296-P-16)

H-2-36035, *Filter Box for Exhauster Units* (296-P-16)

H-2-38206, *Structural/Architectural Miscellaneous Details and Instrument Enclosure 244A Lift Station* (296-A-25)

H-2-38208, *Electrical Site Plan and Details* (296-A-25)

H-2-38209, *Electrical One Line and Control Diagrams* (296-A-25)

H-2-38215, *Ventilation Plan and Details* (296-A-25)

H-2-38217, *Instrumentation Engineering Flow Diagram* (296-A-25)

H-2-41277, *Structural Concrete and Steel, Stack and Foundation Plans and Sections* (296-C-05)

H-2-41745, *Heat and Vent Plan - Ductwork to Filter and Stack* (296-C-05)

H-2-41746, *Heat and Vent Sections - Ductwork to Filter and Stack* (296-C-05)

H-2-41781, *Heating and Ventilation Plan and Sections - Stack Exhaust Fans and Platform* (296-C-05)

H-2-41788, *Heating and Ventilation Plans - Process Tank Vault* (296-C-05)

H-2-41789, *Heating and Ventilation Sections - Process Tank Vault* (296-C-05)

H-2-41928, *Instrument-Electrical Interconnection Diagram - Panel Boards to Equipment* (296-C-05)

H-2-41930, *Instrument-Electrical Interconnection Diagram - Panel Boards to Equipment* (296-C-05)

H-2-46785, *Instrumentation Exhaust Unit Enclosure Assembly* (296-S-22)

H-2-46786, *Electrical/Instrumentation Interconnection Diagram/EFD* (296-S-22)

H-2-71047, *Ventilation Air Flow and Control Diagram and Schedules* (296-S-22)

H-2-71048, *Ventilation Plan and Details* (296-S-22)

H-2-71050, *Piping Engineering Flow Diagram* (296-S-22)

H-2-71090, *Electrical Plans and Elevations* (296-S-22)

H-2-71092, *Electrical Diagrams and Details* (296-S-22)

H-2-71093, *Electrical Wire Run List and Conduit Schedules* (296-S-22)

H-2-73794, *Architectural/Structural Instrument Building Plans, Sections, and Details* (296-B-28)

H-2-73796, *Engineering Flow Diagram, System No. 1* (296-T-18)

H-2-73797, *Engineering Flow Diagram, System No. 2* (296-B-28)

H-2-73809, *Instrumentation Exhaust Unit Enclosure Assembly - System No. 2 & 3* (296-B-28)

H-2-73810, *Instrumentation Annulus Unit Enclosure Assembly* (296-8-28 & 296-T-18)

H-2-73812, *Instrumentation Exhaust Unit Enclosure Assembly - System No. 1* (296-T-18)

H-2-73815, *Instrumentation Annunciator Arrangement and Wiring* (296-T-18)

H-2-73818, *Electrical One Line and Elementary Diagram - System No. 1* (296-T-18)

H-2-73819, *Electrical One Line and Elementary Diagram - System No. 2* (296-B-28)

H-2-73834, *Electrical-Instrument Wire Run List 244-TX System No. 1* (296-T-18)

H-2-73835, *Electrical/Instrumentation Wire Run List System No. 2* (296-B-28)

H-2-73838, *HVAC Air Flow and Control Diagram and Schedule* (296-B-28 & 296-T-18)

H-2-73839, *HVAC Plans, Sections, and Details* (296-B-28 & 296-T-18)

H-2-73948, *Electrical One-Line Diagrams, Tank Farm* (296-P-16)

H-2-73957, *Electrical Distribution Plan 241-C Tank Farm* (296-P-16)

H-2-91116, *Electrical One-Line & Elementary Diagrams* (296-P-16)

H-2-92517, *Stack Monitor Concrete Pad* (296-C-05)

H-2-92519, *Stack Monitor Installation 296-C-5* (296-C-05)

H-2-92523, *296-C-5 Stack Monitor Probe Assembly* (296-C-05)

H-2-93797, *Drawing List/HVAC Equipment Plan and Sections* (296-P-16)

H-2-93801, *Electrical Plan, Diagrams, and Details* (296-P-16)

H-2-95267, *296-P-16 Stack Monitor Installation, Flow Diagram, and Wiring Diagram* (296-P-16)

H-2-95268, *296-P-16 Stack Extension and Cover Assemblies* (296-P-16)

H-2-95269, *Probe Assembly Stack Sampler/Monitor* (296-P-16)

H-2-95298, *296-A-25 Stack Monitor Installation* (296-A-25)

H-2-95299, *296-A-25 Stack Monitor Probe Assembly* (296-A-25)

H-14-030011, *Electrical EDS One Line Diagram & Panelboard Schedule* (296-B-28)

APPENDIX A: COST ESTIMATE SUMMARY

FLUOR DANIEL NORTHWEST, INC.
NUMATEC HANFORD CORPORATION
JOB NO. W420
FILE NO. W420BAB3

** IEST - INTERACTIVE ESTIMATING **
STACK MONITORING SYSTEM UPGRADES
CONCEPTUAL ESTIMATE REV. 1
PHMCR01 - PROJECT COST SUMMARY

DATE 10/27/98 09:30:53
BY DKH/AJR/JMS

COST CODE	DESCRIPTION	ESCALATED TOTAL COST	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
020	TITLE II	580,000	10	60,000	640,000
030	TITLE III	220,000	10	20,000	240,000
060	PROJECT MANAGEMENT	350,000	15	50,000	400,000
550	OTHER STRUCTURES	70,000	30	20,000	90,000
700	SPECIAL EQUIP/PROCESS SYSTEMS	780,000	27	210,000	990,000
788	HPT	90,000	15	10,000	100,000
810	DEMOLITION	240,000	27	70,000	310,000
	(ADJUSTED/ROUNDED)	(30,000)		(40,000)	(70,000)
TOTAL ESTIMATED COST (TEC)		2,300,000	17	400,000	2,700,000
900	OTHER PROJECT COST	1,090,000	8	90,000	1,200,000
	(ADJUSTED/ROUNDED)	10,000		10,000	20,000
TOTAL OTHER PROJECT COST (OPC)		1,100,000	9	100,000	1,200,000
TOTAL PROJECT COST (TPC)		3,400,000	15	500,000	3,900,000

TYPE OF ESTIMATE CONCEPTUAL REV. 1 OCTOBER 27, 1998	REMARKS:
FDNW LEAD ESTIMATOR [signature] ESTIMATING MANAGER [signature]	
PROJECT MANAGER [signature]	
CLIENT	

(ROUNDED/ADJUSTED TO THE NEAREST " 1,000 / 10,000 " - PERCENTAGES NOT RECALCULATED TO REFLECT ROUNDING)

FLUOR DANIEL NORTHWEST, INC.
NUMATEC HANFORD CORPORATION
JOB NO. W420
FILE NO. W420BAB3

** IEST - INTERACTIVE ESTIMATING **
STACK MONITORING SYSTEM UPGRADES
CONCEPTUAL ESTIMATE, REV. 1
PHMCR02 - WORK BREAKDOWN STRUCTURE (WBS) SUMMARY

DATE 10/28/98 07:09:34
BY DKH/AJR/JMS

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	SUB TOTAL	SITE ALLOCAT'N	TOTAL DOLLARS
112110	STACK INSTRUMENTATION ENG.	12934	0.70	90	13024	10	1239	14264	3102	17367
112120	STACK INSTRUMENTATION DESIGN	21164	0.70	148	21312	10	2028	23341	5076	28417
112140	STACK ELECTRICAL ENGINEERING	70400	0.70	492	70892	10	6748	77641	16887	94528
112150	STACK ELECTRICAL DESIGN	29277	0.70	204	29481	10	2806	32288	7022	39311
112160	STACK CIVIL/STRUCTUAL ENG.	107243	0.70	750	107993	10	10281	118274	25724	143999
112170	STACK CIVIL/STRUCTUAL DESIGN	45392	0.70	317	45709	10	4351	50061	10888	60949
112180	STACK ENVIRONMENTAL ENG	28063	0.70	196	28259	10	2690	30949	6731	37681
SUBTOTAL 1121	STACK DRWNGS. CALCS. & SPEC	314473	0.70	2201	316674	10	30147	346821	75433	422255
112800	DESIGN REVIEW & INTEGRATION	158650	0.70	1110	159760	10	15209	174969	38055	213025
SUBTOTAL 112	DEFINITIVE DESIGN FOR STACK	473123	0.70	3311	476434	10	45356	521791	113489	635281
113000	FIELD ENG. AND INSPECTION	174919	1.05	1836	176755	10	16827	193582	42422	236005
SUBTOTAL 113	FIELD ENG. AND INSPECTION	174919	1.05	1836	176755	10	16827	193582	42422	236005
SUBTOTAL 11	DESIGN ENGINEERING	648042	0.79	5148	653190	10	62183	715374	155912	871286
121000	PROCUREMENT OF STACK MONITORS	454896	0.50	2274	457170	25	112098	569268	0	569268
SUBTOTAL 121	NHC - PROCUREMENT OF STACK	454896	0.50	2274	457170	25	112098	569268	0	569268
122100	296-A-25 -WORK PLATFORMS	3842	1.05	40	3882	30	1146	5028	1081	6109
122200	296-B-28 -WORK PLATFORMS	4276	1.05	44	4320	30	1275	5596	1203	6799
122300	296-S-22 -WORK PLATFORMS	4276	1.05	44	4320	30	1275	5596	1203	6799
122400	296-T-18 -WORK PLATFORMS	4276	1.05	44	4320	30	1275	5596	1203	6799
122500	296-C-05 -WORK PLATFORMS	7421	1.05	77	7498	30	2213	9712	2088	11800
122600	296-P-16 -WORK PLATFORMS	5219	1.05	54	5273	30	1556	6830	1468	8299
SUBTOTAL 122	FDNW PROCUREMENT OF WORK PL	29310	1.05	307	29617	30	8743	38360	8247	46608
123100	296-A-25 -STACK SECTIONS	3082	1.05	32	3114	30	919	4033	867	4900
123200	296-B-28 -STACK SECTIONS	3082	1.05	32	3114	30	919	4033	867	4900
123300	296-S-22 -STACK SECTIONS	3082	1.05	32	3114	30	919	4033	867	4900

FLUOR DANIEL NORTHWEST, INC.
NUMATEC HANFORD CORPORATION
JOB NO. W420
FILE NO. W420BAB3

** IEST - INTERACTIVE ESTIMATING **
STACK MONITORING SYSTEM UPGRADES
CONCEPTUAL ESTIMATE,REV. 1
PHMCR02 - WORK BREAKDOWN STRUCTURE (WBS) SUMMARY

DATE 10/28/98 07:09:34
BY OKH/AJR/JMS

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	SUB TOTAL	SITE ALLOCAT'N	TOTAL DOLLARS
123400	296-T-18 -STACK SECTIONS	3082	1.05	32	3114	30	919	4033	867	4900
123600	296-P-16 -STACK SECTIONS	3082	1.05	32	3114	30	919	4033	867	4900
SUBTOTAL 123	FDNW PROCUREMENT OF STACK S	15410	1.05	161	15571	30	4596	20168	4336	24504
SUBTOTAL 12	PROCUREMENT	499616	0.55	2744	502360	25	125438	627798	12583	640382
131100	296-A-25 SITEWORK/DEMOLITION	10547	2.30	242	10790	30	3237	14027	4888	18915
131200	296-A-25 SUPPORT PAD	8335	2.30	191	8527	30	2558	11085	3811	14896
131300	296-A-25 STACK MODIFICATIONS	2546	2.30	58	2605	30	781	3387	1180	4567
131400	296-A-25 EQUIPMENT/PLATFORM	17186	2.30	395	17581	30	5274	22856	6969	29825
131500	296-A-25 ELECTRICAL	7579	2.30	174	7753	30	2326	10079	3503	13583
131600	296-A-25 WASTE DISPOSAL	12761	2.30	293	13055	30	3853	16909	4100	21009
131700	296-A-25 ATP	5457	2.30	125	5582	30	1674	7257	2528	9786
SUBTOTAL 131	296-A-25 STACK	64414	2.30	1481	65895	30	19706	85601	26982	112584
132100	296-B-28 SITEWORK/DEMOLITION	6014	2.30	138	6152	30	1845	7998	2786	10785
132200	296-B-28 SUPPORT PAD	15800	2.30	363	16164	30	4849	21013	7278	28291
132300	296-B-28 STACK MODIFICATIONS	2546	2.30	58	2605	30	781	3387	1180	4567
132400	296-B-28 EQUIPMENT/PLATFORM	16531	2.30	380	16911	30	5073	21984	6662	28647
132500	296-B-28 ELECTRICAL	7576	2.30	174	7750	30	2325	10076	3503	13579
132600	296-B-28 WASTE DISPOSAL	11303	2.30	259	11563	30	3469	15032	3344	18377
132700	296-B-28 ATP	5457	2.30	125	5582	30	1674	7257	2528	9786
SUBTOTAL 132	296-B-28 STACK	65231	2.30	1500	66731	30	20019	86750	27284	114035
133100	296-S-22 SITEWORK/DEMOLITION	7049	2.30	162	7211	30	2163	9374	3265	12640
133200	296-S-22 SUPPORT PAD	6594	2.30	151	6745	30	2023	8769	3021	11790
133300	296-S-22 STACK MODIFICATIONS	2546	2.30	58	2605	30	781	3387	1180	4567
133400	296-S-22 EQUIPMENT/PLATFORM	16531	2.30	380	16911	30	5073	21984	6662	28647
133500	296-S-22 ELECTRICAL	7576	2.30	174	7750	30	2325	10076	3503	13579
133600	296-S-22 WASTE DISPOSAL	11633	2.30	267	11900	30	3570	15471	3513	18985
133700	296-S-22 ATP	5457	2.30	125	5582	30	1674	7257	2528	9786
SUBTOTAL 133	296-S-22 STACK	57388	2.30	1319	58708	30	17612	76321	23675	99996
134100	296-T-18 SITEWORK/DEMOLITION	7718	2.30	177	7896	30	2368	10265	3576	13841

FLUOR DANIEL NORTHWEST, INC.
NUMATEC HANFORD CORPORATION
JOB NO. W420
FILE NO. W420BAB3

** IEST - INTERACTIVE ESTIMATING **
STACK MONITORING SYSTEM UPGRADES
CONCEPTUAL ESTIMATE, REV. 1
PHMCR02 - WORK BREAKDOWN STRUCTURE (WBS) SUMMARY

DATE 10/28/98 07:09:35
BY DKH/AJR/JMS

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	SUB TOTAL	SITE ALLOCAT'N	TOTAL DOLLARS
134200	296-T-18 SUPPORT PAD	9383	2.30	215	9599	30	2879	12479	4295	16774
134300	296-T-18 STACK MODIFICATIONS	2546	2.30	58	2605	30	781	3387	1180	4567
134400	296-T-18 EQUIPMENT/PLATFORM	16531	2.30	380	16911	30	5073	21984	6662	28647
134500	296-T-18 ELECTRICAL	7575	2.30	174	7749	30	2324	10074	3502	13577
134600	296-T-18 WASTE DISPOSAL	11633	2.30	267	11900	30	3570	15471	3513	18985
134700	296-T-18 ATP	5457	2.30	125	5582	30	1674	7257	2528	9786
SUBTOTAL 134	296-T-18 STACK	60846	2.30	1399	62246	30	18673	80919	25259	106179
135100	296-C-05 SITEWORK/DEMOLITION	6559	2.30	150	6710	30	2013	8723	3040	11764
135200	296-C-05 SUPPORT PAD	9787	2.30	225	10012	30	3003	13016	4483	17500
135300	296-C-05 STACK MODIFICATIONS	5525	2.30	127	5652	30	1695	7348	2410	9758
135400	296-C-05 EQUIPMENT/PLATFORM	20408	2.30	469	20877	30	6263	27140	8454	35594
135500	296-C-05 ELECTRICAL	7632	2.30	175	7807	30	2342	10150	3522	13672
135600	296-C-05 WASTE DISPOSAL	11743	2.30	270	12013	30	3604	15617	4031	19648
135700	296-C-05 ATP	5457	2.30	125	5582	30	1674	7257	2528	9786
SUBTOTAL 135	296-C-05 STACK	67113	2.30	1543	68656	30	20597	89254	28470	117724
136100	296-P-16 SITEWORK/DEMOLITION	10435	2.30	240	10675	30	3202	13877	4346	18224
136200	296-P-16 SUPPORT PAD	8286	2.30	190	8476	30	2542	11019	3790	14809
136300	296-P-16 STACK MODIFICATIONS	7603	2.30	174	7778	30	2333	10112	3034	13147
136400	296-P-16 EQUIPMENT/PLATFORM	17214	2.30	395	17610	30	5283	22893	6979	29873
136500	296-P-16 ELECTRICAL	7617	2.30	175	7792	30	2337	10130	3517	13647
136600	296-P-16 WASTE DISPOSAL	11450	2.30	263	11713	30	3514	15227	3420	18648
136700	296-P-16 ATP	5457	2.30	125	5582	30	1674	7257	2528	9786
SUBTOTAL 136	296-9-16 STACK	68064	2.30	1565	69630	30	20889	90519	27617	118137
138000	LHMC FIELD SUPPORT	239610	2.30	5511	245121	15	35863	280984	0	280984
SUBTOTAL 138	LHMC SUPPORT PIC. HPT. OPPS	239610	2.30	5511	245121	15	35863	280984	0	280984
139000	WASTE DISPOSAL	68512	2.30	1575	70087	20	14017	84105	0	84105
SUBTOTAL 139	WASTE DISPOSAL	68512	2.30	1575	70087	20	14017	84105	0	84105
SUBTOTAL 13	CONSTRUCTION - ONSITE FORCE	691181	2.30	15897	707078	24	167379	874457	159289	1033747

FLUOR DANIEL NORTHWEST, INC.
NUMATEC HANFORD CORPORATION
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** IEST - INTERACTIVE ESTIMATING **
STACK MONITORING SYSTEM UPGRADES
CONCEPTUAL ESTIMATE,REV. 1
PHMCR02 - WORK BREAKDOWN STRUCTURE (WBS) SUMMARY

DATE 10/28/98 07:09:35
BY DKH/AJR/JMS

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	SUB TOTAL	SITE ALLOCAT'N	TOTAL DOLLARS
141000	PROJECT MGMT & INTGRATION	171012	1.50	2565	173577	15	26036	199613	0	199613
SUBTOTAL 141	PROJECT MGMT & INTGRATION	171012	1.50	2565	173577	15	26036	199613	0	199613
142000	BUSINESS MANAGEMENT	49433	1.50	741	50174	15	7526	57700	0	57700
SUBTOTAL 142	BUSINESS MANAGEMENT	49433	1.50	741	50174	15	7526	57700	0	57700
143000	CONFIGURATION MANAGEMENT	23766	1.50	356	24122	15	3618	27740	0	27740
SUBTOTAL 143	CONFIGURATION MANAGEMENT	23766	1.50	356	24122	15	3618	27740	0	27740
144000	ENVIRONMENTAL SAFETY & QA	74288	1.50	1114	75402	15	11310	86712	0	86712
SUBTOTAL 144	ENVIRONMENTAL SAFETY & QA	74288	1.50	1114	75402	15	11310	86712	0	86712
145000	TEST & EVAL. MANAGEMENT	30204	1.50	453	30657	15	4598	35255	0	35255
SUBTOTAL 145	TEST & EVAL. MANAGEMENT	30204	1.50	453	30657	15	4598	35255	0	35255
SUBTOTAL 14	PROJECT MGMT. INTEGRATION	348703	1.50	5230	353933	15	53090	407023	0	407023
151000	ENGINEERING	169417	1.50	2541	171958	10	17195	189154	0	189154
SUBTOTAL 151	ENGINEERING	169417	1.50	2541	171958	10	17195	189154	0	189154
152000	ENVIRONMENTAL/PERMITS	22114	1.50	331	22445	10	2244	24690	0	24690
SUBTOTAL 152	ENVIRONMENTAL/PERMITS	22114	1.50	331	22445	10	2244	24690	0	24690
153000	ATP/OTP SUPPORT & STARTUP	315130	1.50	4726	319856	10	31985	351842	0	351842
SUBTOTAL 153	ATP/OTP SUPPORT & STARTUP	315130	1.50	4726	319856	10	31985	351842	0	351842

FLUOR DANIEL NORTHWEST, INC.
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CONCEPTUAL ESTIMATE, REV. 1
PHMCR02 - WORK BREAKDOWN STRUCTURE (WBS) SUMMARY

DATE 10/28/98 07:09:35
BY DKH/AJR/JMS

WBS DESCRIPTION	ESTIMATE SUBTOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	SUB TOTAL	SITE ALLOCAT'N	TOTAL DOLLARS
154000 TRAINING	70115	1.50	1051	71166	10	7116	78283	0	78283
SUBTOTAL 154 TRAINING	70115	1.50	1051	71166	10	7116	78283	0	78283
155000 READINESS REVIEW	31714	1.50	475	32189	10	3218	35408	0	35408
SUBTOTAL 155 READINESS REVIEW	31714	1.50	475	32189	10	3218	35408	0	35408
156000 SAFETY ANALYSIS	17598	1.50	263	17861	10	1786	19648	0	19648
SUBTOTAL 156 SAFETY ANALYSIS	17598	1.50	263	17861	10	1786	19648	0	19648
157000 PRIOR PROJECT COSTS (COST TO DATE)	142965	0.00	0	142965	0	0	142965	0	142965
SUBTOTAL 157 PRIOR PROJECT COSTS (CTD)	142965	0.00	0	142965	0	0	142965	0	142965
158000 PROJECT EXECUTION FY/98	153058	0.00	0	153058	0	0	153058	0	153058
SUBTOTAL 158 PROJECT EXECUTION FY/98	153058	0.00	0	153058	0	0	153058	0	153058
SUBTOTAL 15 OTHER PROJECT COST NHC/LMHC	922111	1.02	9391	931502	7	63547	995050	0	995050
PROJECT TOTAL	3,109,653	1.24	38,411	3,148,064	15	471,639	3,619,704	327,786	3,947,490

FLUOR DANIEL NORTHWEST, INC.
NUMATEC HANFORD CORPORATION
JOB NO. W420
FILE NO. W420BAB3

** IEST - INTERACTIVE ESTIMATING **
STACK MONITORING SYSTEM UPGRADES
CONCEPTUAL ESTIMATE REV. 1
PHMCR03 - ESTIMATE BASIS SHEET

DATE 10/26/98 09:47:26
BY DKH/AJR/JMS

1. ESTIMATE PURPOSE

CONCEPTUAL COST ESTIMATE: THIS ESTIMATE WILL BE USED TO ESTADLISH THE PROJECT BUDGET(BASELINE).

2. ESTIMATE TECHNICAL BASIS

A. THIS ESTIMATE HAS BEEN PREPARED FOR THE STACK MONITORING SYS UPGRADE W-420 PROJECT AS REQUESTED BY FDNW PROJECT MANAGER. THE WORK BREAKDOWN STRUCTURE OF THE ESTIMATE WAS PROVIDED BY FDNW PROJECT MANAGEMENT AND INCLUDES THOSE ELEMENTS OF PREVIOUS PROJECT ESTIMATES.

B. A DESCRIPTION OF THE TECHNICAL SCOPE OF WORK MAY BE FOUND IN THE FOLLOWING REFERENCE DOCUMENTS:

1. REQUEST FOR ESTIMATE DATED 08/24/1998.

2. A COPY OF THE SCOPE OF WORK (SOW) - PROJECT W-420. CONCEPTUAL DESIGN REPORT STACK MONITORING SYSTEMS UPGRADE/R4D16. HNF-SD-W420-CDR-001, REV.0-A (DRAFT).

3. FACILITY STACK DRAWINGS #s:

(296-A-25)	H-2-38206 H-2-38208 H-2-38209 H-2-38215 H-2-38217 H-2-95298 H-2-95299
(296-B-28)	H-2-73794 H-2-73797 H-2-73809 H-2-73810 H-2-73819 H-2-73835 H-2-73838 H-2-73839 H-14-030011
(296-S-22)	H-2-46785 H-2-46786 H-2-71047 H-2-71048 H-2-71050 H-2-71090 H-2-71092 H-2-71093
(296-T-18)	H-2-73796 H-2-73810 H-2-73812 H-2-73815 H-2-73818 H-2-73834
(296-C-05)	H-2-41277 H-2-41745 H-2-41746 H-2-41781 H-2-41788 H-2-41789 H-2-41928 H-2-41930 H-2-92517 H-2-92519 H-2-92523
(296-P-16)	H-2-35769 H-2-36035 H-2-72195 H-2-73948 H-2-73957 H-2-91116 H-2-93797 H-2-93801 H-2-95267 H-2-95268 H-2-95269

4. FUNCTIONAL DESIGN CRITERIA DEFINITIONS FOR PROJECT W-420: HNF-SD-W420-FDC-001 AS REFERENCED IN CDR.

C. THE FOLLOWING CONSTRAINTS AND/OR SPECIAL CONDITIONS EXIST:
1. MODIFY EXISTING CDR ESTIMATE USING CURRENT FDNW ESTIMATING SOFTWARE.
2. UPDATE WAGES AND ESCALATION RATES TO CURRENT PUBLISHED DATA.
3. UPDATE ESTIMATE TO REFLECT APPLICATION OF CURRENT CONSTRUCTION OVERHEADS AND INDIRECT ALLOWANCES.
4. UPDATE ESTIMATE TO REFLECT APPLICATION OF CURRENT FDH SITE ALLOCATION PERCENTAGES.

D. THIS ESTIMATE UTILIZES AN ESTIMATE WORK BREAKDOWN STRUCTURE WHICH INTERFACES WITH THE PROJECT WORK BREAKDOWN STRUCTURE AS PROVIDED BY THE W-420 PROJECT CONCEPTUAL DESIGN REPORT.

E. THE FOLLOWING CONSTRAINTS AND/OR SPECIAL CONDITIONS EXIST: AS DESCRIBED FURTHER BELOW THE ESTIMATED COSTS OF WORK IN THE HANFORD TANK FARMS IS ADJUSTED TO ACCOUNT FOR SPECIAL TRAINING, WORK SITE ACCESS, WORK CONTROLS AND PROCEDURES REQUIRED FOR CONSTRUCTING FACILITIES IN THE AP TANK FARM. THE PROCEDURES ARE DEFINED IN HNF-IP-0842, "TWRS ADMINISTRATION MANUAL".

2. ESTIMATE TECHNICAL BASIS (CONTINUED)

F. THIS ESTIMATE ALSO UTILIZES A STANDARD FDNW DEFINED CHART OF ACCOUNTS, AS SUBSTITUTED FOR THE INDUSTRY STANDARD CONSTRUCTION SPECIFICATION INSTITUTE (CSI) SYSTEM. THE CHART OF ACCOUNTS IS USED TO ACCUMULATE ALL COSTS ON FLUOR DANIEL PROJECTS. THE CHART OF ACCOUNTS IS SEPARATED INTO NINE CATEGORIES DEFINED AS FOLLOWS:

0 - EXCAVATION & CIVIL
1 - CONCRETE
2 - STRUCTURAL STEEL
3 - ARCHITECTURAL
4 - MACHINERY & EQUIPMENT
5 - PIPING
6 - ELECTRICAL
7 - INSTRUMENTATION
8 - INSULATION & COATINGS
9 - INDIRECTS FIELD, HOME OFFICE COST, AND OTHER COST & FEES

THE ESTIMATE REFLECTS LOWER LEVEL BREAKDOWNS OF THE ABOVE CHART OF ACCOUNTS.

3. ESTIMATE METHODOLOGY

A. DIRECT COSTS:
A COST REVIEW AND UPDATE TECHNIQUE HAS BEEN UTILIZED IN THE PREPARATION OF THIS ESTIMATE.

(1) CONSTRUCTION LABOR, MATERIAL AND EQUIPMENT UNITS HAVE BEEN ESTIMATED BASED UPON ONE OR MORE OF THE FOLLOWING STANDARD COMMERCIAL ESTIMATING RESOURCES, PUBLISHED ESTIMATING MANUALS/DATABASES: IN HOUSE DATABASES, R.S. MEANS RICHARDSON'S PROCESS PLANT CONSTRUCTION ESTIMATING STANDARDS NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION, INC. (NECA) MANUAL OF LABOR UNITS, ELECTRICAL RESOURCES, INC. ELECTRICAL ESTIMATING PRICE AND LABOR MANUAL.
THE UNITS MAY HAVE BEEN FACTORED/ADJUSTED BY THE ESTIMATOR AS APPROPRIATE TO REFLECT INFLUENCES BY CONTRACT, WORK SITE, OR OTHER IDENTIFIED PROJECT OR SPECIAL CONDITIONS.

(2) FLUOR DANIEL HANFORD & PROJECT HANFORD MANAGEMENT CONTRACT (PHMC) SUBCONTRACTOR DIRECT COSTS FOR DUKE ENGINEERING & SERVICES HANFORD, INC. LOCKHEED MARTIN HANFORD CORP. NUMATEC HANFORD CORP AND WASTE MANAGEMENT HANFORD HAVE BEEN PROVIDED BY NHC PROJECT MANAGEMENT FOR INCLUSION INTO THIS ESTIMATE.

(3) THIS ESTIMATE WAS PREPARED IN PART FROM A PREVIOUS ESTIMATE DATED 04/09/1997. THAT CDR AND ESTIMATE WAS PROVIDED TO NHC BY ARES CORPORATION.

B. DIRECT COST FACTORS:

(1) SALES TAX HAS BEEN APPLIED TO ALL MATERIALS AND EQUIPMENT PURCHASES AT 8%.

(2) A SPECIAL WORK PROCEDURE (SWP) ITEM IS APPLIED TO THE ESTIMATE TO ACCOUNT FOR HANFORD TANK FARM WORK REQUIREMENTS. THE SWP FACTOR ADJUSTS DIRECT LABOR UPWARD TO ACCOUNT FOR TIME DURING THE WORK DAY PERIOD REQUIRED TO BE SPENT ON SUCH ITEMS AS DAILEY PRE-JOB SAFETY MEETINGS, GAINING ACCESS AUTHORIZATION TO THE TANK FARM FROM OPERATIONS, DRESSING AND UNDRESSING PERSONAL PROTECTIVE EQUIPMENT (PPE), CLEARING OR RELEASING WORK AREAS OF CONTAMINATED MATERIALS, AND MOVING MATERIALS, TOOLS AND EQUIPMENT IN AND OUT OF THE FARM. THE SWP ASSUMES THE FOLLOWING: (A) ALL REQUIRED ATTENDEES AT PREJOB MEETINGS ARE PRESENT WITHIN 15 MINUTES OF OFFICIAL SHIFT START TIME; (B) THE PREJOB SAFETY MEETING IS 30 MINUTES IN DURATION; (C) TANK FARM ENTRY TIME FOR DOSIMETRY, DRESSING IN (PPE) OF 30 MINUTES TWICE PER SHIFT; (D) EGRESS FROM THE FARM WILL BEGIN NO SOONER THAN 30 MINUTES PRIOR TO THE LUNCH BREAK AND 30 MINUTES PRIOR TO THE OFFICIAL SHIFT END TIME; (E) CONSTRUCTION WILL BE PERFORMED DURING NORMAL WORKING HOURS; (F) WORK BREAKS ARE COORDINATED WITH THE PHMC SUPPORT CRAFTS AND DO NOT INCLUDE AN ENTIRE CRAFT OR CREW WITHDRAWAL FOR REST BREAKS (MEAL BREAK EXCLUDED).

B. DIRECT COST FACTORS: (CONTINUED)

(2) THE SWP FACTOR FOR THIS ESTIMATE IS APPLIED AS FOLLOWS:
LABOR HOURS ARE ADJUSTED UPWARD 35% FOR WORK IN THE TANK FARM WITHOUT PPE.
LABOR HOURS ARE ADJUSTED UPWARD 100% FOR WORK IN THE TANK FARM WITH PPE AND RESPIRATOR.
THIS SWP ADJUSTMENT AMOUNT IS SHOWN WITHIN THE ESTIMATE EXCEPT FOR WBS ACTIVITIES THAT ARE ESTIMATED BY WORK CREW. WORK CREW ACTIVITIES HAVE LABOR HOURS WHICH INCLUDE CONSIDERATIONS OF SWP IN THE CREW MAKEUP AND TASK DURATION.

(3) A FACTOR OF 15% HAS BEEN APPLIED TO DIRECT CRAFT LABOR FOR GENERAL REQUIREMENTS & 23.58% FOR TECHNICAL SERVICES.

(4) GENERAL FOREMAN COSTS ARE ESTIMATED AT 7% OF THE DIRECT CRAFT LABOR HOURS. THE GENERAL FOREMAN IS REQUIRED PER THE HANFORD SITE STABILIZATION AGREEMENT. THE 7% WAS ESTABLISHED PRIOR TO THE PHMC CONTRACT AND WAS BASED ON CRAFT LABOR STUDIES.

(5) A FACTOR OF 10% HAS BEEN APPLIED TO DIRECT CRAFT LABOR TO ALLOW FOR USAGE OF GOVERNMENT OWNED EQUIPMENT CONTROLLED BY DYNCORP (LIGHT EQUIPMENT POOL). LIGHT EQUIPMENT MAINLY INCLUDES SEDANS, VANS, AND PICKUP TRUCKS USED BY CONSTRUCTION FORCES. THE COSTS FOR THE EQUIPMENT IS "POOLED" BY DYNCORP AND THEN DISTRIBUTED TO PHMC COST ACCOUNTS AT A VALUE APPROXIMATELY 10% OF THE CRAFT LABOR CHARGE.

(6) CONSTRUCTION CONSUMABLE ITEMS SUCH AS SMALL TOOLS, WELD ROD, TAPE, CAULKING, PLASTICS, GLOVES, PAPER, ETC. ARE ESTIMATED AS A FACTOR OF DIRECT CRAFT LABOR COSTS 3.2%. THE CONSUMABLES PERCENTAGE WAS ESTABLISHED PRIOR TO THE PHMC CONTRACT AND WAS PREVIOUSLY BASED ON MATERIAL PROCUREMENTS.

(7) *ALL MANUAL AND NON-MANUAL PERSONNEL ARE REQUIRED TO ATTEND A FOUR HOUR SAFETY MEETING EACH MONTH. THE ESTIMATE* INCLUDES THE COST FOR CONDUCTING AND ATTENDING THESE MEETINGS. IT IS ASSUMED THAT THE MEETING DATES WILL BE COORDINATED WITH THE PHMC MANDATORY SAFETY MEETINGS SO WORK WILL NOT BE DISRUPTED DUE TO THE ABSENSE OF PHMC SUPPORT PERSONNEL AT THE CONSTRUCTION SITE FOR SUCH MEETINGS.

(8) SALES/USE TAX HAS BEEN APPLIED TO ALL MATERIALS AND EQUIPMENT PURCHASES AT 8%.

(9) NO WAREHOUSING COSTS FOR GFE ARE SHOWN SINCE THEY ARE CONSIDERED TO BE INCLUDED IN THE MATERIAL PROCUREMENT RATE (MPR)

(10) PREMIUM PAY OVERTIME REQUIREMENTS AND SHIFT DIFFERENTIAL PAY FOR CRAFT LABOR ARE UNION NEGOTIATED UNDER THE HANFORD SITE STABILIZATION AGREEMENT.

(11) EQUIPMENT AND MATERIAL PURCHASES (WBS ITEM 12) MONITOR CABINETS IS BEING DONE BY NHC. THE COST ESTIMATE AMOUNTS ARE NHC FURNISHED ACTUAL AMOUNTS INCLUDING PHMC MPR AND G&A, WAREHOUSING, AND SALES/USE TAX. THE EXCEPTION IS THE WORK PLATFORMS AND THE STACK ASSEMBLIES BEING PURCHASED BY FDNW.

C. RATES:

(1) FOR ESTIMATING PURPOSES, AVERAGE FDNW RATES BY OPERATIONS CODE HAVE BEEN DEVELOPED BASED UPON RECENT COST HISTORY AND ADJUSTED TO REFLECT INDUSTRY AVERAGE AE/CM RATES.

(2) FLUOR DANIEL NORTHWEST SERVICES (CONSTRUCTION CRAFT) LABOR RATES ARE THOSE LISTED IN APPENDIX A OF THE HANFORD SITE STABILIZATION AGREEMENT (HSSA). THE HSSA RATES INCLUDE BASE WAGE, FRINGE BENEFITS AND OTHER COMPENSATION AS NEGOTIATED BETWEEN FLUOR DANIEL HANFORD, INC. AND THE NATIONAL BUILDING AND CONSTRUCTION TRADES DEPARTMENT, AFL-CIO. FLUOR DANIEL NORTHWEST INCORPORATES FACTORS TO COVER ADDITIONAL COSTS FOR WORKERS COMPENSATION, FICA AND STATE AND FEDERAL UNEMPLOYMENT INSURANCE TO DEVELOP A FULLY BURDENED RATE BY CRAFT.

(3) FDH & PHMC SUBCONTRACTOR STANDARD LABOR RATES ARE THOSE LISTED IN THE FINANCIAL DATA SYSTEM (FDS) FDST 321R REPORT ORGANIZATION RATES PLUS ADDERS. THE RATES ARE USED IN THE ESTIMATE FOR WORK ITEMS DESIGNATED AS FDH OR PHMC CONTRACTOR SCOPE OF WORK.

D. SITE ALLOCATIONS FACTORS:

COST RELATED TO PHMC HANFORD SITE G&A, GOVERNMENT FURNISHED SERVICES (GFS), MATERIAL PROCUREMENT RATE (MPR), AND FEE ARE INCLUDED IN THE ESTIMATE. THE APPLICABLE RATE IS DETERMINED BY FLUOR DANIEL HANFORD (FDH) AND IS PROVIDED TO FDNW

(1) DYNCORP EQUIPMENT USAGE: APPLIED TO HOME OFFICE ENGINEERING COSTS FOR GOVERNMENT OWNED EQUIPMENT CONTROLLED BY DYNCORP 0.25%

(2) A/E/CM LABOR FACTOR FY99: 21.50 WAS APPLIED BASED ON GFS 5% AND G&A 15.7%.

(3) CONSTRUCTION LABOR FACTOR: A COMPOSITE OF 26.92% WAS APPLIED BASED ON A WEIGHTED AVERAGE DEVELOPED FROM THE CONSTRUCTION SCHEDULE (FY99 8 MONTHS @ 21.50% AND FY00 11 MONTHS @ 30.54%).

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DATE 10/26/98 09:47:26
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4. ESCALATION

ESCALATION PERCENTAGES WERE CALCULATED FROM THE JANUARY 1998 UPDATE OF THE ECONOMIC ESCALATION PRICE CHANGE INDICES FOR DOE CONSTRUCTION PROJECTS AS PUBLISHED BY THE "OFFICE OF INFRASTRUCTURE ACQUISITION" FM-50.

5. CONTINGENCY

A. DEFINITION OF CONTINGENCY AS PROVIDED BY DOE

"CONTINGENCY COVERS COSTS THAT MAY RESULT FROM INCOMPLETE DESIGN, UNFORESEEN AND UNPREDICTABLE CONDITIONS, OR UNCERTAINTIES WITHIN THE DEFINED PROJECT SCOPE. THE AMOUNT OF CONTINGENCY WILL DEPEND ON THE STATUS OF DESIGN, PROCUREMENT, AND CONSTRUCTION; AND THE COMPLEXITY AND UNCERTAINTIES OF THE COMPONENT PARTS OF THE PROJECT. CONTINGENCY IS NOT TO BE USED TO AVOID MAKING AN ACCURATE ASSESSMENT OF EXPECTED COST" (OFFICE OF WASTE MANAGEMENT (EM-30) COST AND SCHEDULE GUIDE.

B. CONTINGENCY ALLOWANCE GUIDELINES

THE DOE GUIDELINE CONTINGENCY ALLOWANCE FOR A... PLANNING ESTIMATE - STANDARD = 20% - 30%

C. METHODOLOGY

CONTINGENCY IS EVALUATED AT THE LOWEST WORK BREAKDOWN STRUCTURE (WBS) LEVEL WITHIN THE COST ESTIMATE DETAILS. IT IS SUMMARIZED AT UPPER WBS LEVELS AND REPORTED ON THE SUMMARY REPORTS.

D. ANALYSIS

AN ASSESSMENT OF DESIGN MATURITY, WORK COMPLEXITY AND PROJECT UNCERTAINTIES HAS BEEN PERFORMED. AN EXPLANATION OF THIS ASSESSMENT AND CONTINGENCY RATES WHICH HAVE BEEN ADDED TO THE COST OF WORK ARE AS FOLLOWS:

(COST CODE 000)

1. WBS (11 DESIGN) A CONTINGENCY OF 10% HAS BEEN APPLIED TO COVER POSSIBLE UNKNOWN DESIGN CHANGE REQUIREMENTS. THESE ACTIVITIES MAY REQUIRE ADDITIONAL DEGREES OF DESIGN AND ANALYSIS TO SUPPORT ADDITIONAL FIELD ATTACHMENTS POINTS AND/OR RELOCATION OF THOSE POINTS AND THE POSSIBLE REMOVAL OF ADDITIONAL EQUIPMENT.
2. WBS (14 PROJECT MANAGEMENT) A CONTINGENCY OF 15% HAS BEEN APPLIED TO SUPPORT ANY POSSIBLE CHANGES IN INTEGRATION, CONFIGURATION, QUALITY ASSURANCE OR TEST AND EVALUATION PROCEDURES.
3. WBS (15 OTHER PROJECT COST) A CONTINGENCY OF 10% HAS BEEN APPLIED TO COVER CHANGES IN ENVIRONMENTAL COMPLIANCE/ PERMITS, ATP/OTP SUPPORT AND START UP, READINESS REVIEW AND SAFETY ANALYSIS (JSA)/(JHA).

(COST CODE 700)

4. WBS (12 PROCUREMENT) A CONTINGENCY OF 30% HAS BEEN APPLIED TO COVER ANTICIPATED CHANGES IN EQUIPMENT AND POSSIBLE BUDGETARY COSTS CHANGES AT THE TIME THE EQUIPMENT IS ORDERED.
5. WBS (13 CONSTRUCTION) A CONTINGENCY OF 30% HAS BEEN APPLIED TO COVER THE CONSTANT CHANGES IN FIELD CONDITIONS IN THE FARMS. A FIELD VERIFICATION ALSO NOTED SEVERAL PIECES OF PIPE AND CONDUIT THAT MAY NEED RELOCATION.

FLUOR DANIEL NORTHWEST, INC.
NUMATEC HANFORD CORPORATION
JOB NO. W420
FILE NO. W420BAB3

** IEST - INTERACTIVE ESTIMATING **
STACK MONITORING SYSTEM UPGRADES
CONCEPTUAL ESTIMATE REV. 1
PHMCR03 - ESTIMATE BASIS SHEET

DATE 10/26/98 09:47:26
BY DKH/AJR/JMS

6. ROUNDING

THE PROJECT COST SUMMARY REPORT IS SUMMARIZED AND ADJUSTED/ROUNDED AS FOLLOWS:
THE ESCALATED TOTAL COST COLUMN, CONTINGENCY TOTAL COLUMN AND TOTAL DOLLARS COLUMN SUB-TOTALS ARE SUMMARIZED BY CONTRACTOR. THE COLUMN SUBTOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $1,000/$10,000. THE PROJECT TOTAL SUMMARY LINE TOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $10,000/$100,000.

7. REMARKS

MAJOR ASSUMPTIONS WHICH HAVE BEEN MADE IN THE PREPARATION OF THIS ESTIMATE ARE AS FOLLOWS:

A.) THIS ESTIMATE WAS PREPARED IN PART FROM INFORMATION ON PREVIOUS ESTIMATE DATED 04/09/1997. THE ESTIMATE HAS BEEN MODIFIED BASED ON FIELD WALKDOWNS, ANALYSIS OF CONSTRUCTION AND ENGINEERING TASKS BY FDNW.

(COST CODE 000)
B.) WBS 11 ENGINEERING WAS REVISDED FROM ORIGINAL ESTIMATE BASED ON CDR CHANGES WHICH INCLUDED SAFETY CLASS CHANGES.
1. A&I ACCEPTANCE INSPECTION ESTIMATE WAS ADDED PER FDH A&I PLANNING SHEET SUPPLIED BY G. CHINERY.
2. IT WAS ASSUMED THAT ALL MANHOURS SHOWN FOR PREPARE AND REVIEW CONCEPTUAL DESIGN WERE NUMATEC SUPPORT ENGINEERING PERSONNEL AND THAT THESE ARE FIXED COSTS.
3. COSTS ASSOCIATED WITH THE CONCEPTUAL DESIGN (WBS 11) WERE CONSIDERED "COSTS SPENT TO DATE" AND LISTED WITH THE PROJECT OPC COSTS WITHIN WBS 15. THE CONTINGENCY ALLOWANCE FOR THE CONCEPTUAL DESIGN WAS ALSO ASSUMED TO HAVE BEEN SPENT TO DATE.
4. THE TOTAL DEFINITIVE DESIGN ESTIMATE WAS ASSUMED TO BE AN ASSIGNED PROJECT THAT FDNW WOULD BE CONTRACTED TO PREPARE. THEREFORE. ALL ENGINEERING DETAILED TASKS WITHIN WBS 11 WERE ASSIGNED TOO THE ASSUMED DISCIPLINE AND OPERATIONS CODE FOR CORRECT LABOR RATE APPLICATION.

(COST CODE 700)
C.) WBS 12 PROCUREMENT USED SAME DATA APPLYING NEW ESC AND PHMC FACTORS.
1. A PROCUREMENT ALLOWANCE OF ($70,200 EA.) FOR THE STACK MONITORS WAS PROVIDED BY NHC AND IS ASSUMED TO INCLUDE ALL MPR AND SITE ALLOCATIONS. AN 8% SALES TAX HAS BEEN APPLIED AND PROCUREMENT IS TO BE BY NUMATEC.
2. THE WORK PLATFORMS AND NEW STACK SECTIONS WERE ASSUMED TO BE PROCURED BY FDNW. SALES TAX WAS DEDUCTED FROM THE ORIGINAL AMOUNTS AND APPLIED SEPARATELY. COSTS WERE ALSO SHOWN IN THE MATERIAL CATEGORY RATHER THAN SUBCONTRACT ACCOUNT.

(COST CODE 700)
D.) WBS 13 CONSTRUCTION USED SOME DATA FROM THE ORIGINAL ESTIMATE AND ADDED INFORMATION GATHERED BY NHC, FDNW, LMHC WALK DOWN OF TANK FARM STACK SITES.
1. ALL CONSTRUCTION ACTIVITIES WERE ASSUMED TO BE PERFORMED BY ONSITE CONSTRUCTION FORCES ORGANIZATION. LABOR HOURS FROM THE ARES ESTIMATE WERE MODIFIED BASED ON ADDED SCOPE DETERMINED FROM THE WALKDOWN OF THE STACKS.
2. A 35% SPECIAL WORK PROCEDURE (SWP) ADDER WAS APPLIED TO ALL CONSTRUCTION WORK WITHIN THIS ESTIMATE. THIS WAS BASED ON INFORMATION FOUND IN TANK FARM OPERATING PROCEDURE TO-100-052 2.5.1.
3. THE ESTIMATE ASSUMES ADEQUATE AND TIMELY SUPPORT WILL BE PROVIDED. I/E PIC AND HPT SUPPORT.

7. REMARKS CONTINUED

(COST CODE 700)

4. THE CUBIC FEET OF MIXED WASTE MATERIAL AND THE NUMBER OF CONTAINERS REQUIRED FOR THIS JOB HAS BEEN BASED ON THE ARES CORPORATION ESTIMATE, NOTES TAKEN DURING THE FIELD WALKDOWN AND THE CDR.
5. THE WASTE MATERIALS BEING DISPOSED OF ARE CONSIDERED MIXED WASTE.
6. ASSUMING ALL BURIAL CONTAINERS CAN BE PLACED WITHIN 30' OF THE WORK AREAS AND THAT NO HIGH RADIOLOGICAL CONTAMINATION IS DISCOVERED DURING EXCAVATION AND DEMOLITION OF EQUIPMENT.

(COST CODE 000)

E.) WBS 14 MANAGEMENT USED SAME DATA APPLYING NEW ESC AND PHMC 1998 LABOR RATES.

1. ALL PROJECT MANAGEMENT HANFORD CONTRACTORS LABOR RATES AND THE FDNW ENGINEERING AND CONSTRUCTION LABOR RATES WERE UPDATED TO THE CURRENT ESTABLISHED AND PUBLISHED RATES AVAILABLE.

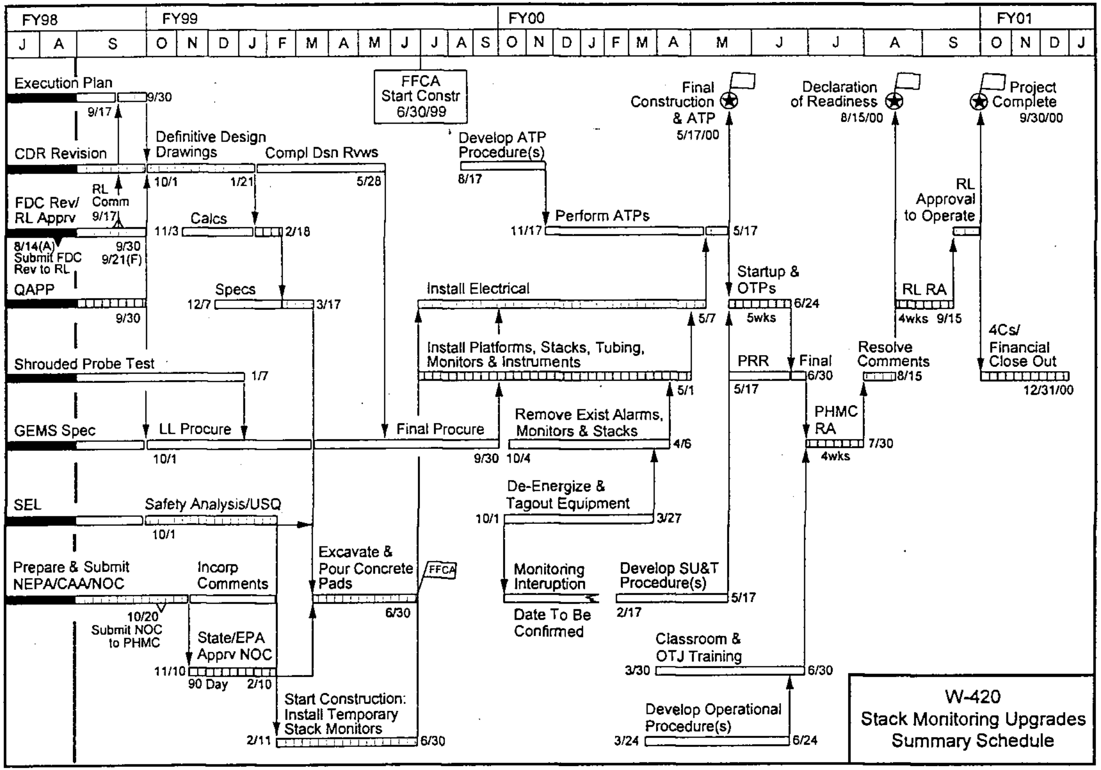
(COST CODE 000)

F.) WBS 15 OTHER PROJECT COST USED SAME DATA APPLYING NEW ESC AND PHMC 1998 LABOR RATES.

1. ALL ACTIVITIES ASSOCIATED WITH WBS 14&15 WERE ASSIGNED BY NUMATEC PROJECT W-420 ENGINEER SO APPROPRIATE LABOR RATES COULD BE ASSIGNED.
2. ESCALATION RATES WERE UPDATED FOR THIS ESTIMATE AND APPLIED USING THE NEW NHC. SCHEDULE.
3. ASSUMING ALL SITE ALLOCATION FACTORS ARE INCLUDED IN THE PHMC COSTS FOR WBS 14&15 AND 121 PROCUREMENT OF MONITOR CABINETS.

APPENDIX B: CONCEPTUAL PROJECT SCHEDULE

Project W-420 Schedule.



September 3, 1998 (W420_BSL.DRW) C

APPENDIX C: ENERGY CONSERVATION REPORT

At the time of the preparation of this report, all electrical load information was not available from the stack monitor vendor. However, for the equipment running full time (vacuum pump, radiation monitor and associated electronics, data collection computer, temperature transmitter, and flow transmitter) the estimated load is approximately 147×10^6 Btu/yr (4.3×10^4 kW-hr/yr) for all six units. This load is considerably less than 500×10^6 Btu/yr (1.5×10^5 kW-hr/yr) where DOE Order 6430.1A criteria apply. 10 CFR 435 is also not applicable to this project, as all facilities are unoccupied process equipment enclosures. The instrument cabinets contain small heating units, but no active cooling is required.

APPENDIX D: ECONOMIC ANALYSIS AND LIFE-CYCLE COST ANALYSIS

A Life-Cycle Cost Analysis (LCCA) was conducted to determine the expected operations and maintenance costs for the life cycle. Because the stack monitor is a required piece of equipment, comparisons with other alternatives were not made. Disposal costs are not calculated. The LCCA was prepared for an average individual unit as the cost differences between locations is very minimal. The average life cycle used was 22.5 years.

Initial Capital Costs
The average initial capital cost was $431,000 per unit.

Annual Operations and Maintenance Costs
The cost of major electronic equipment in each stack monitor is approximately $24,000. Electronic equipment of this nature typically fails and needs replacement every ten years. It was therefore estimated that $2,400 of equipment would need to be replaced per unit per year. It was further estimated that 40 man hours would be needed to replace the equipment. Routine maintenance was estimated as 4 man hours per month to replace record sampler filters and to conduct routine monthly checks. In addition, semi-annual calibrations with inspection of the sample probe was estimated to require 32 man hours per year. At a labor rate of $32/hr the total annual labor maintenance costs were estimated to be $3,840. The total annual Operations and Maintenance costs including labor and materials is $6,240.

Annual Energy Costs
The annual energy use per unit is 6,143 kW-hr per year.

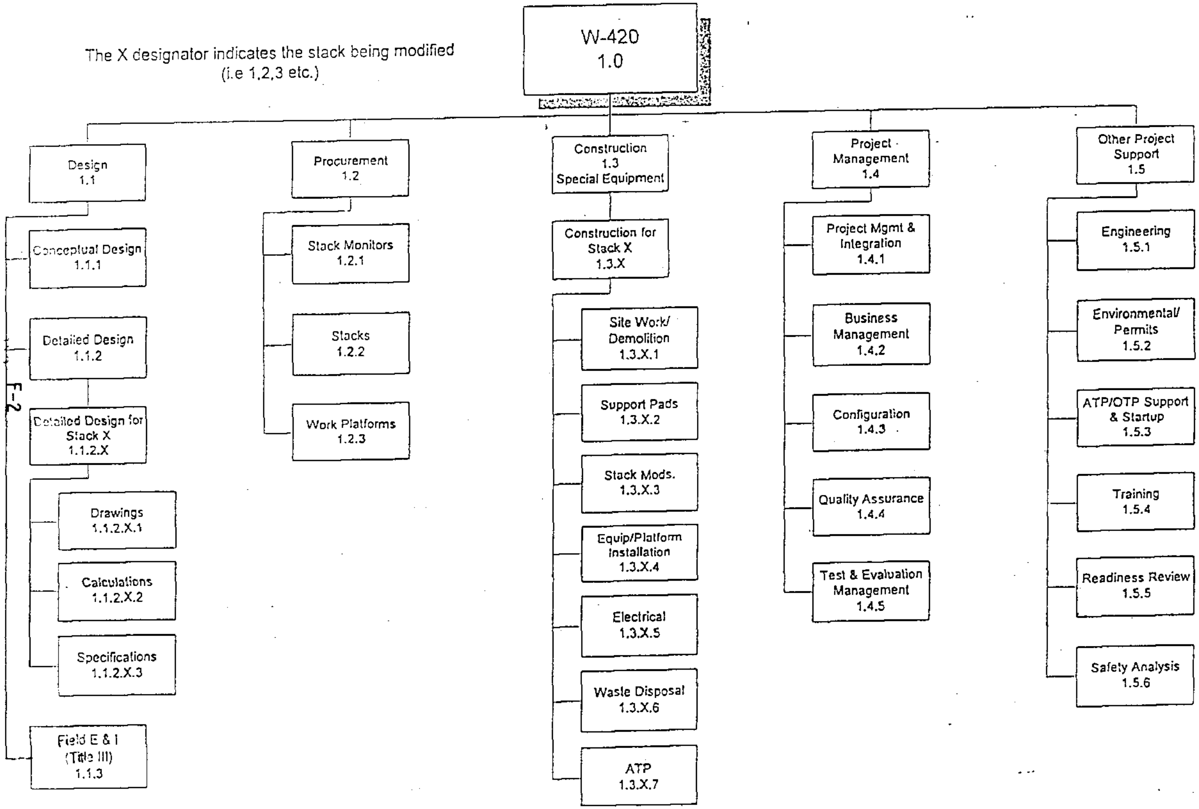
Life-Cycle Cost Determination
The initial capital costs, annual Operations and Maintenance costs, and the annual energy usage was then entered into BLCC4 which is a life-cycle costing program prepared by the National Institute of Standards and Testing (NIST). BLCC4 uses standard Federal discount rates to determine the total life cycle cost in today's dollars. The BLCC4 input and output files are attached, with the overall life cycle cost for each unit coming to $513,403.

APPENDIX E: PLANT FORCES WORK REVIEW

A Plant Forces Work Review (PFWR) will be performed in accordance with site procedure HNF-PRO-070, *Plant Forces Work Review (Davis-Bacon Act Compliance)*.

APPENDIX F: WORK BREAKDOWN STRUCTURE

Project W-420
Work Breakdown Structure
April 1, 1996



APPENDIX G: OUTLINE SPECIFICATIONS

DIVISION 2 - SITE WORK

Section 02200 Earthwork

1. Excavation for underground pipe and wire conduits.

2. Compacted sand bedding for underground pipe and conduits.: ASTM D 653.

3. Plastic sheet marker for buried piping and conduits.

4. Stabilization of disturbed areas.

DIVISION 3 - CONCRETE

Section 03300 Cast-In-Place Concrete

1. Concrete construction will be in accordance with American Concrete Institute (ACI) 301.

2. Concrete Minimum Strength: 4000 psi at 28 days for Safety Class 3.

3. Reinforcing Steel: ASTM A 615, deformed, Grade 60.

4. Welded Wire Fabric: ASTM A 185.

5. Steel Wire: ASTM A 853.

5. Non-Shrink Grout: Nonmetallic type.

6. Concrete Forms: Wood, steel, or plywood or similar.

7. Sampling and testing of concrete per ACI.

8. Tolerances per ACI 117.

DIVISION 5 - METALS

Section 05500 Metal Fabrications

1. Fabricate in accordance with industry standards.

2. Rolled steel shapes and miscellaneous steel: ASTM A 36.

3. Steel Pipe: ASTM A 53, Schedule 40, Grade B; except straight sections may be ASTM A 120.

4. Guardrails: galvanized steel pipe conforming to ASTM A 123. Zinc coating not less than 2.8 ounces per square foot.

5. Steel grating: Galvanized, ASTM A 123. Zinc coating not less than 2.8 ounces per square foot.

6. Metal decking: Galvanized steel sheet conforming to ASTM A 526.

7. Steel plate: ASTM A 36 or A 283.

8. Steel bars and rods: ASTM A 36.

9. Nuts and Bolts: ASTM A 307, Grade A or B. Nuts shall be hexagon series.

10. Expansion anchors: Hilti® Kwik-Bolt II or HSL.

11. Weld Studs: ASTM A 108: Nelson Stud Welding Company, Type H4L.

12. Welding and visual examination per AWS D1.1 and AWS D1.3. Visual examination will be performed by CWI.

DIVISION 13 - SPECIAL CONSTRUCTION

Section 13440 Instrumentation

1. Instrumentation specifications are in accordance with WHC-S-0400, *Procurement Specification for the Generic Effluent Monitoring System* (White 1995).

DIVISION 15 - MECHANICAL

Section 15493 Chemical Process Piping Systems

1. Specifications for the sample transport and sample return piping are in accordance with WHC-S-0400, *Procurement Specification for the Generic Effluent Monitoring System* (White 1995).

Section 15500 Heating, Ventilation, and Air Conditioning

1. Exhaust ductwork: ASTM A 527 galvanized steel, fabricated in accordance with Sheet Metal and Air Conditioning Contractors Association, Inc (SMACNA) heating, ventilating and air-conditioning (HVAC) Duct Construction Standards, Metal and Flexible.

2. Duct and equipment supports will be fabricated from ASTM A 36 carbon steel, welded.

3. Stacks: Galvanized steel sheet, or carbon steel pipe.

DIVISION 16 - ELECTRICAL

Section 16400 Service and Distribution

1. Conductors: Stranded copper with type THWN/THHN insulation.

2. Conduit below grade: PVC coated rigid steel.

3. Exposed Conduit: Galvanized rigid steel.

4. Conduit concealed in concrete: Rigid steel.

5. Connections to motors and lighting fixtures: seal tight flexible metal conduit.

6. Distribution panel boards: Bolt-on type circuit breakers with thermal magnetic strips.

7. Disconnects: NEMA Type I enclosures, fusible locking disconnects (UL approved, CSA certified).

DISTRIBUTION SHEET

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Project Title/Work Order		EDT No. n/a
Project W-420 Ventilation Stack Monitoring System Upgrades; HNF-SD-W420-CDR-001, *Project W-420 Stack Monitoring System Upgrades Conceptual Design Report.*		ECN No. 647029

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