S

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 651127

Proj. ECN

2. ECN Category (Mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersedure ~~☒~~ 9/28/00 Cancel/Void ☐	Brad Coverdell, S1800, S7-12, 373-0598	☐ Yes ☒ No	April 4, 2000
	6. Project Title/No./Work Order No. Characterization Project / CACN 102250	7. Bldg./Sys./Fac. No. 200 G	8. Approval Designator ESQ
	9. Document Numbers Changed by this ECN (includes sheet no. and rev) 9/28/00 ~~SEE BLOCK 13B~~ EHG HNF-SD-WM-CR-062 RV1	10. Related ECN No(s). N/A	11. Related PO No. N/A
12a. Modification Work ☐ Yes (fill out Blk. 12b) ☒ No (NA Blks. 12b, 12c, 12d)	12b. Work Package No. N/A	12c. Modification Work Completed N/A Design Authority/Cog. Engineer Signature & Date	12d. Restored to Original Condition (Temp. or Standby ECNs only) N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

13b. Design Baseline Document? ☒ Yes ☐ No DAV 9/28/00

This ECN contains a complete revision of HNF-SD-WM-CR-062 Rev 1, "Baseline Design Compliance Matrix For The Rotary Mode Core Sampling System". The following list outlines the major changes to Revision 1 on the DCM;

- Added Core Sampling Riser Equipment,
- Added Core Sampling Support Trucks,
- Added Ramps and Platforms,
- Added Foot Clamp,
- Added Purged Camera System and
- Revised and Updated references.

14a. Justification (mark one)		14b. Justification details
Criteria Change	☒	Five new subsystems were added to the original ten rotary mode core sampling subsystems. Requirements for these systems were obtained from background documentation such as released ECNs, supporting documents and specifications. The background documentation for the equipment was retrieved from the date of the equipment origination through February 2000.
Design Improvement	☐	
Environmental	☐	
Facility Deactivation	☐	
As-Found	☐	
Facilitate Const.	☐	
Const. Error/Omission	☐	
Design Error/Omission	☐	

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RELEASE STAMP

DATE: OCT 02 2000 STA: 1 HANFORD RELEASE ID: 2

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1. ECN (use no. from pg. 1): 651127

16. Design Verification Required	17. Cost Impact				18. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION			
☒ Yes	Additional ☐	$ N/A	Additional ☐	$ N/A	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	☐	-----	☐
Environmental Permit	☐	Inventory Adjustment Request	☐	None	☒

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
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21. Approvals

	Signature	Date
Design Authority: GP Janicek	G.P. Janicek	09/28/2000
Cog. Eng. RN Dale	R.N. Dale	4/19/00
Cog. Mgr. JS Schofield	John Schofield	9/27/00
QA: JL Logston	J.L. Logston	4-24-00
Safety: CD Jackson	C.D. Jackson	4/19/00
Environ. LL Penn	L.L. Penn	5/9/00
Informal Rev. GW Wilson	G.W. Wilson	4/25/00

This ECN does not change existing safety significant or safety class equipment or add any safety significant or safety class equipment, therefore, a formal design review is not required.

	Signature	Date
Design Agent BL Coverdell	B.L. Coverdell	4/19/00
PE		
QA		
Safety		
Design		
Environ.		
Other	J.L. Logston	9/28/00

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

BASELINE DESIGN COMPLIANCE MATRIX FOR THE ROTARY MODE CORE SAMPLING SYSTEM

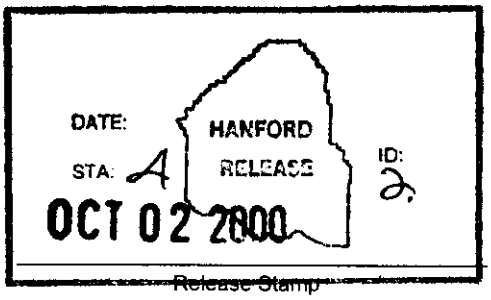
Prepared by CH2M Hill Hanford Group, Inc.
2400 Stevens
Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-99RL14047

EDT/ECN: 651127 UC: 2070
Cost Center: 74900 Charge Code: 102250
B&R Code: EW3130000 Total Pages: 64

Key Words: Design, design compliance matrix, DCM, single shell tanks storage tanks, radioactive waste, RMCS, core sampling, characterization, sampling equipment, design requirements.

Abstract: This ECN contains a complete revision of HNF-SD-WM-CR-062 Rev 2, "Baseline Design Compliance Matrix For The Rotary Mode Core Sampling System". The following list outlines the major changes to Revision 1 on the DCM; added Core Sampling Riser Equipment, added Core Sampling Support Trucks, added Ramps and Platforms, added Foot Clamp, added Purged Camera System and revised and updated references.

Release Approval 9/28/00 Date



Approved For Public Release

RECORD OF REVISION	(1) Document Number HNF-SD-WM-CR-062	Page 1

(2) Title

Baseline Design Compliance Matrix for the Rotary Mode Core Sampling System

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) Initial issue, EDT 622124, 12/12/97		
1	Revision 1 is a complete revision to add design requirements for nine more Rotary Mode Core Sampling System (RMCS) subsystems to the requirements. Revision 0 addressed only the RMCS exhauster. ECN 648036	R. N. Dale	J. S. Schofield
2 RS	Revision 2 is a complete revision. Five more RMCS subsystems are added to the design requirements. All requirements to existing subsystems have been updated. ECN 651127	R. N. Dale 10/2/00	J. S. Schofield 10/2/00

BASELINE DESIGN COMPLIANCE MATRIX FOR THE ROTARY MODE CORE SAMPLING SYSTEM

Prepared for CH2M Hill Group Hanford, Inc.
Characterization Engineering Group
By
B. L. Coverdell
COGEMA Engineering Corporation

April, 2000

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APPENDICES

BASELINE DESIGN COMPLIANCE MATRIX FOR THE ROTARY MODE CORE SAMPLING SYSTEM

1.0 BACKGROUND

The rotary mode core sampling (RMCS) system is designed to collect radioactive waste samples from single-shell tanks (SST) that contain a hard waste form that cannot be collected by push mode core sampling. The RMCS system consists of fifteen major subsystems;

- Rotary Mode Core Sample Trucks,
- Exhausters System,
- Universal Samplers,
- Diesel Generators,
- Distribution Trailers,
- X-Ray Cart System,
- Breathing Air Compressor,
- Nitrogen Supply Trailers,
- Service Trailers,
- Casks/Cask Trucks,
- Core Sampling Riser Equipment,
- Core Sampling Support Trucks,
- Foot Clamp,
- Ramps and Platforms and
- Purged Camera System.

Figure 1 shows the arrangement of equipment for sampling in the rotary mode.

SSTs that are not actively ventilated require the use of the RMCS exhauster during RMCS operations to prevent tank pressurization and to control emissions. During the course of calibrating the RMCS exhauster in 1996, an off-normal occurrence report was issued, resulting in a review of the design process within Characterization Engineering. The reviewers made several recommendations, including the development of a design compliance matrix (DCM). In response to this recommendation, a desk instruction for implementing the use of a DCM was issued (LMHC 1997c) to support all engineering design and design-related activities performed on behalf of the Characterization Project.

This revision of the DCM includes the addition of new equipment as well as additions to existing equipment. Background documentation for existing equipment was retrieved from the date of the equipment origination through February 2000. All documentation was in the form of Drawings, Engineering Change Notices, Engineering Task Plans and/or Supporting Documents.

2.0 PURPOSE

The purpose of the DCM is to provide a single-source document of all design requirements associated with the fifteen subsystems that make up the RMCS system. It is intended to be the baseline requirement document for the RMCS system and to be used in governing all future design and design verification activities associated with it.

3.0 SCOPE

This document is the DCM for the RMCS system used on Hanford single-shell radioactive waste storage tanks. This includes the Exhauster System, Rotary Mode Core Sample Trucks, Universal Sampling System, Diesel Generator System, Distribution Trailer, X-Ray Cart System, Breathing Air Compressor, Nitrogen Supply Trailer, Casks and Cask Truck, Service Trailer, Core Sampling Riser Equipment, Core Sampling Support Trucks, Foot Clamp, Ramps and Platforms and Purged Camera System. Excluded items are tools such as light plants and light stands. Other items such as the breather inlet filter are covered by a different design baseline. In this case, the inlet breather filter is covered by the Tank Farms Design Compliance Matrix.

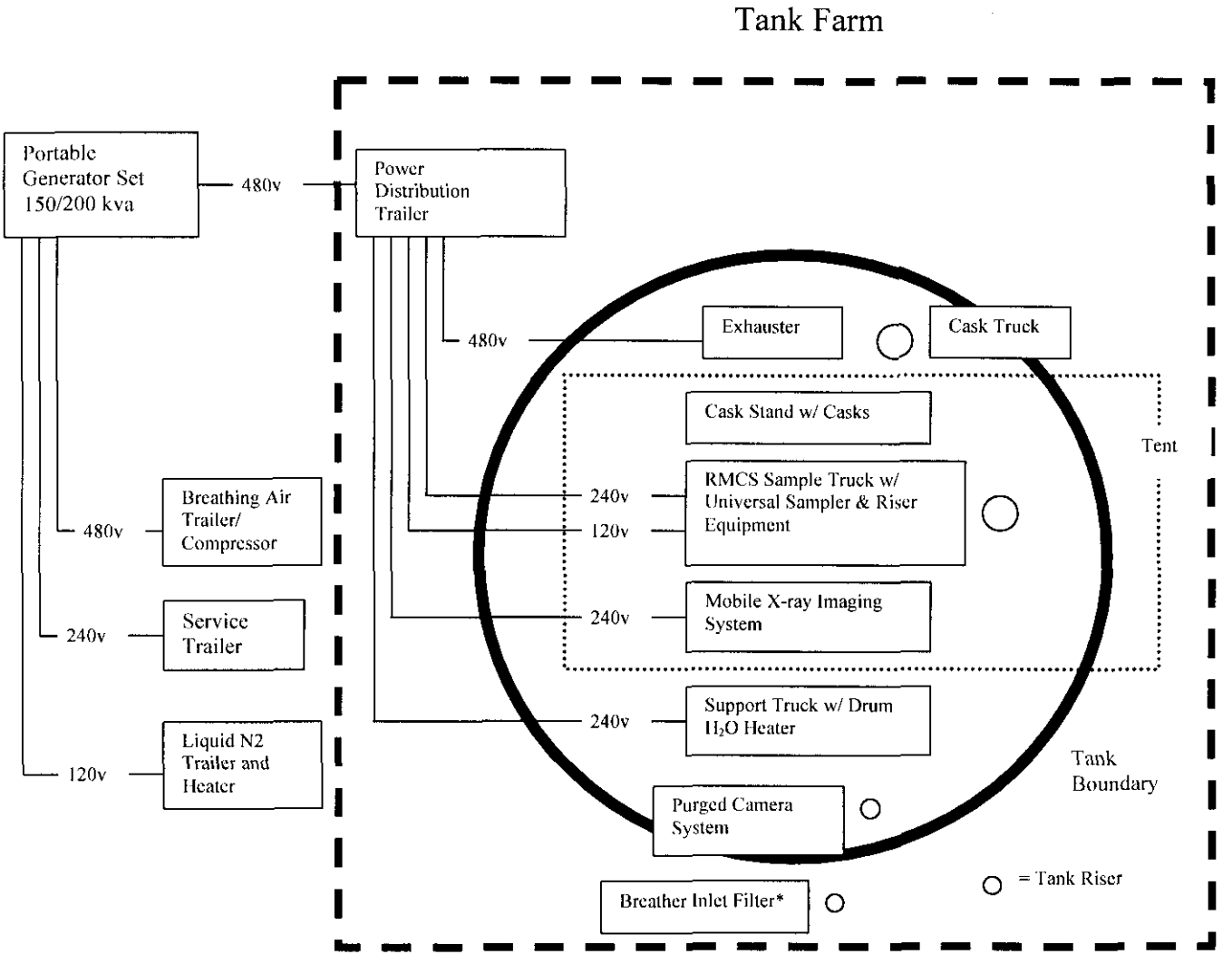

Figure 1. Equipment Arrangement for Core Sampling in the Rotary Mode

* The design requirements for the breather inlet filter are contained in the Tank Farms Design Baseline.

4.0 DEFINITION

The baseline DCM is a single-source compilation of validated, traceable, cohesive, consistent, and current design requirements for the RMCS system. It consists of three sections: 1) design requirements, 2) design solution, and 3) design verification. The baseline DCM presented herein completes the first two sections.

5.0 RESPONSIBILITIES

The assigned RMCS Design Authority is responsible for proper preparation and maintenance of the DCM and exercises ownership of it on behalf of Characterization Equipment Engineering and Characterization Project Operations management.

The baseline DCM, and any portion thereof, is considered a baseline requirements document. Changes to the DCM that affect the safety and environmental requirements will require Safety, Quality Assurance, and Environmental approval in addition to that of the assigned Design Authority, cognizant engineer, and cognizant engineer's manager.

6.0 DESIGN REQUIREMENTS

Design requirements within the DCM are divided into two logical parts: functional characteristics and constraints. The functional characteristics describe the purpose of the equipment in terms of its required functions and external interfaces. The constraints put limits on how the design will attain its functional characteristics. The design is in compliance with the requirements if it performs the required functions within the constraints of the safety requirements, environmental regulations, design codes, and operational requirements imposed on, or selected by, the project. In addition, the design must be compatible with the tank waste and outdoor environmental conditions (Appendix A, Table 1). The RMCS system may be operated over the full range of outdoor temperatures, but the exhauster, the RMCS truck, the X-Ray cart, and the Core Sample Support Trucks were not designed to operate at the lower temperatures, and their performance will suffer at low temperatures. Therefore, operating procedures are used to place administrative controls on operation of these subsystems outside of their design temperature range.

The design requirements contained herein are gleaned from existing functional design criteria, purchase specifications, and authorization basis documents. Some of the criteria are in issued documents, some are in draft documents, and some are prescribed by the design engineer. From all the design requirements (so obtained) a group of engineers eliminated obsolete criteria and criteria not essential to the design. The final product of that effort is the DCM (Appendix B, Table 2 that lists all the RMCS requirements by subsystem. The requirements for each subsystem are grouped by the requirement type, of which there are six: performance, external interface, safety, environmental, design code, and other. Table 2 also lists how the existing equipment satisfies the design requirement.

To provide some perspective on the origin of the design requirements, the major requirements and their sources are discussed in the following sections for each of the fifteen RMCS subsystems. The discussion of each subsystem is divided into two main parts--functional characteristics and constraints. The complete list of requirements is in Table 2.

6.1 EXHAUSTER SYSTEM

There are two exhauster systems, numbered 296-P33 (Exhauster B) and 296-P34 (Exhauster C). Design configuration of these exhausters is maintained by drawings, including assembly drawing H-2-821455. Vendor information is filed under vendor information number 22660.

6.1.1 Functional Characteristics

The exhausters are part of the tank waste sampling equipment. The equipment is moved from tank to tank to perform sampling operations and will be used year-round. During rotary mode core drilling, the drill string is purged with nitrogen at a rate of up to 100 cfm. To ensure that the added gas does not pressurize the tank and cause uncontrolled emissions of radioactive matter, tank vapors are withdrawn by the exhauster at a rate of about 200 cfm. The tank pressure is monitored to ensure that the exhauster does not create an excessive vacuum in the tank that might damage the tank.

The exhauster interfaces with the tank riser adapter, the rotary mode core sampling truck, the HEPA test equipment, and a portable generator.

The RMCS system is exposed to the Hanford climate (FDNW 1997), natural phenomena (FDH 1997a), and the tank waste environmental conditions. The tank waste environmental conditions and the outdoor environmental conditions are listed in Table 1. The system must operate under the waste conditions and be constructed of material that is compatible with the waste environment. The system must also be designed to operate outdoors. Operation may be limited by administrative controls during extreme weather conditions.

The electrical connectors for exhausters B and C that connect to the interfacing equipment (Rotary Mode Core Sample Truck, Distribution Trailer) must be compatible with the connectors installed on the interfacing equipment. In addition, the power connectors on the exhauster must be wired with the same phasing orientation as the distribution trailer. The mechanical connection for the HEPA Test Equipment must also remain compatible with the test equipment connector. Furthermore, Exhauster B must remain interchangeable with Exhauster C to facilitate continuous Rotary Mode Core Sampling.

6.1.2 Constraints

The constraints described here were imposed on or by the project to ensure that the equipment designed to meet the functional requirements is also designed within the accepted safety envelope, is in compliance with environmental regulations and pertinent design codes, and meets the operability standards considered important by the project and the Design Authority.

6.1.2.1 Safety Requirements

The safety requirements protect the tank from damage caused by pressure excursions. Compliance with the safety requirements ensures that the personnel, the public, and the environment are not exposed to unacceptable risks of radiation and contamination. The requirements related to sampling tanks containing flammable gases are described in *Tank Waste Remediation System Final Safety Analysis Report (FSAR)* (CHG 1999) and in the *Tank Waste Remediation System Technical Safety Requirements (TSR)* (CHG 1998c). The requirements related to toxicological exposure and other safety-related issues are described in the *Safety Assessment of Rotary-Mode Core Sampling in Flammable-Gas Single-Shell Tanks: Hanford Site, Richland, Washington* (LANL 1997).

During sampling operations, the exhauster will accumulate radioactive particles in the high efficiency particulate air (HEPA) filters and on other exhauster components. To minimize operating personnel radiation exposure, the exhauster must be designed in accordance with the RPP As Low As Reasonably Achievable (ALARA) Program (CHG 1997b).

Safety requirements in *Functional Design criteria for Core Sampling in flammable gas Watch List Tanks* and *Functional Design Criteria for the Rotary Mode Core Sampling Exhauster* (WHC 1995a and LMHC 1997b respectively) that are consistent with the FSAR (CHG 1999) and the safety assessment are listed in Table 2.

6.1.2.2 Environmental Regulations

Waste tank sampling, including RMCS, was evaluated for the activity's impact on the environment (DOE 1994) in an environmental assessment as required by the National Environmental Policy Act. The environmental assessment was reviewed by the DOE, and the DOE determined that the activity did not constitute a major federal action significantly affecting the quality of the human environment. The environmental assessment states that the sampling would be conducted using standard operating procedures for sampling high-level waste tanks that reflect the potential presence of flammable or explosive material in the tank or waste. The environmental assessment also recognized the need for regulatory approval because of the potential for an increase in the toxic and radionuclide air emissions.

The pertinent environmental regulations limit radioactive and toxic air emissions. The governing radioactive air emission standard is Chapter 246-247 of the Washington Administrative Code (WAC 1995) and the Hanford Site Environmental Procedure, "Air Quality - Radioactive Emissions." (CHG 1999c) The governing toxic air pollutant standard is WAC 173-460 (WAC 1994). Permission to operate the exhauster must be obtained from three regulatory agencies. The State of Washington Department of Health (WDOH) and the Environmental Protection Agency (EPA) must approve the radioactive air emission control plan, and the State of Washington Department of Ecology (Ecology) must approve the toxic air emission control plan. These separate plans are submitted in the form of a notice of construction (NOC) by the U.S. Department of Energy, Richland Operations Office (RL) to the appropriate agency. The agency then can approve the plan, disapprove the plan, or approve the plan with conditions.

The RL NOC for the control of toxic air emissions (DOE 1995) was approved by Ecology contingent on additional conditions (WDOE 1995). Likewise, the RL NOC for the control of radioactive air emissions (DOE 1997) was approved by the EPA (Frankel 1997) and approved, contingent on additional conditions, by the WDOH (WDOH 1997). The DOE provided additional information to describe how the additional conditions would be satisfied (Rasmussen 1998a and Rasmussen 1998b), and the regulatory agencies approved the proposals (Conklin 1998 and Hensley 1998).

As a result of the interactions with the regulators, several design changes were made. The HEPA filter housing was improved to allow the two HEPA filters to be tested individually, and additional emission monitoring was installed to allow continuous monitoring (a record sampler) to monitor, collect, and measure radionuclides as required by 40 CFR 61, Subpart H, (CFR 1996). In addition, a continuous monitor was added to measure gross radiation activity in the filtered air stream as required by the Hanford Site Environmental Procedure (CHG 1999c). The emission monitoring was added because the WDOH determined that the exhauster's potential-to-emit exceeded 0.1 mrem/year effective dose equivalent.

The environmental design requirements are listed in Table 2.

6.1.2.3 Major Design Codes

The design codes of particular interest to exhauster design are component design (ASME 1989b, ASME 1989c, and ASME 1994) and electrical design (NFPA 1996). Component design compliance is accomplished according to the NOCs, functional design criteria, and supplemental letters between RL and the WDOH (where exceptions to ASME 1989b requirements are discussed).

6.1.2.4 Other Requirements

Design features that the Design Authority considers to be important to the exhauster are listed in Table 2 under the 'Other Requirements' heading. These requirements typically ensure that the exhauster will be reliable and more easily maintained and operated.

6.1.3 Permit Changes

Changes to the exhauster components must meet all the requirements for the original system, as a minimum. These requirements are listed in the DCM. In addition to meeting the listed design requirements, design changes that affect the air emissions or system as described in the NOC must be approved by the regulatory authority. Changes that will require approval include flow rate increase, prefilter efficiency decrease, and sampling equipment that does not meet CFR 1996.

6.2 ROTARY MODE CORE SAMPLING TRUCKS

There are two rotary mode core sampling truck systems, designated HO-68K-4600 (Truck #3) and HO-68K-4647 (Truck #4). Design configuration of these trucks is maintained on drawings, including assembly drawing H-2-690000.

6.2.1 Functional Characteristics

The RMCS trucks perform all the sampling operations and are the central feature of the tank waste sampling equipment. The other subsystems, such as the exhausters and the nitrogen supply trailers, support the truck operations. The truck and the support equipment is moved from tank to tank to perform sampling operations and will be used year round. The truck delivers a sample collection unit (universal sampler) to the waste, drills into the waste to collect the sample, retrieves the sample unit to grade level, delivers the sampler to the X-Ray subsystem, and then loads the sampler into a cask for shipment to the waste laboratory for analysis. Pressurized nitrogen is supplied to the truck during drilling to cool the drill bit, clear cutting debris, and purge flammable gases from the drill assembly.

To perform these operations, the truck is equipped with a shielded receiver assembly to deliver and retrieve the sampler, a drill rig to insert and turn the drill string, and a grapple hoist to hold the vertical position of the sampler piston while the drill penetrates the waste. All this equipment is located on the truck's platform that rotates as needed to align the equipment with the tank riser and the support systems.

The truck interfaces with the tank riser, the universal sampler, the exhauster, the nitrogen supply trailer, casks, distribution trailer, X-Ray cart, breathing air compressor, and a portable generator.

The RMCS system is exposed to the Hanford climate (FDNW 1997), natural phenomena (CHG 1997a), and the tank waste environmental conditions. The tank waste environmental conditions and the outdoor environmental conditions are listed in Table 1. The system must operate under the waste conditions and be constructed of material that is compatible with the waste environment. The system must also be designed to operate outdoors. Operation may be limited by administrative controls during extreme weather conditions.

The electrical connectors for RMCSTs 3 and 4 that connect to the interfacing equipment (Exhauster, Distribution Trailer, X-Ray Cart, and the Breathing Air Compressor) must be compatible with the connectors installed on the interfacing equipment. In addition, the Trucks must remain mechanically compatible with the hose fitting for the nitrogen supply trailer. Furthermore, RMCST 3 must remain interchangeable with RMCST 4 to facilitate continuous Rotary Mode Core Sampling.

6.2.2 Constraints

The constraints described here were imposed on or by the project to ensure that the equipment designed to meet the functional requirements is also designed within the accepted safety envelope, is in compliance with environmental regulations and pertinent design codes, and meets the operability standards considered important by the project and the Design Authority.

6.2.2.1 Safety Requirements

The safety requirements protect the tank from damage caused by pressure excursions and waste fires. Compliance with the safety requirements ensures that the personnel, the public, and the environment are not exposed to unacceptable risks of radiation and contamination. Pressure excursions caused by ignition of flammable gases are addressed in one set of safety documentation and pressure excursions caused by waste fires are addressed in a second set of safety documentation. The requirements related to sampling tanks containing flammable gases are described in Tank Waste Remediation System Final Safety Analysis Report (FSAR) (CHG 1999) and in the technical safety requirements (TSR) (CHG 1998c). The requirements related to toxicological exposure and other safety-related issues are described in the RMCS safety assessment (LANL 1997).

During sampling operations, there are actions that expose the workers to radiation and contamination. For example, the radioactive waste samples will be brought to the surface through the drill string, and the drill string will be separated to allow removal of the sampler. Also, to add sections to the drill string, the string must be separated, increasing the potential for contamination to spread. To minimize personnel exposure, the truck must be designed in accordance with the RPP ALARA Program (CHG 1997b).

6.2.2.2 Environmental Regulations

There are no environmental regulations for the RMCS trucks that are unique to the RMCS activity and none that have a significant impact on the truck design.

6.2.2.3 Major Design Codes

The parts of the system potentially exposed to waste are purged with pressurized nitrogen. These parts and the purge gas piping itself must meet the applicable sections of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME 1989a). Pressure vessels in the system are to have an ASME code stamp. Electrical design is to be in accordance with the National Electric Code (NFPA 1996).

6.2.2.4 Other Requirements

Design features that the Design Authority considers being important to the RMCS trucks are listed in Table 2 under the heading 'Other Requirements'. These requirements typically ensure that the trucks will be reliable and more easily maintained and operated.

6.3 UNIVERSAL SAMPLER SYSTEM

The samplers are disposable devices. New samplers are used to collect each segment of waste. Sampler design configuration is maintained by drawing H-2-690140.

6.3.1 Functional Characteristics

The universal sampler is the vessel used to reliably collect and retain up to a 19-inch-long waste sample. The sampler is installed through the drill string and, once in position, is designed to prevent tank waste and tank gases from entering the drill string. The shielded receiver assembly installs and retrieves the sampler.

The remote latch unit secures and releases the universal sampler in the core barrel. The hydrostatic head balancing system maintains a positive pressure in the drill string to prevent tank waste and tank gases from entering the drill string when the sampler is not locked in the sampling position.

The sampler interfaces with the sampler hoist assembly, the drill string, the grapple, the grapple hoist assembly, a remote latching mechanism, the shielded receiver tube, the X-Ray cart, the shipping cask, and the waste analysis laboratory.

The RMCS system is exposed to the Hanford climate (FDNW 1997), natural phenomena (CHG 1997a), and the tank waste environmental conditions. The tank waste environmental conditions and the outdoor environmental conditions are listed in Table 1. The system must operate under the waste conditions and be constructed of material that is compatible with the waste environment. The system must also be designed to operate outdoors. Operation may be limited by administrative controls during extreme weather conditions.

Use of the rotary mode sampler with the push mode core sample bit during rotary mode core sampling is prohibited and will shut down the core sample truck. However, use of the use of the push mode sampler with the rotary mode core sample bit during rotary mode core sampling is permitted and will not shut down the core sample truck.

6.3.2 Constraints

The constraints described here were imposed on or by the project to ensure that the equipment designed to meet the functional requirements is also designed within the accepted safety envelope, is in compliance with environmental regulations and pertinent design codes, and meets the operability standards considered important by the project and the Design Authority.

6.3.2.1 Safety Requirements

The safety requirements associated with the universal sampler protect the tank from damage caused by pressure excursions. Compliance with the safety requirements ensures that the personnel, the public, and the environment are not exposed to unacceptable risks of radiation and contamination. Pressure excursions caused by ignition of flammable gases are addressed in the FSAR (CHG 1999) and in the TSR (CHG 1998c).

During sampling operations there are actions that expose the workers to radiation and contamination. For example, the radioactive waste samples will be brought to the surface through the drill string and the drill string will be separated to allow removal of the sampler. To minimize personnel exposure, the sampler must be designed in accordance with the RPP ALARA Program (CHG 1997b).

6.3.2.2 Environmental Regulations

The materials of construction for the universal sampler must conform to the EPA water sampling requirements (EPA 1986).

6.3.2.3 Major Design Codes

There are no major design codes applicable to the universal sampler.

6.3.2.4 Other Requirements

Design features that the Design Authority considers to be important to the Universal Sampler System are listed in Table 2 under the 'Other Requirements' heading. These requirements typically ensure that the system will be reliable and more easily maintained and operated.

6.4 DIESEL GENERATOR SYSTEM

There are five diesel generator systems. Their trailer numbers are HO-74-4761, HO-74-4793, HO-74-4984, HO-74-4985, and HO-74-6033. Design configuration of the electrical connections is maintained on drawings H-2-827188, H-2-827189, H-2-827192, and H-2-827193.

6.4.1 Functional Characteristics

The generators are portable and diesel powered and supply all the electrical power required by the RMCS System. The system must also be designed to operate outdoors. Operation may be limited by administrative controls during extreme weather conditions.

The generators interface with the service trailer, distribution trailer, breathing air compressor, and nitrogen supply trailer.

The electrical connectors for Generators A, B, C, and E that connect to the interfacing equipment (Distribution Trailer, Service Trailer, and Breathing Air Compressor) must be compatible with the connectors installed on the interfacing equipment. Furthermore, the phase rotation of the wiring at the power connectors to the distribution trailer and Breathing Air Compressor must be in the correct direction. In addition, all four diesel generators must remain interchangeable to facilitate continuous Rotary Mode Core Sampling.

6.4.2 Constraints

The constraints described here were imposed on or by the project to ensure that the equipment designed to meet the functional requirements is also designed within the accepted safety envelope, is in compliance with environmental regulations and pertinent design codes, and meets the operability standards considered important by the project and the Design Authority.

6.4.2.1 Safety Requirements

There are no safety requirements for the Diesel Generator System that are unique to the RMCS activity and that affect the Diesel Generator System design other than those contained in the design codes.

6.4.2.2 Environmental Regulations

There are no environmental statutes applicable to the Diesel Generator System that are unique to the RMCS activity.

6.4.2.3 Major Design Codes

The design code of particular interest to the diesel generator design is the National Electric Code (NFPA 1996).

6.4.2.4 Other Requirements

Design features that the Design Authority considers to be important to the diesel generators are listed in Table 2 under the 'Other Requirements' heading. These requirements typically ensure that the generators will be reliable and more easily maintained and operated.

6.5 DISTRIBUTION TRAILER

There are three distribution trailers. Their trailer numbers are HO-64-3532, HO-64-3533, and HO-64-3540. Design configuration of the trailers is maintained by drawings, including assembly drawing H-2-85350.

6.5.1 Functional Characteristics

The distribution trailer is portable and contains the electrical equipment and cables required to distribute power to the RMCS equipment. The system must also be designed to operate outdoors. Operation may be limited by administrative controls during extreme weather conditions.

The trailer interfaces with the diesel generator, the drill rig instruments, the auxiliary air compressor, the exhauster, the X-Ray cart, the convenience power box, and the core sampler support trucks. The electrical connectors for Distribution Trailers B, C, and D that connect to the interfacing equipment (Exhauster, Air Compressor, Support Truck, X-Ray Cart, Propane Heater, and Portable Generator) must be compatible with the connectors installed on the interfacing equipment. In addition, the trucks must remain mechanically compatible with the hose fitting for the nitrogen supply trailer. Furthermore, the phase rotation associated with the power wiring to the exhausters must be in the proper direction. Finally, all three distribution trailers must remain interchangeable to facilitate continuous Rotary Mode Core Sampling.

6.5.2 Constraints

The constraints described here were imposed on or by the project to ensure that the equipment designed to meet the functional requirements is also designed within the accepted safety envelope, is in compliance with environmental regulations and pertinent design codes, and meets the operability standards considered important by the project and the Design Authority.

6.5.2.1 Safety Requirements

There are no special safety requirements for the distribution trailer other than those contained in the design codes.

6.5.2.2 Environmental Regulations

There are no environmental statutes that regulate the design of the distribution trailer that are unique to the RMCS activity.

6.5.2.3 Major Design Codes

The design code of particular interest to the distribution trailer is the National Electric Code (NFPA 1996).

6.5.2.4 Other Requirements

Design features that the Design Authority considers to be important to the distribution trailer are listed in Table 2 under the 'Other Requirements' heading. These requirements typically ensure that the trailer will be reliable and more easily maintained and operated.

6.6 X-RAY CART SYSTEM

There are four X-Ray Cart Systems. Their trailer numbers are HO-64-5979, HO-64-6042, HO-64-6043, and HO-64-6044. Design documentation is maintained in vendor index file number 22772.

6.6.1 Functional Characteristics

The X-Ray Cart System is portable and provides real time radiography of core samples.

The X-Ray Cart System interfaces with the shielded receiver of the RMCS truck and the distribution trailer.

The system must be capable of operation between exterior temperatures of 32 and 105 degrees Fahrenheit. This operating temperature range is more limiting than any specified operating temperature limit for the other RMCS subsystems.

The X-Ray Cart must be mechanically compatible with the shielded receiver and electrically compatible with the Distribution Trailers. All three of the operating X-Ray Carts must be interchangeable to facilitate Rotary Mode Core Sampling

6.6.2 Constraints

The constraints described here were imposed on or by the project to ensure that the equipment designed to meet the functional requirements is also designed within the accepted safety envelope, is in compliance with environmental regulations and pertinent design codes, and meets the operability standards considered important by the project and the Design Authority.

6.6.2.1 Safety Requirements

Although precautions are taken to clean the samplers, they still retain some external contamination. The repeated insertion and removal of samples in the X-Ray chamber will lead to an accumulation of contamination. To minimize personnel exposure, the design must be in accordance with the RPP ALARA program (CHG 1997b). Safety requirements are also specified in the design codes.

6.6.2.2 Environmental Regulations

There are no environmental statutes that significantly affect the design of the X-Ray Cart System that are unique to the RMCS activity.

6.6.2.3 Major Design Codes

X-Ray systems must meet the shielding and safety requirements specified in the Code of Federal Regulations (CFR 1997a), Washington Administrative Code (WAC 1997), and national standards (ANSI 1993b).

6.6.2.4 Other Requirements

Design features that the Design Authority considers to be important to the X-Ray Cart System are listed in Table 2 under the 'Other Requirements' heading. These requirements typically ensure that the system will be reliable and more easily maintained and operated.

6.7 BREATHING AIR COMPRESSOR

There is one breathing air compressor. Its trailer number is HO-64-4963. Design configuration is maintained on drawings, including assembly drawing H-2-85287.

6.7.1 Functional Characteristics

The breathing air compressor is a portable, electric-motor-driven unit that supplies Grade D breathing air for up to 12 people. The system must be designed to operate outdoors. Operation may be limited by administrative controls during extreme weather conditions.

The compressor interfaces with the diesel generators, the personnel breathing apparatus, and the RMCS truck.

The electrical connectors on the Breathing Air Compressor must be compatible with those on the portable generator. The phase orientation of the breathing air compressor wiring must be matched to the phase orientation of the diesel generator. The Breathing Air Compressor must be compatible with the personnel breathing apparatus. If addition Breathing Air Compressors are procured, they must be interchangeable with the existing Breathing Air Compressor to facilitate continuous Rotary Mode Core Sampling.

6.7.2 Constraints

The constraints described here were imposed on or by the project to ensure that the equipment designed to meet the functional requirements is also designed within the accepted safety envelope, is in compliance with environmental regulations and pertinent design codes, and meets the operability standards considered important by the project and the Design Authority.

6.7.2.1 Safety Requirements

The compressor must provide air that meets the breathing air quality standards per 29 CFR 1910 Subpart I (CFR 1997b).

6.7.2.2 Environmental Regulations

There are no environmental statutes that regulate the design of the breathing air compressor that are unique to the RMCS activity.

6.7.2.3 Major Design Codes

The major design codes of particular interest to the breathing air compressor design are the ASME Boiler and Pressure Vessel Code (ASME 1989a) and the National Electric Code (NFPA 1996). The pressurized tanks require an ASME code stamp. The trailer must meet the Department of Transportation (DOT) requirements (CFR 1995).

6.7.2.4 Other Requirements

Design features that the Design Authority considers to be important to the breathing air compressor design are listed in Table 2 under the 'Other Requirements' heading. These requirements typically ensure that the nitrogen supply will be reliable and more easily maintained and operated.

6.8 NITROGEN SUPPLY TRAILERS

There are three nitrogen supply trailers. Their trailer numbers are HO-64-4966, HO-64-4968, and HO-64-5170. Trailer design configuration is maintained on drawing H-9-000174.

6.8.1 Functional Characteristics

The nitrogen supply trailers provide the purge gas and hydrostatic head gas at the proper temperature, pressure, and rate of flow. The system must be designed to operate outdoors. Operation may be limited by administrative controls during extreme weather conditions.

The Nitrogen Supply Trailers interface with the nitrogen gas system on the RMCST via a hose fitting that must be compatible with the RMCST hose connector. Nitrogen Trailers A, B, and C must all be interchangeable to facilitate continuous Rotary Mode Core Sampling.

6.8.2 Constraints

The constraints described here were imposed on or by the project to ensure that the equipment designed to meet the functional requirements is also designed within the accepted safety envelope, is in compliance with environmental regulations and pertinent design codes, and meets the operability standards considered important by the project and the Design Authority.

6.8.2.1 Safety Requirements

There are no special safety requirements that significantly affect the design of the nitrogen supply trailer and are unique to the RMCS activity.

6.8.2.2 Environmental Regulations

There are no environmental statutes that regulate the designs of the nitrogen supply trailer that are unique to the RMCS activity.

6.8.2.3 Major Design Codes

The trailer must comply with DOT requirements for the transport of nitrogen, the National Electric Code (NFPA 1996), and the ASME Boiler and Pressure Vessel Code (ASME 1989a). Trailers using propane and a water heater loop must comply with the DOT requirements for the transport of propane.

6.8.2.4 Other Requirements

Design features that the Design Authority considers to be important to the nitrogen supply trailer are listed in Table 2 under the 'Other Requirements' heading. These requirements typically ensure that the nitrogen supply will be reliable and more easily maintained and operated.

6.9 CASKS AND CASK TRUCKS

There are four cask trucks. Their numbers are HO-IC-0254, HO-IC-0255, HO-IC-2247, and HO-IC-2248. Design configuration of the trucks is maintained by drawings H-2-83320 and H-2-83324. There are 126 on-site transfer casks, each built to drawing H-2-38079.

6.9.1 Functional Characteristics

The casks contain the samplers with captured waste samples and provide shielding. The cask truck loads and transports up to three casks at a time to the characterization laboratories. The system must be designed to operate outdoors. Operation may be limited by administrative controls during extreme weather conditions.

The casks interface with the universal sampler, the shielded receiver assembly, and the waste laboratory receiving system.

6.9.2 Constraints

The constraints described here were imposed on or by the project to ensure that the equipment designed to meet the functional requirements is also designed within the accepted safety envelope, is in compliance with environmental regulations and pertinent design codes, and meets the operability standards considered important by the project and the Design Authority.

6.9.2.1 Safety Requirements

The casks must withstand normal and accident loads as described in *Safety Analysis Report for Packaging (Onsite) Onsite Transfer Cask* (WMFS 1998) and protect the worker from exposure to excessive radiation and high cask surface temperature (WMFS 1998). The contents of the cask for samples from flammable gas storage tanks is limited to 500 cc of waste.

6.9.2.2 Environmental Regulations

There are no environmental statutes that regulate the design of the casks and cask trucks that are unique to the RMCS activity.

6.9.2.3 Major Design Codes

The design is specified in the safety analysis report for packaging (WMFS 1998) and must be in accordance with applicable sections of the ASME Boiler and Pressure Vessel Code (ASME 1996a) and federal regulations for transport of radioactive materials (CFR 1988 and CFR 1995).

6.9.2.4 Other Requirements

Design features that the Design Authority considers to be important to the casks and cask trucks are listed in Table 2 under the 'Other Requirements' heading. These requirements typically ensure that the casks and cask trucks will be reliable, and more easily maintained and operated.

6.10 SERVICE TRAILER

There are two service trailers. Their trailer numbers are HO-64-3523 and HO-64-3524. Design configuration of the trailers is maintained by drawings, including assembly drawing H-2-79842.

6.10.1 Functional Characteristics

The service trailer is portable and provides enclosed equipment storage and personnel area.

The Service Trailer interfaces with the portable distribution trailer. The electrical connector on the Service Trailer must be able to interface with the connector on the portable generator. Service Trailers A and B must be interchangeable to facilitate continuous Rotary Mode Core Sampling.

6.10.2 Constraints

The constraints described here were imposed on or by the project to ensure that the equipment designed to meet the functional requirements is also designed within the accepted safety envelope, is in compliance with environmental regulations and pertinent design codes, and meets the operability standards considered important by the project and the Design Authority.

6.10.2.1 Safety Requirements

There are no special safety requirements for the service trailer other than those contained in the design codes.

6.10.2.2 Environmental Regulations

There are no environmental statutes that regulate the design of the service trailer that are unique to the RMCS activity.

6.10.2.3 Major Design Codes

The trailer must meet DOT requirements (CFR 1995) and the National Electric Code (NFPA 1996).

6.10.2.4 Other Requirements

Design features that the Design Authority considers to be important to the service trailer are listed in Table 2 under the 'Other Requirements' heading. These requirements typically ensure that the trailers will be reliable and more easily maintained and operated.

6.11 CORE SAMPLING RISER EQUIPMENT

The core sampling riser equipment consists of the pipe wiper and drill rod washer. Other equipment may be required to attach the listed equipment to the riser to be sampled.

Drawings H-2-690134, H-2-99346 and H-2-99347 depict the core sampling riser arrangement.

6.11.1 Functional Characteristics

The drill rod washer is a ring of spray nozzles used to remove radioactive waste from the drill string and is used in conjunction with the pipe wiper. The pipe wiper is a small rubber disk with a hole in the center sized to allow the drill string to pass through while maintaining a tight seal. These two items are used to minimize personnel as well as environmental exposure to radioactive material. For this reason, the drill string and pipe wiper must be designed in accordance with the RPP ALARA Program (CHG 1997b).

6.11.2 Constraints

The constraints described here were imposed on or by the project to ensure that the equipment designed to meet the functional requirements is also designed within the accepted safety envelope, is in compliance with environmental regulations and pertinent design codes, and meets the operability standards considered important by the project and the Design Authority.

6.11.2.1 Safety Requirements

During sampling operations, there are actions that expose the workers to radiation and contamination. To minimize personnel exposure, the drill string and pipe wiper must be designed in accordance with the RPP ALARA Program.

6.11.2.2 Environmental Regulations

There are no environmental statutes that regulate the design of core sampling riser equipment that are unique to the RMCS activity.

6.11.2.3 Major Design Codes

As currently designed, there are no major design codes that are applicable to the design of core sampling riser equipment.

6.11.2.4 Other Requirements

Design features that the Design Authority considers to be important to core sampling riser equipment are listed in Table 2 under the 'Other Requirements' heading. These requirements typically ensure that core sampling riser equipment will be reliable and more easily maintained and operated.

6.12 CORE SAMPLE SUPPORT TRUCKS

There are two core sample support trucks, which are designated HO-01C-428 and HO-01C-185. Design configuration of the spray wash trucks is maintained by drawings H-2-81853 and H-2-829939.

6.12.1 ctional Characteristics

The Core Sample Support Trucks must provide high-pressure two molar lithium bromide solution or water to the cable spray washer and the drill string spray washer. The Core Sample Support Trucks also provide secure, lockable, control of drill rod segments for specific cores.

The Core Sample Support Trucks interfaces with the distribution trailer (Section 6.5). The electrical connector on the Core Sample Support Trucks must interface with the electrical connector on the distribution trailer.

6.12.2 Constraints

The constraints described here were imposed on or by the project to ensure that the equipment designed to meet the functional requirements is also designed within the accepted safety envelope, is in compliance with environmental regulations and pertinent design codes, and meets the operability standards considered important by the project and the Design Authority.

6.12.2.1 Safety Requirements

There are no special safety requirements for the Core Sample Support Trucks other than those contained in the design codes.

6.12.2.2 Environmental Regulations

There are no environmental statutes that regulate the design of the Core Sample Support Trucks that are unique to the RMCS activity.

6.12.2.3 Major Design Codes

The Core Sample Support Trucks must meet DOT requirements (CFR 1995) and the National Electric Code (NFPA 1996).

6.12.2.4 Other Requirements

Design features that the Design Authority considers to be important to the service trailer are listed in Table 2 under the 'Other Requirements' heading. These requirements typically ensure that the Core Sample Support Trucks will be reliable and more easily maintained and operated.

6.13 RAMPS AND PLATFORMS

There are four platforms and four sets of two ramps. Design configuration of the ramps and platforms is maintained by drawing H-2-85633.

6.13.1 Functional Characteristics

Dimensionally the ramps and platform assemblies must provide for the driving of a core sample truck from ground level to the top of a platform, also, the ramps and platforms must support the weight of a 35,000 lb. core sample truck.

6.13.2 Constraints

The constraints described here were imposed on or by the project to ensure that the equipment designed to meet the functional requirements is also designed within the accepted safety envelope, is in compliance with environmental regulations and pertinent design codes, and meets the operability standards considered important by the project and the Design Authority.

6.13.2.1 Safety Requirements

There are no special safety requirements for the ramps and platforms other than those contained in the design codes.

6.13.2.2 Environmental Regulations

There are no environmental statutes that regulate the design of the ramps and platforms that are unique to the RMCS activity.

6.13.2.3 Major Design Codes

The ramps and platforms must meet the American Institute of Steel Construction requirements for structural steel design (AISC 1989).

6.13.2.4 Other Requirements

Design features that the Design Authority considers to be important to the ramps and platforms are listed in Table 2 under the 'Other Requirements' heading. These requirements typically ensure that the ramps and platforms will be reliable and more easily maintained and operated.

6.14 FOOT CLAMP

The foot clamp is a pneumatically operated device used to hold the drill string in a fixed vertical position while the drill string is not supported by other means. Design configuration of the foot clamp is maintained by drawing H-2-690138.

6.14.1 Functional Characteristics

The foot clamp shall hold the drill string in a fixed vertical position when the drill string is not supported by other means and shall interface with the Core Sampling System.

6.14.2 Constraints

The constraints described here were imposed on or by the project to ensure that the equipment designed to meet the functional requirements is also designed within the accepted safety envelope, is in compliance with environmental regulations and pertinent design codes, and meets the operability standards considered important by the project and the Design Authority.

6.14.2.1 Safety Requirements

The safety requirements protect the tank from damage caused by pressure excursions and waste fires. Compliance with the safety requirements ensures that the personnel, the public, and the environment are not exposed to unacceptable risks of radiation and contamination. Pressure excursions caused by ignition of flammable gases are addressed in one set of safety documentation and pressure excursions caused by waste fires are addressed in a second set of safety documentation. The requirements related to sampling tanks containing flammable gases are described in Tank Waste Remediation System Final Safety Analysis Report (FSAR) (CHG 1999) and in the technical safety requirements (TSR) (CHG 1998c). The requirements related to toxicological exposure and other safety-related issues are described in the RMCS safety assessment (LANL 1997).

During sampling operations, there are actions that expose the workers to radiation and contamination. To minimize personnel exposure, the drill string and pipe wiper must be designed in accordance with the RPP ALARA Program (CHG 1997b).

6.14.2.2 Environmental Regulations

There are no environmental statutes that regulate the foot clamp that are unique to the RMCS activity.

6.14.2.3 Major Design Codes

Electrostatic ignition sources shall be controlled by providing bonding or grounding according to NFPA 1993.

6.14.2.4 Other Requirements

Design features that the Design Authority considers to be important to the foot clamp are listed in Table 2 under the 'Other Requirements' heading. These requirements typically ensure that the foot clamp will be reliable and more easily maintained and operated.

6.15 PURGED CAMERA SYSTEM

The baseline design requirements for the Purged Camera System are found in the *Specification for Purged Camera System* (LMHC 1999). The Purged Camera System is not used exclusively by CPO, therefore, the baseline design requirements are maintained in the referenced document.

6.15.1 Functional Characteristics

The purged camera system provides a means of viewing and recording a radioactive waste tank vapor space. As a minimum, the camera system must fit in a 4 in. schedule 80 riser with a Class-150 flange on top and be able to extend 50 feet through the riser into the tank vapor space. The camera/light module must be mounted on a pan and tilt head capable of 350 deg. of pan and from "straight down" to 60 deg. above the vertical.

6.15.2 Constraints

The constraints described here were imposed on or by the project to ensure that the equipment designed to meet the functional requirements is also designed within the accepted safety envelope, is in compliance with environmental regulations and pertinent design codes, and meets the operability standards considered important by the project and the Design Authority.

Since the tank vapor space is not lighted and it is also considered a flammable gas environment, a means of lighting must be provided and it must be purge with nitrogen gas per NFPA 496, Type X. In order to prevent electrostatic ignition of flammable gas the purged camera system must be bonded or grounded per NFPA 77. Power to the purged camera system will be a 120 VAC, 60 HZ, 15-amp Ground Fault Circuit Interrupt.

7.0 DESIGN SOLUTION

For each design requirement, Table 2 lists the design attribute that satisfies the requirement. For requirements that apply to a specific component, the component is identified. With respect to safety, additional information on the safety function fulfilled and how it is fulfilled by a specific component may be found in the safety equipment list (SEL) (LMHC 1997a).

8.0 DESIGN VERIFICATION

The last two columns in the DCM table of requirements, Table 2, are not completed as part of this document but are provided to assist in future design verification activities. The table provides a convenient checklist to verify that design changes comply with all the design requirements. The table may also be used to support other activities such as readiness reviews.

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WMFS, 1998, *Safety Analysis Report for Packaging (Onsite) Onsite Transfer Cask*, WHC-SD-TP-SARP-002, Rev. 1e, Waste Management Federal Services, Richland, Washington.

APPENDIX A: Table 1. Tank Waste and Environmental Conditions

Table 1. **Tank Waste and Environmental Conditions**

Tank Waste Vapor	The vapor temperature is between 0° and 71°C- (32° and 130°F).
	The relative humidity is between 15% and 100%.
	The waste suspended in the air space has a pH factor that, generally, is between 12 and 14 but in some tanks may be as low as 8 or 9.
	Toxic compounds in the vapor may include up to 930 parts per million (p/m) ammonia and 1.5 p/m nitric oxide.
	The vapor may contain flammable gases.
Tank Waste (liquid and solids)	The waste temperature is between 13° and 90°C (55° and 194°F).
	The pH factor is, generally, between 12 and 14 but in some tanks may be as low as 7 (WHC 1992).
	Debris in the waste may include rocks and tools.
	Chemical compounds in the liquid, sludge and salt cake include sodium nitrate, sodium nitrite, organic compounds, fluorides, and chlorides.
	Radioactivity is 1000 R/hr or less at contact.
Outdoor Equipment - Operating Environment Administrative Control Limits	Operation management approval is required to operate the system when the air temperature is below -7°C (20°F).
	Operation will be terminated when sustained wind speeds exceed 48 km/hr (30 miles/hr) (CHG 1999a)
Outdoor Equipment - Storage Environment	The air temperature is between -23° and 43°C (-10 and 110°F).
	The wind speed is up to 129 km/hr (80 miles/hr).
	The conditions include blowing dust, sand, rain, and snow.

APPENDIX B: Table 2. Baseline Design Compliance Matrix

Table 2. **Baseline Design Compliance Matrix**

I	EXHAUSTER SYSTEM
II	ROTARY MODE CORE SAMPLE TRUCKS
III	UNIVERSAL SAMPLER SYSTEM
IV	DIESEL GENERATOR SYSTEM
V	DISTRIBUTION TRAILER
VI	X-RAY CART SYSTEM
VII	BREATHING AIR COMPRESSOR
VIII	NITROGEN SUPPLY TRAILER
IX	CASKS AND CASK TRUCKS
X	SERVICE TRAILERS
XI	CORE SAMPLE RISER EQUIPMENT
XII	CORE SAMPLE SUPPORT TRUCKS
XIII	RAMPS AND PLATFORMS
XIV	FOOT CLAMP

When requirement sources/basis documents have been revised, superceded, or deleted, the latest revision or document is referenced if the criteria/requirement have not changed. In the event that a revision, supercedure, or deletion has modified the requirement, the original referenced document is listed, or the new requirement is referenced in the matrix if compliance is required.

TABLE 2. BASELINE DESIGN COMPLIANCE MATRIX
I - EXHAUSTER SYSTEM

	REQUIREMENTS					SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
	enter functional or design criteria exactly as stated in the requirements source document	enter source doc.	enter origin of requirement if other than Source	Performance Ext. Interface Safety Environmental Design Code Other	enter all additional information which amplifies, qualifies, justifies, ..etc. the criteria statement.	describe the manner in which the design purports to fulfill the criteria statement - be as specific as possible.	enter component name if Source is specific	provide ref. for design attribute (drawing, procedure, spec....etc.)	provide discussion on method, evidence, reasoning used, ...etc., to verify that the design complies with requirements - be specific - include any qualifications, if appropriate.	person or group attesting to verif. (initialed)
1	The system shall be designed to prevent HEPA bypass and fugitive emissions.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	ASME N509 (ASME 1989b) / AG-1 (ASME 1994)	1 Performance	General Construction	Meets ASME N509 and AG-1	Filter Train	H-2-821455		
2	The exhauster shall flow a constant nominal 5.66 cubic meter per minute +/-1.42 (200 +/- 50 scfm) flow from the stack.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	1 Performance	The exhauster is sized and set to remove 200 scfm which is in excess of the anticipated purge gas flow rate of 100 scfm.	Exhauster flow of 200 +/- 50 scfm	System	H-2-821455 H-2-818186		
3	All supplied equipment shall be new and suitable for use in the environment.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	1 Performance	General Construction	Equipment is compatible with Environmental Conditions (Table 3)	System	H-2-821455 H-2-818186		
4	All materials used shall be new, free of defects, and suitable for use in the environment.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	1 Performance	General Construction - Materials shall be compatible with their working environment as described in the table of Environmental Conditions	Material is compatible with the Environmental Conditions (Table 3)	System	H-2-821455 H-2-818186		
5	The skid shall be suitable for transportation between tanks, between tank farms, and on public highways.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Operation Input	1 Performance	General Construction	Transportable and compliant with standards for public highways	Skid	H-2-821456		
6	The RMCS exhauster is necessary to keep tank pressure at or below atmospheric pressure even in cases of maximum purge gas (2.8 cubic meters per min. or 100 scfm) usage.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	RPP-PRO-450 (CHG 1999b)	1 Performance	The system and exhaust fan are sized to remove in excess of 100 scfm to preclude pressurizing the tank.	Exhauster provides flow greater than 100 scfm	System	H-2-821455 H-2-818186		
7	The CSS shall have a design life of 5 years minimum.	WHC-SD-WM-FDC-048 Rev. 0 (WHC 1995a)	Engineering Judgment	1 Performance	Replaceable equipment and components may have a design life of fewer years.	Materials are compatible with the Environmental Conditions and failure is not expected	System	H-2-821455 H-2-818186		
8	All o-ring and seal material in contact with waste or waste gases shall be checked for compatibility with high ammonia concentrations and replaced as necessary.	WHC-SD-WM-FDC-048 Rev. 0 (WHC 1995a)	WHC-SD-WM-SAD-035 Rev. 0b Section 6.5.4.1 (LANL 1997)	1 Performance	Waste vapor may contain up to 930 p/m ammonia.	O-ring compatible with the waste environment	Gaskets	VI #22660 H-2-818202-15,16,17,19,20		
9	The exhauster shall operate on 480 volt, three-phase power, 60 Hz.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	2 External Interface	General Construction	Compatible connection with power supply	480V connection	H-2-818201 H-2-821455-36		

TABLE 2. BASELINE DESIGN COMPLIANCE MATRIX
I - EXHAUSTER SYSTEM

REQUIREMENTS						SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
10	The duct connection shall connect to a 12 inch 150# riser flange.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Interface Requirement	2 External Interface	General Construction	Compatible dimensions with the riser flange	Duct Connection	H-14-100740-1		
11	A normally open electrical contact which reliably conducts very low current and opens upon loss of exhaust stack flow shall be provided for core sample truck connection.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	WHC-SD-WM-SAD-035 Rev. 0b Section 6.8.7.6 (LANL 1997)	2 External Interface	Required Alarms and Shutdowns - Truck/Exhauster Interlock	Fail safe operation (fail open)	Truck Shutdown Relay	VI #22660 H-14-030122		
12	Any exhauster mechanical equipment in contact with the tank ventilation airstream shall be qualified for use in flammable gas environments. (Mechanical components in ventilation airstream. An exception to the non-sparking mechanical equipment requirement exists for slow moving parts.)	HNF-SD-WM SAR-067 Rev. 1c (CHG 1999c), Appendix E Table 4.3 Item 27 and Section 6.1.2.3		3 Safety/ AB	Ignition Sources. They shall be tested per national standards to show they are nonsparking or analyzed and shown not to be capable of causing an ignition. Equipment shall be approved for application by the FGEAB.	Fan is designed to meet ignition source control set 2	Fan	H-2-821455-99		
13	Any exhauster elec. components in contact with the tank ventilation airstream shall be suitable for operation in a Class 1, Division II, Group B atmosphere as defined in the 1996 edition of the NEC.	HNF-SD-WM TSR-006 Rev. 1d (CHG 1998c)	HNF-SD-WM-SAR-067 Rev. 1c (CHG 1999c)	3 Safety/ AB	Ignition Sources - Electrical components in contact with the tank airstream will meet the criterion listed or shall be approved for the application by the FGEAB.	Refer to SEL, HNF-SD-WM-SEL-044, (LMHC 1997a) - Electrical components meet ignition control set 2.	Electrical Components in ventilation airstream	H-2-821455 H-2-818186		
14	Exposed polymer materials shall be rendered incapable of electrostatic charge or discharge potential with sufficient energy to combust hydrogen.	HNF-SD-WM TSR-006 Rev. 1d (CHG 1998c)	HNF-SD-WM-SAR-067 Rev. 1c (CHG 1999c)	3 Safety/ AB	Ignition Sources. All non metals exposed to the airstream shall be tested or shall be approved for the application by the FGEAB.	Low surface resistivity of non-metals meet ignition source control set 2.	Riser connection (duct), Bellows, Gaskets (Non-metals in airstream)	H-2-821455-98/ H-2-821455-55		
15	The exhauster shall be constructed as to ensure that all of the ESD components are bonded via intimate contact with the surrounding metal components.	HNF-SD-WM TSR-006 Rev. 1d (CHG 1998c)	HNF-SD-WM-SAR-067 Rev. 1c (CHG 1999c)	3 Safety/ AB	Ignition Sources. All non metals exposed to the airstream are bonded to metals or shall be approved for the application by the FGEAB.	Riser connection, bellows, and gaskets are in intimate contact with metal components - meet ignition source control set 2	Riser connection, Bellows, Gaskets (Non-metals in airstream)	H-2-821455-98/ H-2-821455-55/ H-2-8218202-15,16,17,19,20		
16	Mech. equip. and materials shall be constructed of spark-resist. material, or shall be rendered incapable of sparking with sufficient energy to combust H2, or shall have been analyzed and eval. to be incapable of sparking with suff. energy to combust H2.	HNF-SD-WM TSR-006 Rev. 1d (CHG 1998c)	HNF-SD-WM-SAR-067 Rev. 1c (CHG 1999c)	3 Safety/ AB	Ignition Sources - Mechanical components in contact with the tank airstream will meet the criterion listed or shall be approved for the application by the FGEAB.	Meets ignition source control set 2	Fan	H-2-821455-99		
17	The exhauster shall automatically shut off when tank vacuum pressure exceeds the specific tank maximum vacuum pressure (Nominal 5.6 mm Hg (3 inches W.G.) vacuum.	HNF-SD-WM TSR-006 Rev. 1d (CHG 1998c)	WHC-SD-WM-SAD-035 Rev. 0b Section 6.8.7.4 (LANL 1997)	3 Safety/ AB	Required Alarms and Shutdowns	Exhauster shutdown on low tank pressure signal	Tank Pressure Sensor and Shutdown Circuit	H-2-821455-110/ H-14-030122		

TABLE 2. BASELINE DESIGN COMPLIANCE MATRIX
I - EXHAUSTER SYSTEM

REQUIREMENTS						SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
18	The HEPA filter housing design shall emphasize ease of exterior decontamination and shall be of the bag-in/bag-out type design.	HNF-SD-WM-FDC-025 Rev. 2 (LMHC 1997b)	ASME N509 (ASME 1989b) HNF-IP-0842, Volume VII, Section 1.1, Rev. 7b(CHG 1997b)	3 Safety/ ALARA	General Construction - Radiological Control	Minimize effort for exterior decontamination and is bag-in/bag-out design	Filter Train	H-2-821455		
19	As this exhauster is intended to move between tank farms, the design shall provide for containment during transportation.	HNF-SD-WM-FDC-025 Rev. 2 (LMHC 1997b)	HNF-IP-0842, Volume VII, Section 1.1, Rev. 7b(CHG 1997b)	3 Safety/ ALARA	General Construction - Radiological Control	Meets transportation design requirements for contaminated components	System	H-2-821455 H-2-818186		
20	The connection between the exhauster and the tank riser shall be flexible to allow for misalignment and elevation differences.	HNF-SD-WM-FDC-025 Rev. 2 (LMHC 1997b)	HNF-IP-0842, Volume VII, Section 1.1, Rev. 7b(CHG 1997b)	3 Safety/ ALARA	General Construction - Radiological Control	Duct is flexible	Riser Connection	H-2-821455-98		
21	Insulation shall be of closed cell type and shall not be exposed to the airstream to prevent moisture and contamination build-up.	HNF-SD-WM-FDC-025 Rev. 2 (LMHC 1997b)	HNF-IP-0842, Volume VII, Section 1.1, Rev. 7b(CHG 1997b)	3 Safety/ ALARA	General Construction - Radiological Control	Closed cell type	Insulation	VI #22660 H-2-821455		
22	The exhauster shall automatically shutdown and send a shutdown signal to the truck when pressure across the filter train exceeds 5.9 inches.	HNF-SD-WM-FDC-025 Rev. 2 (LMHC 1997b)	WHC-SD-WM-SAD-035 Rev. 0b Section 6.8.7.6 (LANL 1997)	3 Safety/ ALARA	Required Alarms and Shutdowns for Defense in Depth	Signal sent to exhauster and truck on high differential pressure activates exhauster shutdown and truck shutdown.	Differential Pressure Switch	H-2-821455 H-14-030122		
23	The exhauster shall automatically shutdown and send a shutdown signal to the truck if the stack flow increases above 7.1 cubic m. per min. (250 scfm) for a period of 5 min. or immediately when flow falls below 4.2 cubic m. per min. (150 scfm).	HNF-SD-WM-FDC-025 Rev. 2 (LMHC 1997b)	WHC-SD-WM-SAD-035 Rev. 0b Section 6.8.7.6 (LANL 1997)	3 Safety/ ALARA	Required Alarms and Shutdowns for Defense in Depth - The exhauster will shutdown automatically after 5 minutes of high flow but shutdown immediately for low flow	Automatic shutdown on high or low stack flow	Masstron Stack Flow Transmitter	VI #22660 H-14-030122		
24	HEPA filter housing radiological loading shall be limited to <100 mrem/hr contact dose rate	WHC-SD-WM-SAD-035 Rev. 0b Section 6.8.7.5 (LANL 1997)		3 Safety/ ALARA	If periodic radiation surveys indicate the dose rate exceeds the criteria, action, such as replacement of the filters, will be taken.	Filter is replaceable and housing minimizes contaminant capture	Filter Train	H-2-821455		
25	Effluent flow rate measurements shall be made using ref. method 2 or (if temp is between 0 and 50C) method 2A of 40CFR60 App. A. Measurement frequency may be periodic or continuous.	40 CFR 61, Subpart H (CFR 1996)		4 Environmental	Ref. method 2C is not identified as allowed in the source	Rate measuring equipment meets the standard or is permitted by the NOC and FEMP.	Effluent Monitor	H-2-829086-6		
26	Use Ref. method 1 of App. A of 40CFR60 to select monitoring or sampling sites.	40 CFR 61, Subpart H (CFR 1996)		4 Environmental	Radionuclides that could contribute >10% of the potential EDE shall be directly monitored or extracted, collected, and measured.	Monitoring location meets the standard or is permitted by the NOC and FEMP.	Effluent Monitor	H-2-829086 H-2-829087		
27	Radionuclides shall be monitored directly and continuously w/ an in line detector or representative sample withdrawn continuously from the sampling site (using guidance from ANSI N13.1-1969, includ. App. A).	40 CFR 61, Subpart H (CFR 1996)		4 Environmental	Radionuclides that could contribute >10% of the potential EDE shall be directly monitored or extracted, collected, and measured.	Continuous monitoring equipment meets the standard or is permitted by the NOC and FEMP.	Effluent Monitor	H-2-829087-11		

TABLE 2. BASELINE DESIGN COMPLIANCE MATRIX
I - EXHAUSTER SYSTEM

	REQUIREMENTS					SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
28	Radionuclides shall be collected and measured based on the principles of measurement in 40 CFR 61 App. B method 114.	40 CFR 61, Subpart H (CFR 1996)		4 Environmental	Radionuclides that could contribute >10% of the potential EDE shall be directly monitored or extracted, collected, and measured.	Appropriate radionuclide collection and measurement methods meet the standard or are permitted by the NOC and FEMP.	Effluent Monitor	H-2-829087-11		
29	The portable exhaust stack will be approximately 4.3 m (14 ft) high, with an effective height of more than 4.6 m (15 ft), and have a 10-cm (4-in) diameter duct.	DOE/RL-94-117 Rev. 0 (DOE 1995)		4 Environmental	The height of the stack allows for a reasonable dispersion of the exhaust before contact with workers.	Stack size	Stack	H-2-821455		
30	Both HEPA filters on the RMCS exhausters must be testable.	DOH, AIR 97-901 (WDOH 1997)	ASME N509 (ASME 1989b)	4 Environmental	Provides for higher confidence in filter integrity.	Ports and hardware as needed to individually test each HEPA filter	HEPA filters	VI# 22660		
31	The exhausters must operate as major designated NESHAPs stacks.	DOH, AIR 97-901 (WDOH 1997)		4 Environmental	Specific requirements are captured elsewhere in this table.	See specific requirements listed in this table	System	H-2-821455 H-2-818186		
32	When the exhauster operates, it must be continuously monitored, as required by 40 CFR 61. The monitoring systems must be fully compliant with ANSI N13.1.	DOH, AIR 97-901 (WDOH 1997)		4 Environmental	Specific requirements for 40 CFR 61 are included in this table. ANSI N13.1 is a guide and "shoulds" are not considered requirements. "Musts" are not more restrictive than the CFR.	Monitoring instruments and recording devices meet the standard or are permitted by the NOC and FEMP.	Monitoring	H-2-829086 H-2-829087		
33	The exhauster shall alarm when radiological emissions exceed alarm set points.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	HNF-SD-WM-TSR-006 Rev. 1d (CHG 1998c)	4 Environmental	LCO 3.1.4A is assumed to apply to the RMCS exhauster	Emission monitor (CAM) initiates an alarm	CAM and alarm	H-2-829086 H-2-829087		
34	The housing shall comply with the requirements of American Society of Mechanical Engineers (ASME) standard N509.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	WAC 246-247 (WAC 1995)	4 Environmental	General Construction	Meets ASME code	Filter Train	H-2-821455		
35	The HEPA filters shall meet the requirements of procurement specification HNF-S-0552 (FDH 1997b)	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	WAC 246-247 (WAC 1995)	4 Environmental	General Construction	Filters meet ASME AG-1 Section FC requirements	Filter Train	H-2-821455		
36	The HEPA filters shall be fire and moisture resistant.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	WAC 246-247 (WAC 1995)	4 Environmental	General Construction	Resistant to fire and moisture per ASME AG-1 Appendix FC-I	Filter Train	H-2-821455		
37	The housing shall be leak tested per ASME N510 section 6.5.3 at a test pressure of -5.98 kPa (24 in. W.G. vacuum).	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	WAC 246-247 (WAC 1995) and Engineering Judgement	4 Environmental	General Construction	Leak tight	Filter Train	H-2-821455		
38	The HEPA filter mounting frames shall be leak tested per ASME N510 sections 7 and 6.5.3 at a test pressure of -2.49 kPa (10 inches W.G. vacuum).	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	WAC 246-247 (WAC 1995) and Engineering Judgement	4 Environmental	General Construction	Leak tight	Filter Train	H-2-821455		

TABLE 2. BASELINE DESIGN COMPLIANCE MATRIX
I - EXHAUSTER SYSTEM

	REQUIREMENTS					SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
39	The (HEPA filter train) system shall be 99.95% efficient as tested per ASME N510. The HEPA filters shall be individually testable per the applicable sections of ASME N510 when installed.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	RPP-PRO-450 (CHG 1999b)	4 Environmental	General Construction	Overall filter efficiency is as described and testing hardware/access is provided	HEPA filters	VI# 22660		
40	The stack flow rate shall be fully instrumented with correction for temperature. The flow sensor shall be arranged such that it will provide flow totalization.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	RPP-PRO-450 (CHG 1999b)	4 Environmental	Accurate flow rate is needed to estimate emissions.	Flow rate sensor provides information to data logger for flow totalization.	Flow Rate Sensor	H-2-829087-12		
41	Sampling ports shall be available for sampling the air stream within the stack as required for HEPA aerosol testing per ASME N510 or other confirmatory sampling.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	RPP-PRO-450 (CHG 1999b)	4 Environmental	Sampling ports are required for performing HEPA tests.	Sampling Ports are present	Sampling Ports	H-2-818188-B,C		
42	The exhauster is attached to a tank riser by a flexible connector.	WDOE , Order No. NWP 95-RMCS(3) (WDOE1995)		4 Environmental	The flexible connector allows routing around the obstructions at the tank top.	Attachment is flexible	Riser Connector	H-2-821455 (98)		
43	A prefilter is located in the filter housing immediately upstream of two HEPA filters in series. After passing through the HEPA filters, the exhaust gas is released to the atmosphere through a 14 ft. stack.	WDOE , Order No. NWP 95-RMCS(3) (WDOE1995)		4 Environmental	General Construction	Filter arrangement and stack height	System	H-2-821455 H-2-818186		
44	The (exhaust) stack will contain an access port for monitoring both organic compounds (TOC) and ammonia.	WDOE , Order No. NWP 95-RMCS(3) (WDOE1995)		4 Environmental	Ports are provided for special monitoring if desired.	Presence of an access port	Monitoring	H-2-821455 sht 3		
45	The operation of sampling activity shall be stopped if the gaseous flow in the HEPA filters has more than 80 percent relative humidity at any time.	WDOE , Order No. NWP 95-RMCS(3) (WDOE1995)		4 Environmental	A minimum increase in gas temperature through the heater or direct measurement of the humidity will satisfy the criteria.	Humidity is measured directly or by inference from temperature measurements	System	H-2-821455-49 H-2-818186 VI# 22660		
46	Shall alarm at emission concentrations as low as possible without resulting in an excessive # of alarms due to normal fluctuations .	RPP-PRO-450 (CHG 1999b)		4 Environmental	For EDE > 0.1 mrem/yr	Proper alarm set point	Effluent Monitor	FEMP		
47	The flow volume totalizer shall record total sample volume in units of cu. meters.	RPP-PRO-450 (CHG 1999b)		4 Environmental	For EDE > 0.1 mrem/yr	Units of record	Effluent Monitor	H-2-829086		
48	Specific radionuclide analysis shall be required for all radionuclides that could contribute > 10% of the potential EDE, from the release point.	RPP-PRO-450 (CHG 1999b)		4 Environmental	For EDE > 0.1 mrem/yr	Appropriate monitoring/sampling equipment	Effluent Monitor	H-2-829087		
49	The design of monitoring equipment shall meet the intent of the guidance provided in the ANSI N13.1 and in Chap. 3.0, Section 3.5.8, of DOE/EH-0173T.	RPP-PRO-450 (CHG 1999b)		4 Environmental	Standard provides good practice guidelines	Appropriate sampling equipment	Effluent Monitor	H-2-829087 H-2-829086		
50	The equipment shall include continuous monitoring with remote alarms	RPP-PRO-450 (CHG 1999b)		4 Environmental	For EDE > 0.1 mrem/yr	Continuous monitoring and alarm capability meets the standard or is permitted by the NOC and FEMP.	Effluent Monitor	H-2-829087 H-2-829086		

TABLE 2. BASELINE DESIGN COMPLIANCE MATRIX
I - EXHAUSTER SYSTEM

Count	REQUIREMENTS					SOLUTION			VERIFICATION	
	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
51	Shall have an alarm set to provide timely warnings of increase in radionuclide concentrations	RPP-PRO-450 (CHG 1999b)		4 Environmental	For EDE > 0.1 mrem/yr	Proper alarm set point	Effluent Monitor	H-2-829087 H-2-829086		
52	The detection portion of the monitoring system shall allow for daily inspections and monthly source-checks with known sources.	RPP-PRO-450 (CHG 1999b)		4 Environmental	For EDE > 0.1 mrem/yr	Accessible equipment	Effluent Monitor	H-2-829087 H-2-829086		
53	Continuous monitoring systems shall be powered from a source that has the same or equivalent emergency capability as the air mover.	RPP-PRO-450 (CHG 1999b)		4 Environmental	For EDE > 0.1 mrem/yr	Monitoring system power reliability	Effluent Monitor	H-2-829108 H-2-829110		
54	The CSS shall be designed to provide for confinement barriers and air filtration systems for contamination control.	WHC-SD-WM-FDC-048 Rev. 0 (WHC 1995a)	RPP-PRO-450 (CHG 1999b)	4 Environmental	Air emission of radioactive particles shall be controlled.	The CSS is in compliance with Notice of construction and DOH limiting conditions	System	H-2-821455 H-2-818186		
55	The peak heater temperature shall not exceed the maximum allowable for the HEPA filter	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	ASME AG-1 Section FC (ASME 1994)	5 Design Code	The criteria protects the HEPA filters from damage.	Temperature control capability in the range of interest	Heater Thermostat	H-14-030122		
56	The design pressure shall be equal to the operating pressure.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	ASME N509 (ASME 1989b)	5 Design Code	General Construction	Strength of the filter housing and duct	Filter Housing and Duct	VI# 22660 H-2-821455-98		
57	Piping shall comply with ASME B31.3	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	5 Design Code	General Construction	Complies with code	Piping	H-2-821455		
58	The exhauster and all of the associated components shall comply with the 1996 edition of the National Electric Code (NFPA-70)	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	NEC (NFPA 1996)	5 Design Code	General Construction	Compliance with NEC	System	H-14-030122 H-14-100739 H-14-100740 H-14-100741		
59	The skid and mounted equipment shall be capable of withstanding the transportation, environmental, and operational loads incurred.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Standard Design Criteria	5 Design Code	General Construction	The skid and equipment meet relevant design codes for the expected transportation, and operational loads.	Skid and Mounted Equipment	H-2-821456		
60	The prefilter shall be 30% efficient as tested per ASHRAE Standard 52.1 and listed as UL Class 1.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Reconciliation Letters to be issued	6 Other	General Construction	30% efficient and UL Class 1	Filter Train	H-2-821455		
61	Vibration isolation shall be provided at the fan connections.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	ASME N509 (ASME 1989b)	6 Other	General Construction	Vibration isolation	Fan	H-2-821455-99		
62	Differential pressure across each HEPA filter and across the entire HEPA filter train shall be indicated	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	ASME N509 (ASME 1989b) and WHC-SD-WM-SAD-035 Rev. 0b (LANL 1997)	6 Other	Operator Aids	Displays differential pressure	Differential Pressure Gauge	H-2-821455		

TABLE 2. BASELINE DESIGN COMPLIANCE MATRIX
I - EXHAUSTER SYSTEM

REQUIREMENTS						SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
63	The filter housing shall be seismically qualified by dynamic analysis.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Design Authority Input	6 Other	Analysis is in VI# 22660	Seismic resistance	Filter Housing	VI# 22660 H-2-821455		
64	Lift points and methods shall comply with the Hanford Site Hoisting and Rigging Manual (DOE-RL-92-36)	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	DOE-RL-92-36 (DOE 1993)	6 Other	O&M Requirements	Lift points comply with Hoisting and Rigging Manual	Lift Points	H-2-821456		
65	The exhauster shall alarm and shutdown on high air stream temperature.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	6 Other	The criteria protects the HEPA filters and provides an alert of out-of-normal conditions.	Temperature sensor - sensing capability in the range of interest	Temperature Sensor	H-14-030122		
66	The stack shall also be fabricated from 300 series stainless steel.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	6 Other	General Construction	Material is 300 series stainless steel	Stack	H-2-818188		
67	Final configuration of the exhauster and all components shall allow HEPA filter change out without component disassembly or removal of any portion of the exhauster (except doors).	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	6 Other	General Construction	Minimize effort for consumable material (HEPA) removal	Filter Train	H-2-821455		
68	The HEPA filter housing shall be of welded construction wherever possible. The housing shall be fabricated from 300L series stainless steel.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	6 Other	General Construction	Housing is 300L series stainless steel.	Filter Train	H-2-821455		
69	All piping and tubing and fittings shall be 300 series stainless steel.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	6 Other	General Construction	Material is 300 series stainless steel	Piping and Duct	H-2-821455		
70	Provisions shall be made for the collection and removal of condensate from the system on a regular basis.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	6 Other	General Construction	Drainable condensate collection container	Piping and Duct	H-2-821455		
71	Welded components shall be 300L series stainless steel.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	6 Other	General Construction	Material is 300L series stainless steel	Piping and Duct	H-2-821455		
72	Following the initiation of exhauster startup the components of the system shall be fully operational/stable within 1 hour of being energized	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	6 Other	The one hour warm-up supports the operations schedule.	The system reaches stable condition within 1 hour	System	H-2-821455 H-2-818186		
73	Equipment shall be capable of operation under the Hanford environmental conditions with temperature extremes of -7 to 43 C (20 to 110 F), sustained wind up to 32 km/hr (20 MPH)	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	6 Other	These are the range of conditions typically encountered in operation.	Equipment is compatible with Environmental Conditions (Table 3)	System	H-2-821455 H-2-818186		

TABLE 2. BASELINE DESIGN COMPLIANCE MATRIX
I - EXHAUSTER SYSTEM

Count	REQUIREMENTS					SOLUTION			VERIFICATION	
	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
74	Ducts between the heater, HEPA filter housing, and fan shall be fabricated from 300 series stainless steel.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	6 Other	General Construction	Material is 300 series stainless steel	Piping and Duct	VI #22660		
75	Consideration should be given for ease of removal and disposal of the HEPA filters (bag-in/bag-out housing design)and other consumable components in contact with the airstream that may become contaminated during exhauster operation	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	HNF-IP-1043 (HNF 1997)	6 Other	O&M Requirements - Radiological Control	Minimize effort for consumable material removal	Filter Train	H-2-821455		
76	Condensate lines shall be heat traced to eliminate the possibility of freezing during severe cold.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Operability Requirement	6 Other	General Construction	Heat tracing	Piping	H-2-821455		
77	The stack shall be mounted on the same skid as the filter housing and fan.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Operations Input	6 Other	General Construction	Stack is mounted on the skid	Stack	H-2-821455 H-2-818186		
78	The exhauster shall be designed so that no more than one RMCS operator will be required for operation.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Operations Input	6 Other	O&M Requirements. Set-up/Start-up of the exhauster may require more than one operator.	Sequential operations and automation as required	System	H-2-821455 H-2-818186		
79	The pressure of the tank being exhausted shall be indicated	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Operations Input	6 Other	Operator Aids	Displays tank pressure	Tank Pressure Sensor	H-2-821455-110		
80	High relative humidity shall be indicated with an alarm to notify the operator of a problem.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Operations Input	6 Other	Operator Aids	Relative Humidity Transmitter or Temperature Probes - display of relative humidity. Alarm - compatible with humidity measurement method	Relative Humidity Transmitter or Temperature Probes	H-2-821455-49/ H-14-030122		
81	Hoisting and rigging ease shall be considered for the deployment of the exhauster during setup and take down at each tank.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Operations Input	6 Other	O&M Requirements	Lift points comply with Hoisting and Rigging Manual	Lift Points	H-2-821456		
82	The complete (excluding any remote mounted equip. or instruments) exhauster shall be mounted on a single skid.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Operations Input	6 Other	General Construction	The skid is large enough to accommodate placement of all the exhauster components	Skid	H-2-821456		
83	The exhauster electrical connects shall be compatible with interfacing equipment.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	2 External Interface	General Construction	Compatible connection with power supply	480V connection	H-2-818201 H-2-821455-36		
84	The exhauster shall have same phase orientation as the distribution trailer.	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	2 External Interface	General Construction	Compatible connection with power supply	480V connection	H-2-818201 H-2-821455-36		

TABLE 2. BASELINE DESIGN COMPLIANCE MATRIX
I - EXHAUSTER SYSTEM

	REQUIREMENTS					SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config Control Ref.	Engineering Evaluation Description	Verified By?
85	The exhauster shall remain mechanically compatible with the HEPA Test Equipment	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	2 External Interface	General Construction	Compatible connection with HEPA Test Equipment	Mechanical Connector	N/A		
86	Exhauster B and C must remain compatible	HNF-SD-WM FDC-025 Rev. 2 (LMHC 1997b)	Engineering Judgment	2 External Interface	General Construction	Interchangeability	Exhausters	H-2-829120		

TABLE 2. DESIGN COMPLIANCE MATRIX
II - ROTARY MODE CORE SAMPLE TRUCKS

	REQUIREMENTS					SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
	enter functional or design criteria exactly as stated in the requirements source document.	enter source doc.	enter origin of requirement if other than Source	Performance Ext. Interface Safety Environmental Design Code Other	enter all additional information which amplifies, qualifies, justifies,...etc. the criteria statement.	describe the manner in which the design purports to fulfill the criteria statement - be as specific as possible.	enter component name if Source is specific	provide ref. for design attribute (drawing, procedure, spec....etc.)	provide discussion on method, evidence, reasoning used, ...etc., to verify that the design complies with requirements - be specific - include any qualifications, if appropriate.	person or group attesting to verif. (initialed)
1	The truck shall comply with D.O.T. regulations for transport.	49 CFR 393 (CFR 1995)		1 Performance	RMCS Sample Truck	Truck is equipped for highway driving and has backup alarm	Truck	H-2-690073		
2	The sampling system shall be capable of taking full depth core samples (up to 55 ft. from the top of the riser).	WHC-SD-WM-CR-044 (WHC 1993)	Engineering Judgment	1 Performance	The tank floor is approximately 55 feet from the top of the riser.	System length	System	H-2-690030 H-2-690057		
3	During sampler change-out, waste is prevented from entering the drill string by establishing a hydrostatic head balance.	WHC-SD-WM-FDC-048 (WHC 1995a)	WHC-SD-WM-WP-054 (WHC 1990)	1 Performance	The head balance reduces the potential for contaminating the drill string ID and the sampler OD.	Gas pressure to the drill string is monitored. Head gas design pressure is 37 psig.	Head Balance	H-2-690068		
4	The purge gas piping system shall supply nitrogen gas that cools the bit, aids in chip removal during drilling, and provides hydrostatic head balancing during sampler installation and retrieval.	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgment	1 Performance	Specific requirements are listed elsewhere in this table.	Gas piping system is sized to supply sufficient nitrogen	Purge Gas Piping	H-2-690060		
5	CSS are designed to sample liquid, sludge, and/or salt cake materials in waste tanks.	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgment	1 Performance	The CSS is capable of sampling all waste types.	System is designed in compliance with the constraints	System	H-2-690140		
6	The drill rig shall be compatible with the universal sampler and transport cask.	WHC-SD-WM-FDC-044, Draft (WHC 1995b)	Engineering Judgment	2 External Interface	Drill Rig	Single stroke sampling segment lengths of 19 inches and geometric compatibility.	Drill Rig	H-2-690143 H-2-690052 H-2-690020		
7	The remotely operated sample delivery and retrieval system shall be compatible with the universal sampler.	WHC-SD-WM-FDC-044, Draft (WHC 1995b)	Engineering Judgment	2 External Interface	The sampler and delivery system are parts in the same sampler system.	Remotely operated latch mechanism is compatible with the universal sampler.	Shielded Receiver Assembly and Grapple Hoist Assembly	H-2-690143 H-2-690052		
8	The Rotary Mode Core Sampling (RMCS) trucks have an exhauster interlock system (with manual override) to shut down the drill rig whenever the RMCS exhauster is shut down.	WHC-SD-WM-FDC-048 (WHC 1995a)	WHC-SD-WM-SAD-035 Rev 0b Section 6.8.7.6 (LANL 1997)	2 External Interface	The shutdown limits the emission of fugitive particles.	Drill rig shutdown logic tied to exhauster operation status	Interlock	H-2-690069		
9	The core sample truck (CST) shall be capable of being positioned in the tank farms, above the tank being sampled, adjacent to an access riser.	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgment	2 External Interface	The truck will be used on SSTs.	Truck can be moved over the tank, adjacent to a riser	System	H-2-690012		
10	An alarm will be added to the core sample trucks to detect loss of nitrogen supply pressure (RMCS trucks).	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgment	3 Safety	Operator aide.	Alarm on loss of hydrostatic head	Alarm	H-2-690062		

TABLE 2. DESIGN COMPLIANCE MATRIX
II - ROTARY MODE CORE SAMPLE TRUCKS

REQUIREMENTS						SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
11	Waste intrusive electrical equipment shall be designed to meet NFPA 70, Class 1, Division 1, Group B criteria or provide equivalent safety.	HNF-SD-WM TSR-006 Rev. 1c (CHG1998b)	HNF-SD-WM-SAR-067 Rev. 1c (CHG 1999c)	3 Safety/ AB	Ignition Sources - Electrical components in contact with the tank waste will meet the criterion listed or shall be approved for the application by the FGEAB.	Meets ignition source control set 1	Electrical Equipment	H-2-690026 H-2-690073		
12	Dome intrusive electrical equipment shall be designed to meet NFPA 70. Class 1, Division 2, Group B criteria or provide equivalent safety.	HNF-SD-WM TSR-006 Rev. 1c (CHG1998b)	HNF-SD-WM-SAR-067 Rev. 1c (CHG 1999c)	3 Safety/ AB	Ignition Sources - Electrical components in contact with the tank airstream will meet the criterion listed or shall be approved for the application by the FGEAB.	Meets ignition source control set 2	Electrical Equipment	H-2-690012		
13	Mech. equip. and materials shall be constructed of spark-resist. material, or shall be rendered incapable of sparking with sufficient energy to combust H2, or shall have been analyzed and eval. to be incapable of sparking with suff. energy to combust H2.	HNF-SD-WM TSR-006 Rev. 1c (CHG1998b)	HNF-SD-WM-SAR-067 Rev. 1c (CHG 1999c)	3 Safety/ AB	Ignition Sources - Mechanical components in contact with the tank airstream will meet the criterion listed or shall be approved for the application by the FGEAB.	Non-sparking material or condition. Equipment movement inside the drill string is limited to less than 1 ft/sec (LANL 1997).	System	H-2-690051 FGEAB-97-029		
14	Electrostatic ignition sources (exposed to tank vapor or waste) shall be controlled by providing bonding or grounding according to NFPA 77.	HNF-SD-WM TSR-006 Rev. 1c (CHG1998b)	HNF-SD-WM-SAR-067 Rev. 1c (CHG 1999c)	3 Safety/ AB	Ignition Sources. All non metals exposed to the airstream are bonded to metals or shall be approved for the application by the FGEAB.	Bonding of electrostatic ignition sources	System	H-2-690010		
15	Exposed polymer materials shall be rendered incapable of electrostatic charge or discharge potential with sufficient energy to combust hydrogen.	HNF-SD-WM TSR-006 Rev. 1c (CHG1998b)	HNF-SD-WM-SAR-067 Rev. 1c (CHG 1999c)	3 Safety/ AB	Ignition Sources. All non metals exposed to the airstream shall be tested or shall be approved for the application by the FGEAB.	Polymer materials are designed to not collect or discharge an electrostatic charge.	System	H-2-690143 FGEAB-97-008		
16	The surface temperature of heat-generating devices shall not exceed 416 deg. C if in tank vapor or 160 deg. C if device can contact the waste and cause exothermic reactions.	HNF-SD-WM TSR-006 Rev. 1c (CHG1998b)	HNF-SD-WM-SAR-067 Rev. 1c (CHG 1999c)	3 Safety/ AB	Ignition Sources. The surface temperature of heat-generating devices shall not exceed the limits or be approved for the application by the FGEAB.	Temperature limited by design and operation.	System	H-2-690134		
17	Dome intrusive purged and pressurized (p/p) electrical eq. and p/p heat-generating eq. shall be automatically shutdown by design or alarming with manual SD upon loss of protective gas pressure or flow as defined by NFPA 496 Type Z pressurization.	HNF-SD-WM TSR-006 Rev. 1c (CHG1998b)	HNF-SD-WM-SAR-067 Rev. 1c (CHG 1999c)	3 Safety/ AB	Ignition Sources. Purged electrical equipment shall meet the criteria or shall be approved by the FGEAB.	Automatic shutdown circuit or alarm and manual shutdown on loss of purge gas.	System	H-2-690012		
18	Interlocked start-up restrictions of waste intrusive purged and pressurized electrical or heat-generating equipment shall only be allowed upon system sensing of pre-set safety limits.	HNF-SD-WM TSR-006 Rev. 1c (CHG1998b)	HNF-SD-WM-SAR-067 Rev. 1c (CHG 1999c)	3 Safety/ AB	Ignition Sources. Purged electrical equipment shall meet the criteria or shall be approved by the FGEAB.	System has, as required, the ability to sense pre-set safety limits.	System	H-2-690012		
19	The CST shall be instrumented to prevent operation outside of the operational safety envelop defined by the Authorization Basis (AB).	WHC-SD-WM-SAD-035 Rev 0b (LANL 1997) Section 6.8.14.1		3 Safety/ AB	Protects the tank from pressures outside of structural limits and precludes waste fires and gas burn events.	PLC activates alarms and sends shutdown signal to the drill engine.	Alarm and Interlock Signal	H-2-690069 H-2-690071		

TABLE 2. DESIGN COMPLIANCE MATRIX
II - ROTARY MODE CORE SAMPLE TRUCKS

	REQUIREMENTS					SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
20	The drill bit must be qualified per App. F, G, and T of LANL 1997.	WHC-SD-WM-SAD-035 Rev 0b (LANL 1997) Section 6.8.1.1		3 Safety/ AB	F- Drill Bit Thermal Performance, G- Waste Temp. Limits, T- Qualified Bit 1OOIVD/8 and Sampler H-2-690140, Rev. 1 for RMCS	Drill bit is part number 1OOIVD/8.	Drill Bit	H-2-690134		
21	The drilling operation shall not heat the waste to more than 150 deg C. (preclude waste fires)	WHC-SD-WM-SAD-035 Rev 0b (LANL 1997)		3 Safety/ AB	Precludes waste fires.	The downforce and rotation are limited to preclude excessive waste temperatures.	Drill Rig	H-2-690134 LANL 1997		
22	The equipment shall be capable of operation within the operational safety envelope as defined by the Authorization Basis.	WHC-SD-WM-SAD-035 Rev 0b (LANL 1997) Section 6.8.13		3 Safety/ AB	The safety envelope shall be established using 750 lbs rotary mode downward force, 30-100 scfm purge gas flow, 10-140 deg. F purge gas temperature, 0-55 drill string rpm, $\geq$0.75 in/min feed rate. (LANL 1997)	Drill rig capacity and controls are within safety constraints	Drill Rig	H-2-690068 H-2-690069 LANL 1997		
23	The sampling system shall not penetrate the tank bottom.	WHC-SD-WM-SAD-035 Rev 0b (LANL 1997) Section 6.8.13.1 & 6.8.12.2		3 Safety/ AB	Tank bottom penetration would cause the tank to leak which is to be avoided. Design of the drill bit and downforce interlock provide protection to tank bottom penetration.	The system automatically limits the downforce and, during the last sample segment, causes the penetration to reverse when the limit is reached.	Interlock	H-2-690074 H-2-690014 H-2-690071		
24	Drilling operations shall be terminated automatically for operation outside of the operational safety envelope defined in the AB.	WHC-SD-WM-SAD-035 Rev 0b (LANL 1997) Section 6.8.14.1		3 Safety/ AB	Terminates on drill speed, penetration rate, purge gas flow, downforce, purge gas temperature.	Drilling terminates as described in the criteria	Interlock	H-2-690069		
25	Automatic termination of drilling operations on low purge flow is provided to prevent drill bit overheating.	WHC-SD-WM-SAD-035 Rev 0b (LANL 1997) Section 6.8.13.5		3 Safety/ AB	The drill rig engine shall automatically shut down with nitrogen flow less than 30 scfm, using two out of three redundant logic. (SAD-035 Rev. 0b)	Automatic shutdown of drilling on low flow	Interlock	H-2-690062 H-2-690068 H-2-690069		
26	Materials used in FG/RMCS activities and the drill string components are compatible with the waste stored in SSTs to prevent chemical action or material failures resulting from expected or accidental contact with the wastes.	WHC-SD-WM-SAD-035 Rev 0b (LANL 1997) Section 6.5.4.1		3 Safety/ AB	Reactive metals such as aluminum are not to be used.	Materials are compatible with SST waste	Material in contact with the waste	H-2-690050		
27	The sampling system shall utilize ALARA principles to minimize personnel exposure.	HNF-IP-0842, Volume VII, Section 1.1, Rev. 7b(CHG 1997b)		3 Safety/ ALARA	Standard practice	Sufficient shielding and hydrostatic head gas system	System	H-2-690000		

TABLE 2. DESIGN COMPLIANCE MATRIX
II - ROTARY MODE CORE SAMPLE TRUCKS

	REQUIREMENTS					SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
28	The design shall provide for containment during transportation.	WHC-SD-WM-FDC-048 (WHC 1995a)	HNF-IP-0842, Volume VII, Section 1.1, Rev. 7b(CHG 1997b)	3 Safety/ ALARA	Contamination is in closed components.	Meets transportation design requirements for contaminated components	System	H-2-38079		
29	The chevron seal between the drill bit and sampler provides a barrier between the tank waste and the drill string.	WHC-SD-WM-SAD-035 Rev 0b (LANL 1997)		3 Safety/ ALARA	Inhibits unwanted waste from entering the drill string.	Seal prevents waste intrusion	Chevron Seal	H-2-690134 H-2-690140		
30	Equipment installed in the tank shall be capable of being washed.	WHC-SD-WM-SAD-035 Rev 0b (LANL 1997)		3 Safety/ ALARA	For contamination control	A hot-water spray washer is provided on the riser adapter to reduce the contamination of drill rods as they are removed from the tank.	Spray Washer	H-2-91670		
31	All o-ring and seal material in contact with waste or waste gases shall be checked for compatibility with high ammonia concentrations.	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgment	6 Other	Ammonia can damage some seal materials, causing increased maintenance or poor performance.	O-ring compatible with the waste environment	Gaskets	H-2-690030 H-2-690057		
32	All purge gas used on the core sample trucks will be routed back to the waste tank, or through approved filtration.	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgment	6 Other	Precludes unmonitored emissions.	Purge gas routed to tank or filtration	Purge Gas Piping System	H-2-690012 H-2-690062		
33	All core sampling equipment is designed to be mobile/portable.	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgment	6 Other	Modifications shall not compromise existing traffic safety requirements or handling provisions.	Mobile equipment	System	H-2-690000		
34	The CSS shall have a design life of 5 years minimum.	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgment	6 Other	Replaceable equipment and components may have a design life of fewer years.	Materials are compatible with the Environmental Conditions and failure is not expected	System	H-2-690000		
35	The electrical connectors for RMCSTs 3 and 4 that connect to the interfacing equipment must be compatible with the connectors installed on the interfacing equipment	HNF-SD-WM FDC-048 Rev. 2 (JE Corbet 1995)	Engineering Judgment	2 External Interface	General Construction	Electrical Connector Compatibility	480 Volt Connector	H-2-690072 Draft		
36	The trucks must remain mechanically compatible with the hose fitting for the nitrogen supply trailer	HNF-SD-WM FDC-048 Rev. 2 (JE Corbet 1995)	Engineering Judgment	2 External Interface	General Construction	Mechanical Connector Compatibility	Hose Connector	H-2-690072 Draft		
37	RMCST 3 must remain interchangeable with RMCST 4 to facilitate continuous Rotary Mode Core Sampling	HNF-SD-WM FDC-048 Rev. 2 (JE Corbet 1995)	Engineering Judgment	2 External Interface	General Construction	Interchangeability	RMCST	H-2-690000		

TABLE 2. DESIGN COMPLIANCE MATRIX
III - UNIVERSAL SAMPLER SYSTEM

Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	SOLUTION			VERIFICATION	
						Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
	enter functional or design criteria exactly as stated in the requirements source document.	enter ' source doc.	enter origin of requirement if other than Source	Performance Ext. Interface Safety Environmental Design Code Other	enter all additional information which amplifies, qualifies, justifies,...etc. the criteria statement.	describe the manner in which the design purports to fulfill the criteria statement - be as specific as possible.	enter component name if Source is specific	provide ref. for design attribute (drawing, procedure, spec...etc.)	provide discussion on method, evidence, reasoning used, ...etc., to verify that the design complies with requirements - be specific - include any qualifications, if appropriate.	person or group attesting to verif. (initialed)
1	All parts coming in contact with the sample medium shall not require any special coatings of grease, or be made of materials that will contaminate the sample.	WHC-SD-WM-WP-054 (WHC 1990)	Engineering Judgement	1 Performance	Precludes contamination of the waste sample	Non-contaminating materials	System	H-2-690140		
2	The sampler shall obtain and retain (liquids and sludges)- 90% by volume of the designed capacity of the sampler 90% of the time.	WHC-SD-WM-CR-044 (WHC1993)	Engineering Judgement	1 Performance	The designed capacity for liquid and sludge samples is 310 cc. For acceptance and operational testing purposes the sludge sample recovery may be calculated by the percent length of recovery but must still meet the 90% recovery 90% of the time.	Performance features are met	System	H-2-690140		
3	The sampler shall obtain and retain (hard salt cake)- 90% of the expected length of the sample 90% of the time.	WHC-SD-WM-CR-044 (WHC1993)	Engineering Judgement	1 Performance	The designed length is 19 inches but the expected length may vary depending on drilling procedures.	Performance features are met	System	H-2-690140		
4	The sampler shall minimize changes in chemical and physical properties of the sample (moisture, total organic, etc...)	WHC-SD-WM-CR-044 (WHC1993)	Engineering Judgement	1 Performance	The design attempts to take a representative sample.	Non-reactive materials and minimal pysical disruption of the sample	System	H-2-690140		
5	The sampler shall be able to operate under 30 psig working pressure.	WHC-SD-WM-CR-044 (WHC1993)	Engineering Judgement	1 Performance	This is the hydrostatic head at the tank bottom.	Rating of 30 psig or greater	System	H-2-690140		
6	The sampler is designed to prevent tank waste from entering the drill string.	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgement	1 Performance	Ensures samples are representative and limits contamination of the drill string.	Waste does not enter drill string. With the sampler in the closed position and the sampler fully filled with water and held in a vertical position for a one hour period the valve mechanism will show no leakage.	System	H-2-690140 note 7		
7	19-inch core sample segment is taken	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgement	1 Performance	Standard size	Capable of taking a sample 19 -inch long	System	H-2-690140 item 28		
8	Mechanical tooling, equipment, and materials (exposed to tank vapor or waste) shall be constructed of spark resistant material, or shall have been analyzed and evaluated to not be capable of sparking under the applied conditions.	HNF-SD-WM-TSR-006 Rev. 1c (WHC 1998b)	HNF-SD-WM-SAR-067 Rev. 1c (CHG 1999c)	3 Safety/ AB	Material compatibility shall be evaluated for thermite reaction potential. Ignition Sources - Mechanical components in contact with the tank airstream or waste will meet the criterion listed or shall be approved for the application by the FGEAB.	Non-sparking material or condition	System	H-2-690140 FGEAB-97-029		

TABLE 2. DESIGN COMPLIANCE MATRIX
III - UNIVERSAL SAMPLER SYSTEM

	f					SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
9	The new sampler will conform with the EPA water sampling requirements, SW-846, dated September 1986 for sampler materials (Table 11-1)	WHC-SD-WM-WP-004 (WHC 1989)	Engineering Judgement	4 Environmental	Prevents contamination of the sample.	EPA compliant materials	System	H-2-690140		
10	All o-ring and seal material in contact with waste or waste gases shall be checked for compatibility with high ammonia concentrations.	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgement	6 Other	Ammonia can damage some seal materials, causing increased maintenance or poor performance.	O-ring compatible with the waste environment	Gaskets	H-2-690140		
11	All aluminum potentially in contact with tank waste shall be eliminated.	WHC-SD-WM-FDC-048 (WHC 1995a)	WHC-SD-WM-SAD-035 Rev 0b (LANL 1997)	6 Other	Aluminum is incompatible with caustic waste.	No aluminum allowed in contact with tank waste	System	H-2-690140		
12	All materials used shall be new, free of defects, and suitable for use in the environment.	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgement	6 Other	Compatible materials	Material is compatible with Environmental Conditions (Table 1)	System	H-2-690140		
13	The sample size of the new sampler shall be a minimum of 100 ml and a maximum of 1000 ml.	WHC-SD-WM-WP-004 (WHC 1989)	Engineering Judgement	6 Other	Shipping limits	Sampler size	System	H-2-690140		
14	The sampler shall be able to retrieve a sample when the maximum shear strength of the material to be sampled is 35,000 dynes/sq. cm.	WHC-SD-WM-WP-004 (WHC 1989)	Engineering Judgement	6 Other	Design selection	Sampler meets performance requirement	System	H-2-690140		
15	The maximum pulling force exerted through the quadralatch mechanism assembly to the sampler is 1500 lbs.	WHC-SD-WM-WP-004 (WHC 1989)	Engineering Judgement	6 Other	Design interface limit	Mechanical strength is sufficient to withstand pulling force	System	H-2-690140		
16	The rotary mode sampler can not be used with the push mode core sample bit.	None	Engineering Judgement	1 Performance	Ensures that compatible components are used for core sampling.	Use of rotary sampler with push bit will prevent the flow of nitrogen purge gas. This will result in the shut down of the core sample truck	Component	H-2-690140		
16	The push mode sampler can not be used with the rotary mode core sample bit.	None	Engineering Judgement	1 Performance	Ensures that compatible components are used for core sampling.	Use of push sampler with rotary bit will prevent the flow of nitrogen purge gas. This will result in the shut down of the core sample truck.	Component	H-2-690140		

TABLE 2. DESIGN COMPLIANCE MATRIX
IV - DIESEL GENERATOR SYSTEM

REQUIREMENTS						SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
	enter functional or design criteria exactly as stated in the requirements source document.	enter source doc.	enter origin of requirement if other than Source	Performance Ext. Interface Safety Environmental Design Code Other	enter all additional information which amplifies, qualifies, justifies, ..etc. the criteria statement.	describe the manner in which the design purports to fulfill the criteria statement - be as specific as possible.	enter component name if Source is specific	provide ref. for design attribute (drawing, procedure, spec....etc.)	provide discussion on method, evidence, reasoning used, . .etc., to verify that the design complies with requirements - be specific - include any qualifications, if appropriate.	person or group attesting to verif. (initialed)
1	Core sampling generators are portable generators used to supply power to core sampling equipment.	WHC-S-0252 Rev. 2 (LMHC 1996c)	Engineering Judgement	1 Performance	General requirement	The trailer shall meet Department of Transportation (DOT) requirements for highway travel.	System	WHC-S-0252 section 3.5.2.2		
2	Power supplied by the generators is 480vac, 3 phase and 240/120 vac, single phase.	WHC-S-0252 Rev. 2 (LMHC 1996c)	Engineering Judgement	1 Performance	Design selection	The generator shall be capable of 3 phase, 4 wire, 277/480 VAC and single phase 240/120 VAC, the operating frequency shall be 60 Hertz +/- 0.5%	System	WHC-S-0252 sections 3.1.1, 3.1.1.1, & 3.1.1.2		
3	The generator shall be equipped with a 100 KW load bank, and shall include grounding provisions.	WHC-SD-WM-FDC 044, Draft (WHC 1995b)	Engineering Judgement	1 Performance	Design selection	100 KW load bank and grounding	System	H-2-827188 H-2-827189		
4	The power rating of the engine-generator set is to be 150 KW (minimum) and available at variable load.	WHC-SD-WM-FDC 044, Draft (WHC 1995b)	Engineering Judgement	1 Performance	Design selection	Power rating and variable load feature	System	WHC-S-0252		
5	The generator shall be enclosed to meet the environmental conditions and to meet ALARA noise reduction requirements.	WHC-SD-WM-FDC 044, Draft (WHC 1995b)	Engineering Judgement	3 Safety/ ALARA	Design selection	Enclosed	Enclosure	WHC-S-0252		
6	A control panel and controls shall be provided for controlling and monitoring generator performance and shall shutdown and lock out the engine under abnormal operating conditions.	WHC-SD-WM-FDC 044, Draft (WHC 1995b)	Engineering Judgement	6 Other	Operator aides	Appropriate controls and shutdown capability	Controls	WHC-S-0252		
7	All supplied equipment shall be new and suitable for use in the environment.	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	Design selection	Equipment is compatible with the Hanford climate	System	WHC-S-0252		
8	The CSS shall have a design life of 5 years minimum.	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	Replaceable equipment and components may have a design life of fewer years.	Material is compatible with the environmental conditiions and failure is not expected	System	WHC-S-0252		

TABLE 2. DESIGN COMPLIANCE MATRIX
IV - DIESEL GENERATOR SYSTEM

	REQUIREMENTS					SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
9	The electrical connectors for Generators A, B, C, and E that connect to the interfacing equipment must be compatible with the connectors installed on the interfacing equipment	HNF-SD-WM-FDC 048 Rev. 2 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Electrical Connector Compatibility	Generator System	H-2-690072 Draft		
10	The phase rotation of the wiring at the power connectors to the distribution trailer and Breathing Air Compressor must be in the correct direction	HNF-SD-WM-FDC 048 Rev. 2 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Correct Wiring to maintain correct phase relations	Wiring	H-2-690072 Draft		
11	All four diesel generators must remain interchangeable to facilitate continuous Rotary Mode Core Sampling.	HNF-SD-WM-FDC 048 Rev. 2 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Interchangeable	System	H-2-690072 Draft		

TABLE 2. DESIGN COMPLIANCE MATRIX
V - DISTRIBUTION TRAILER

	REQUIREMENTS					SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
	enter functional or design criteria exactly as stated in the requirements source document.	enter source doc.	enter origin of requirement if other than Source	Performance Ext. Interface Safety Environmental Design Code Other	enter all additional information which amplifies, qualifies, justifies,...etc. the criteria statement.	describe the manner in which the design purports to fulfill the criteria statement - be as specific as possible.	enter component name if Source is specific	provide ref. for design attribute (drawing, procedure, spec....etc.)	provide discussion on method, evidence, reasoning used, ...etc., to verify that the design complies with requirements - be specific - include any qualifications, if appropriate.	person or group attesting to verif. (initialed)
1	All core sampling equipment is designed to be mobile/portable.	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	1 Performance	Modifications shall not compromise existing traffic safety requirements or handling provisions.	Mobile equipment	System	WHC-S-289, Rev 2A		
2	The trailer shall consist of a standard flatbed trailer, 4000 pound GVW minimum, with a power transfr., elect. disconnect switches, cable reels and elect. cables.	WHC-S-0289 Rev. 2a (LMHC 1996b)	Engineering Judgement	1 Performance	General design requirements	Has the features as described	System	WHC-S-289, Rev 2A		
3	The trailer will be used to distribute power to the Core Sample Truck Control Power, Support Truck Water Heater, Spider Power, Truck Air Compressor, Exhauster, X-Ray Cart, and the Space Heater of the RMCS system from a diesel generator.	WHC-S-0289 Rev. 2a (LMHC 1996b), section 3.2	Engineering Judgement	2 External Interface	Provide cable reels for: Exhauster, Generator. Truck Air Compressor, Core Sample Truck, Support Truck Water Heater, Spider Power, X-ray imager. Provide receptacle for Space Heater.	Compatible power cables and connectors	System	WHC-S-289, Rev 2A H-2-82188 H-2-82189		
4	Electrical components and installation shall comply with the NEC.	WHC-S-0289 Rev. 2a (LMHC 1996b), section 3.2	Engineering Judgement	5 Design Code	All components shall be mounted and wired per the requirements stated in the NEC.	Complies with NEC	Electrical parts	WHC-S-289, Rev 2A		
5	All supplied equipment shall be new and suitable for use in the environment.	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	Design selection	Equipment is compatible with the Hanford climate	System	WHC-S-289, Rev 2A		
6	The CSS shall have a design life of 5 years minimum.	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	Replaceable equipment and components may have a design life of fewer years.	Material is compatible with the Environmental Conditions and failure is not expected	System	WHC-S-289, Rev 2A		
7	The electrical connectors for Distribution Trailers B, C, and D that connect to the interfacing equipment must be compatible with the connectors installed on the interfacing equipment	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Compatible power cables and connectors	System	H-2-690072 Draft		
8	The trucks must remain mechanically compatible with the hose fitting for the nitrogen supply trailer.	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Compatible hose fittings	System	H-2-690072 Draft		

TABLE 2. DESIGN COMPLIANCE MATRIX
V - DISTRIBUTION TRAILER

REQUIREMENTS						SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
9	The phase rotation associated with the power wiring to the exhausters must be in the proper direction	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Correct Wirirng to maintain correct phase relations	System	H-2-690072 Draft		
10	All three distribution trailers must remain interchangeable to facilitate continuous Rotary Mode Core Sampling.	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Interchangeability	System	H-2-690072 Draft		

TABLE 2. DESIGN COMPLIANCE MATRIX
VI - X-RAY CART SYSTEM

REQUIREMENTS						SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
	enter functional or design criteria exactly as stated in the requirements source document.	enter source doc.	enter origin of requirement if other than Source	Performance Ext. Interface Safety Environmental Design Code Other	enter all additional information which amplifies, qualifies, justifies,. .etc. the criteria statement.	describe the manner in which the design purports to fulfill the criteria statement - be as specific as possible.	enter component name if Source is specific	provide ref. for design attribute (drawing, procedure, spec....etc.)	provide discussion on method, evidence, reasoning used, ...etc.. to verify that the design complies with requirements - be specific - include any qualifications if appropriate.	person or group attesting to verif. (initialed)
1	A secondary function is to provide some "intelligence" of the physical condition of the sample prior to nuclear assay measurements and other characterizations conducted at the laboratory following extrusion of the core sample in a "Hot Cell" environ.	PR# 428742 (WHC 1995c)		1 Performance	General design requirements	Capable of providing some information on the physical condition of the sample	System	VI #22772 VI #22772 Supp. 01		
2	The functions of the Mobile Nondestructive Sample Examination System are to examine the physical contents of core samples entering and leaving the examination system.	PR# 428742 (WHC 1995c)		1 Performance	Looking for full core samples	Capable of providing some information on the physical condition of the sample	System	VI #22772 VI #22772 Supp. 01		
3	The mobile/transportable systems will perform a full-length real-time X-ray examination of core samples contained within a sampler while in a vertical position.	PR# 428742 (WHC 1995c)		1 Performance	Design selection	Real-time radiography of waste tank core segments	System	VI #22772 VI #22772 Supp. 01		
4	The system performance criteria shall be the visibility of the number 7, ASTM plaque penetrameter (minimum 2-2T sensitivity) superimposed on the sample guide tube (approx. total wall thickness .372 in.) and through the PVC contamination sleeve,	PR# 428742 (WHC 1995c)		1 Performance	... on the live video monitor (no image processing or enhancement) for the RTR inspections.	The resolution and penetration of the examination system shall be demonstrated for the buyer before shipment.	System	VI #22772 VI #22772 Supp. 01		
5	The components of the Mobile NDE system must be capable of operation between exterior temperatures of 32 to 105 deg. F. All interior spaces and enclosures will be ventilated and maintained at a temperature of no greater than 95 deg. F during operation.	PR# 428742 (WHC 1995c)		1 Performance	A lower temperature is acceptable if the equipment is allowed to warm up before use.	Equipment operates withinn the specified temperature range.	System	VI #22772 VI #22772 Supp. 01		
6	The design shall provide for containment during transportation	WHC-SD-WM-FDC 048 (WHC 1995a)	HNF-IP-0842, Volume VII, Section 1.1, Rev. 7b(CHG 1997b)	3 Safety/ ALARA	Contamination is in closed components	Meets transportation design requirements for contaminated components	System	VI #22772 VI #22772 Supp. 01		
7	This system will be considered an "Exempt Shielded Installation" with permanently installed integral shielding, interlocks, and warning devices as defined in ANSI N43.3-1993 and 21 CFR 1020.40.	PR# 428742 (Weber 1995)		5 Design Code	Design selection based on hazard	The Seller shall shield the equipment and apply all the safety requirements dictated in ANSI N43.3, 21 CFR Section 1020, Chapter 246-243 WAC.	System	VI #22772 VI #22772 Supp. 01		

TABLE 2. DESIGN COMPLIANCE MATRIX
VI - X-RAY CART SYSTEM

REQUIREMENTS						SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
8	The enclosure cabinets for the X-Ray System and Displays are to be mounted on a small utility trailer (approximately 7000 lb. capacity) with a maximum trailer length of 10 ft. or less meeting DOT and Washington State reqmts for that class of trailer.	PR# 428742 (WHC 1995c)		5 Design Code	Design selection	The mobile system trailer shall meet all the applicable reqmts of 49 CFR 393 and RCW 4637 with regards to lights, hitch, safety chains, clearance, etc. The overall length of the mobile system trailer and installed equip. shall be 10 ft. or less.	Trailer	VI #22772 VI #22772 Supp. 01		
9	A means of providing a reliable archived recording of images for permanent, traceable record purposes shall be provided as part of the system.	PR# 428742 (WHC 1995c)	Engineering Judgement	6 Other	Design selection	An industrial/ professional, high quality 1/2" S-VHS video cassette recorder with audio recording and play back capability shall be provided.	Recorder	VI #22772 VI #22772 Supp. 01		
10	All supplied equipment shall be new and suitable for use in the environment.	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	Design selection	Equipment is compatible with the Hanford climate.	System	VI #22772 VI #22772 Supp. 01		
11	The X-Ray Cart must be mechanically compatible with the shielded receiver.	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Equipment is mechanically compatible	System	H-2-79076		
12	The X-Ray Cart must be and electrically compatible with the Distribution Trailers	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Equipment is electrically compatible	System	H-2-79077		
13	The X-Ray Carts must be interchangeable to facilitate Rotary Mode Core Sampling	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Equipment is interchangeable	System	H-2-79078		

TABLE 2. DESIGN COMPLIANCE MATRIX
VII - BREATHING AIR COMPRESSOR

REQUIREMENTS						SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
	enter functional or design criteria exactly as stated in the requirements source document.	enter source doc.	enter origin of requirement if other than Source	Performance Ext. Interface Safety Environmental Design Code Other	enter all additional information which amplifies, qualifies, justifies... etc. the criteria statement.	describe the manner in which the design purports to fulfill the criteria statement - be as specific as possible.	enter component name if Source is specific	provide ref. for design attribute (drawing, procedure, spec....etc.)	provide discussion on method, evidence, reasoning used, ...etc., to verify that the design complies with requirements - be specific - include any qualifications, if appropriate.	person or group attesting to verif. (initialed)
1	Each Breathing Air Compressor (BAC) consists of a compressor unit with filters that provide Grade D air at its outlet.	WHC-SD-WM-SDD 067 (LMHC 1996a)	29 CFR 1910.134 (CFR 1997b)	1 Performance	Breathing air quality requirement	The breathing air compressor shall supply purified CGA G-7.1 Type 1, Grade D air.	Compressors	WHC-S-0251, section 3.1.1 (WHC 1994b)		
2	The air hoses must withstand the maximum pressure of the compressor.	WHC-SD-WM-SDD 067 (LMHC 1996a)	Engineering Judgement	1 Performance	Design selection	Pressure rating	Hose	H-2-85287		
3	Output of the BAC is 125 +/- 5 psig at a flow of 72 scfm (6 scfm per person) minimum and 180 scfm (15 scfm per person) maximum.	WHC-SD-WM-SDD 067 (LMHC 1996a)	Operations Input	1 Performance	Normal flow is 90 scfm. The flow requirements are established from HPS-156-M.	Operating pressure shall be 80 to 125 psig. The minimum oper. flow rate is 72 scfm, maximum flow rate 180 scfm.	System	WHC-S-0251, sections 4.1.2, 4.3.1, 4.3.2 (WHC 1994b)		
4	The compressor shall be mounted on a trailer meeting DOT requirements for highway travel and designed to withstand transportation loads.	WHC-SD-WM-SDD 067 (LMHC 1996a)	Engineering Judgement	1 Performance	The compressor is portable	The breathing air compressor unit shall be in a weatherproof enclosure mounted on a highway legal trailer.	Trailer	WHC-S-0251, section 3.2.1 (WHC 1994b)		
5	At the manifold ports, respirator users plug into Schrader type quick-disconnects with their individual air lines.	WHC-SD-WM-SDD 067 (LMHC 1996a)	Engineering Judgement	2 External Interface	Design selection	The manifold shall have 12 quick disconnect check units for air line connection. The check units shall be Schraeder No. 4404-C12.	Manifold	WHC-S-0251, section 4.9.3 (WHC 1994b)		
6	The manifold outlet pressure must meet requirements for the respirator equipment which is in the range of 35 to 45 psig.	WHC-SD-WM-SDD 067 (LMHC 1996a)	Engineering Judgement	2 External Interface	NIOSH	Pressure of 35 to 45 psig	Outlet manifold	WHC-S-0251, section 4.3.2 (WHC 1994b)		
7	The power requirements for the 2AN137 type BAC is 480 Vac, 60 Hz, 60 amps.	WHC-SD-WM-SDD 067 (LMHC 1996a)	Engineering Judgement	2 External Interface	Design selection	The motor shall operate from a 480 VAC, 60 Hz, 3 phase electrical supply.	Power	WHC-S-0251, section 4.7.2, (WHC 1994b), H-2-85287		
8	The electrical design shall comply with the National Elecric Code.	NFPA 1996	29 CFR 1910 (CFR 1997b)	5 Design Code	Minimum requirement	Design complies with the code.	System	WHC-S-0251 (WHC 1994b), H-2-85287		
9	The electrical connectors on the Breathing Air Compressor must be compatible with those on the portable generator	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Electrical Connector Compatibility	System	H-2-85287		

TABLE 2. DESIGN COMPLIANCE MATRIX
VII - BREATHING AIR COMPRESSOR

REQUIREMENTS						SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
10	The phase orientation of the breathing air compressor wiring must be matched to the phase orientation of the diesel generator	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Correct Wirirng to maintain correct phase relations	System	H-2-85287		
11	The Breathing Air Compressor must be compatible with the personnel breathing apparatus.	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Connectable to Personal Breathing Apparatus	System	H-2-85287		
12	If new Breathing Air Compressors are procured, they must be interchangeable with the existing Breathing Air Compressor to facilitate continuous Rotary Mode Core Sampling.	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	7 Other	General Construction	Interchangeable	System	H-2-85287		

TABLE 2. DESIGN COMPLIANCE MATRIX
VIII - NITROGEN SUPPLY TRAILER

REQUIREMENTS						SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
	enter functional or design criteria exactly as stated in the requirements source document.	enter source doc.	enter origin of requirement if other than Source	Performance Ext. Interface Safety Environmental Design Code Other	enter all additional information which amplifies, qualifies, justifies,...etc. the criteria statement.	describe the manner in which the design purports to fulfill the criteria statement - be as specific as possible.	enter component name if Source is specific	provide ref. for design attribute (drawing, procedure, spec....etc.)	provide discussion on method, evidence, reasoning used, ...etc., to verify that the design complies with requirements - be specific - include any qualifications, if appropriate.	person or group attesting to verif. (initialed)
1	The tank shall have the capacity to handle continuous gaseous nitrogen flow rate of 50 scfm at 90 psig for 8 hours when connected to the vaporizing system.	WHC-S-0249 Rev. 1 (WHC 1995d), section 3.2.1	Engineering Judgement	1 Performance	Design selection	Tank size	Nitrogen tank	WHC-S-0249, Rev. 1		
2	The vaporizing system shall be connected to the liquid nitrogen tank to supply gaseous nitrogen at a rate of 0 to 124 SCFM (2.7 to 47 ACFM) at a pressure of 30 to 90 psig and a temperature of 40°F to 150°F.	WHC-S-0249 Rev. 1 (WHC 1995d), section 3.2.5	Engineering Judgement	1 Performance	Establishes vaporizer capacity	System size	Heat Exchanger	WHC-S-0249, Rev. 1		
3	The minimum nitrogen purity shall be 97% volume and shall contain no volatile gasses.	WHC-SD-WM-CR-044 Rev. 1 (WHC 1993)	Engineering Judgement	1 Performance	Design selection	Gas purity	System	WHC-S-0249, Rev. 1		
4	All core sampling equipment is designed to be mobile/portable.	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	1 Performance	Modifications shall not compromise existing traffic safety requirements or handling provisions.	Mobile equipment	System	WHC-S-0249, Rev. 1		
5	The liquid nitrogen tank shall be DOT approved for transporting liquid nitrogen under normal working pressure on public roads.	WHC-S-0249 Rev. 1 (WHC 1995d), section 3.1.3	Engineering Judgement	5 Design Code	Safe to transport	DOT approved	Nitrogen tank	WHC-S-0249, Rev. 1		
6	Nitrogen supply trailer Nitrogen Tank requires ASME code stamp	WHC-SD-WM-FDC 044, Draft (WHC 1995b)	Engineering Judgement	5 Design Code	Piping and Vessels	Complies with the ASME Code	Nitrogen tank	WHC-S-0249, Rev. 1		
7	The Nitrogen Supply Trailers interface with the nitrogen gas system on the RMCST via a hose fitting that must be compatible with the RMCST hose connector	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Mechanical Connector Compatibility	System	H-2-85299		
8	Nitrogen Trailers A, B, and C must all be interchangeable to facilitate continuous Rotary Mode Core Sampling	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Equipment Interchangeability	System	H-2-85299		

TABLE 2. DESIGN COMPLIANCE MATRIX
IX - CASKS AND CASK TRUCKS

	REQUIREMENTS					SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
	enter functional or design criteria exactly as stated in the requirements source document.	enter source doc.	enter origin of requirement if other than Source	Performance Ext. Interface Safety Environmental Design Code Other	enter all additional information which amplifies, qualifies, justifies....etc. the criteria statement.	describe the manner in which the design purports to fulfill the criteria statement - be as specific as possible.	enter component name if Source is specific	provide ref. for design attribute (drawing, procedure, spec....etc.)	provide discussion on method, evidence, reasoning used, ...etc ; to verify that the design complies with requirements - be specific - include any qualifications, if appropriate.	person or group attesting to verif. (initialed)
1	The cask trucks can carry up to three casks at a time.	WHC-SD-TP-SARP-002 Rev. 1e (WMFS 1998)	HNF-PRO-157 (CHG 1998b)	1 Performance	Design selection	Truck load capacity and size	Truck	H-2-83324 H-2-83320		
2	Waste sample temperature must be < 457 deg. C in a fire lasting 15 minutes.	WHC-SD-TP-SARP-002 Rev. 1e (WMFS 1998)		3 Safety	Each cask is limited to one core sample (up to 500cc)	Sufficient thermal protection in the fire accident	Cask	WHC-SD-TP SARP-002 Rev. 1e (WMFS 1998)		
3	Cask surface temperature is < 82 deg. C	WHC-SD-TP-SARP-002 Rev. 1e (WMFS 1998)	49 CFR 173 Subpart I	3 Safety	Each cask is limited to one core sample (up to 500cc)	Cask material and geometry	Cask	WHC-SD-TP SARP-002 Rev. 1e (WMFS 1998)		
4	Criticality acceptance criteria are satisfied.	WHC-SD-TP-SARP-002 Rev. 1e (WMFS 1998)		3 Safety	Each cask is limited to one core sample (up to 500cc)	Casks are limited to 15 g. of fissile material	Cask	WHC-SD-TP SARP-002 Rev. 1e (WMFS 1998)		
5	The cask shall be designed for internal pressure.	WHC-SD-TP-SARP-002 Rev. 1e (WMFS 1998)		3 Safety	Internal gas generation and heat generation during normal conditions increase internal pressure.	The cask design pressure is 20.7 psig	Cask	WHC-SD-TP SARP-002 Rev. 1e (WMFS 1998)		
6	The cask meets the 4 ft. drop requirements.	WHC-SD-TP-SARP-002 Rev. 1e (WMFS 1998)		3 Safety	Design selection	The cask passed the drop test evaluation.	Cask	WHC-SD-TP SARP-002 Rev. 1e (WMFS 1998)		
7	The cask meets structural requirements for normal loads.	WHC-SD-TP-SARP-002 Rev. 1e (WMFS 1998)	10 CFR 71 (CFR 1998)	3 Safety	Minimum requirement	Meets ASME code	Cask	WHC-SD-TP SARP-002 Rev. 1e (WMFS 1998)		
8	Cask meets containment requirements for normal and accident conditions.	WHC-SD-TP-SARP-002 Rev. 1e (WMFS 1998)	HNF-PRO-154 (CHG 1998)/ ANSI N14.5 (ANSI 1993a)	3 Safety	Casks do not leak	Cask meet requirements for THI-3 onsite shipment and leak tightness.	Cask	WHC-SD-TP SARP-002 Rev. 1e (WMFS 1998)		
9	Cask transport containers are permanently mounted to the cask truck	WHC-SD-TP-SARP-002 Rev. 1e (WMFS 1998)		3 Safety	Design selection	Containers are attached to cask truck	Cask Containers	H-2-83324 H-2-83320		

TABLE 2. DESIGN COMPLIANCE MATRIX
IX - CASKS AND CASK TRUCKS

REQUIREMENTS						SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
10	Proper cask tiedown is provided for transport of the cask.	WHC-SD-TP-SARP-002 Rev. 1e (WMFS 1998)	49 CFR 393 (CFR 1995)	3 Safety	Minimum requirement	Cask tiedown meets 49 CFR 393	Truck	H-2-83324 H-2-83320		
11	Casks limit exposure at contact to less than 1000 mrem	WHC-SD-TP-SARP-002 Rev. 1e (WMFS 1998)		3 Safety/ ALARA	ALARA-based selection	Adequate shielding	Cask	H-2-38079		
12	All materials used shall be new, free of defects, and suitable for use in the environment.	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgement	6 Other	Design selection	Material is compatible with Environmental Conditions (Table 1)	Cask	H-2-38079		
13	The core sampling equipment is designed to be portable/mobile	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgement	6 Other	Modifications shall not compromise existing traffic safety requirements or handling provisions. 49 CFR 173 Subpart I	Mobile equipment meets requirements for road travel.	System	H-2-83324 H-2-83320		
14	All supplied equipment shall be new and suitable for use in the environment.	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgement	6 Other	Design selection	Equipment is compatible with Environmental Conditions (Table 1)	System	H-2-38079		

TABLE 2. DESIGN COMPLIANCE MATRIX
X - SERVICE TRAILERS

	REQUIREMENTS					SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
	enter functional or design criteria exactly as stated in the requirements source document.	enter source doc.	enter origin of requirement if other than Source	Performance Ext. Interface Safety Environmental Design Code Other	enter all additional information which amplifies, qualifies, justifies,...etc. the criteria statement.	describe the manner in which the design purports to fulfill the criteria statement - be as specific as possible.	enter component name if Source is specific	provide ref. for design attribute (drawing, procedure, spec....etc.)	provide discussion on method, evidence, reasoning used, ...etc., to verify that the design complies with requirements - be specific - include any qualifications, if appropriate.	person or group attesting to verif. (initialed)
1	Electrical components and installation shall comply with the NEC	WHC-S-056 Rev. 2a (WHC 1994a)	Engineering Judgement	5 Design Code	Minimum requirement	All electrical installations shall conform to the latest edition of the NEC. Electrical components shall be UL approved.	System	WHC-S-056, section 3.3.1		
2	The trailer shall comply with DOT regulations.	WHC-S-056 Rev. 2a (WHC 1994a)	49 CFR 390 through 397	5 Design Code	The trailer has access to public roads	The trailer shall be a van trailer, (furniture type), in accordance with all applicable OSHA Standards, and 49 CFR, Sections 390 through 397.	Trailer	WHC-S-056, section 3 1.1		
3	Electric air condition/ heater with a min. capacity to regulate the temp. to 75 deg. F with 110 deg F outside temp., 20 MPH wind and five people inside the trailer, and 70 deg. F with a -30 deg. F outside temp., 50 MPH wind with no people inside.	WHC-S-056 Rev. 2a (WHC 1994a), section 3.3.2	Engineering Judgement	6 Other	Design selection	Heating and cooling capacity	HVAC	WHC-S-056, section 3.3 2		
4	The electrical connector on the Service Trailer must be able to interface with the connector on the portable generator	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Electrcial Connector Compatibility	System	H-2-690072 Draft		
5	Service Trailers A and B must be interchangeable to facilitate continuous Rotary Mode Core Sampling	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Equipment Interchangeability	System	H-2-690072 Draft		

TABLE 2. DESIGN COMPLIANCE MATRIX
XI - RISE SUPPORT EQUIPMENT

REQUIREMENTS						SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config Control Ref.	Engineering Evaluation Description	Verified By?
	enter functional or design criteria exactly as stated in the requirements source document.	enter source doc.	enter origin of requirement if other than Source	Performance Ext. Interface Safety Environmental Design Code Other	enter all additional information which amplifies, qualifies, justifies,...etc. the criteria statement.	describe the manner in which the design purports to fulfill the criteria statement - be as specific as possible.	enter component name if Source is specific	provide ref. for design attribute (drawing, procedure, spec....etc.)	provide discussion on method, evidence, reasoning used, ...etc., to verify that the design complies with requirements - be specific - include any qualifications, if appropriate.	person or group attesting to verif. (initialed)
1	Riser equipment components must be fabricated using stainless steel.	None	Engineering Judgement	1 Performance	Reduces sparking hazard for core sampling in flammable gas environment.	Riser equipment components are fabricated using any 300 series stainless steel.	Riser sleeve, riser adapter, drill string spray washer, riser sleeve spray washer.	H-2-690128 H-2-690131 H-2-91671 H-2-690132 H-2-690136		
2	All core sampling equipment is designed to be mobile/portable.	WHC-SD-WM-FDC-048 (WHC 1995a)	Engineering Judgement	1 Performance	Modifications shall not compromise existing traffic safety requirements or handling provisions.	Portable equipment	Componets	H-2-690128 H-2-690131 H-2-91671 H-2-690132 H-2-690136		
3	Riser equipment shall be capable of wiping and washing tank waste from drill string surface to enable hand disassembly by operations personnel	None	Engineering Judgement	1 Performance	Modifications to the drill rod washer and pipe wiper shall not reduce the ability to remove radioactive waste.	Drill rod washer and pipe wiper reduce concentration of waste on drill string.	Drill rod washer and pipe wiper	H-2-690134 H-2-821457 H-2-91671		

TABLE 2. DESIGN COMPLIANCE MATRIX
XII - CORE SAMPLE SUPPORT TRUCKS

	REQUIREMENTS					SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
	Enter functional or design criteria exactly as stated in the requirements source document.	Enter source doc.	Enter origin of requirement if other than Source	Performance Ext. Interface Safety Environmental Design Code Other	Enter all additional information which amplifies, qualifies, justifies,...etc. the criteria statement.	Describe the manner in which the design purports to fulfill the criteria statement - be as specific as possible.	Enter component name if Source is specific	provide ref for design attribute (drawing, procedure, spec....etc.)	Provide discussion on method, evidence, reasoning used. ...etc.. to verify that the design complies with requirements - be specific - include any qualifications, if appropriate.	person or group attesting to verif. (initialed)
1	The truck shall comply with D.O.T. regulations for transport.	49 CFR 393 (CFR 1995)		1 Performance	RMCS Support Truck	Truck is equipped for highway driving and has backup alarm	Truck	H-2-81853 H-2-829939 H-2-829940		
2	All core sampling equipment is designed to be mobile/portable.	WHC-SD-WM-FDC 046 (WHC 1995a)	Engineering Judgement	1 Performance	Modifications shall not compromise existing traffic safety requirements or handling provisions.	Mobile equipment	System			
3	Spray wash pump pressure of 1200 psi to riser sleeve spray washer.	None	Engineering Judgement	1 Performance	RMCS Support Truck "A" Only	Pump and support equipment are rated at 3000 psi maximum pressure.	System	H-2-81853		
4	Spray wash pump pressure of 400 psi to drill rod washer manifold assembly.	None	Engineering Judgement	1 Performance	RMCS Support Truck "A" & "B" Only	Pump and support equipment are rated at 3000 psi maximum pressure.	System	H-2-81853		
5	2 molar Lithium bromide solution or water temperature of less than or equal to 140 deg. F.	None	Engineering Judgement	1 Performance	RMCS Support Truck "A" & "B" Only	Support truck has 55 gal. Drum heater assembly.	System	H-2-81853-05		
6	The electrical connector on the Core Sample Support Trucks must be able to interface with the connector on the portable generator.	WHC-SD-WM-FDC 048 (WHC 1995a)	Engineering Judgement	6 Other	General Construction	Electrical Connector Compatibility	System	H-2-81853		

TABLE 2. DESIGN COMPLIANCE MATRIX
XIII-RAMPS AND PLATFORMS

REQUIREMENTS						SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config Control Ref.	Engineering Evaluation Description	Verified By?
	Enter functional or design criteria exactly as stated in the requirements source document.	Enter source doc.	Enter origin of requirement if other than Source	Performance Ext. Interface Safety Environmental Design Code Other	Enter all additional information which amplifies, qualifies, justifies,...etc. the criteria statement.	Describe the manner in which the design purports to fulfill the criteria statement - be as specific as possible.	Enter component name if Source is specific	provide ref. for design attribute (drawing, procedure, spec....etc.)	Provide discussion on method, evidence, reasoning used, ...etc., to verify that the design complies with requirements - be specific - include any qualifications, if appropriate.	person or group attesting to verif. (initialed)
1	Platforms shall be designed to allow core sampling from either side or rear of a core sample truck.	None	Engineering judgement	1 Performance		Platforms support a core sample via I-beams which support the wheels only. The sides and center are accessible for core sampling.	Platforms	H-2-85633		

TABLE 2. DESIGN COMPLIANCE MATRIX
XIV - FOOTCLAMP

REQUIREMENTS						SOLUTION			VERIFICATION	
Count	Criteria	Source	Basis	Requirement Type	Notes/Assumptions/Implications	Design Attribute	Component	Config. Control Ref.	Engineering Evaluation Description	Verified By?
	Enter functional or design criteria exactly as stated in the requirements source document.	Enter source doc.	Enter origin of requirement if other than Source	Performance Ext. Interface Safety Environmental Design Code Other	Enter all additional information which amplifies, qualifies, justifies,...etc. the criteria statement.	Describe the manner in which the design purports to fulfill the criteria statement - be as specific as possible.	Enter component name if Source is specific	provide ref. for design attribute (drawing, procedure, spec....etc.)	Provide discussion on method, evidence, reasoning used, ...etc., to verify that the design complies with requirements - be specific - include any qualifications, if appropriate.	person or group attesting to verif. (initialed)
1	Footclamp shall restrain drill string while disconnected from other means of support	Basic Function	Engineering Judgement	1 Performance	Function of Footclamp	Assembly		H-2-690138	HNF-4292, Test Plan and Report for MXIDRILL Model 3030 Footclamp Work Package 2H9903622	RPP-5628
2	Footclamp shall interface with the Core Sampling System		Engineering Judgement	2 External Interface	Jaw replacement not necessary when changinng drill string types.	Mates with drill rod washer, uses CST pneumatic system, jaws open and close sufficiently to accommodate both drill string types, provides sufficient force to restrain maximum drill string weight		H-2-821457	HNF-4292, Test Plan and Report for MXIDRILL Model 3030 Footclamp Drawing Evaluation Work Package 2H9903622	RPP-5628
3	Footclamp shall not open on loss of supply air	HNF-SD-WM-SEL-044 Rev. 2 (LMHC 1997a)		3 Safety/AB		Spring brake requires air pressure to open. Spring force holds drill string without air.		H-2-690138	HNF-4292, Test Plan and Report for MXIDRILL Model 3030 Footclamp Work Package 2H9903622	RPP-5628
4	Electrostatic ignition sources shall be controlled by providing bonding or grounding according to NFPA 77, Recommended Practice on Static Electricity	HNF-SD-WM-SEL-044 Rev. 2 (LMHC 1997a)	HNF-SD-WM SAR-067 Rev. 1d (CHG 1999c)	3 Safety/AB	Ignition Sources - All non metals exposed to the airstream are bonded to metals or shall be approved for the application by the FGEAB.	Metallic footclamp components form bond upon installation. Non-metallic hoses and diaphrams assembled to metallic components.	System	H-2-821457	Drawing evaluation	RPP-5628
5	The design shall ensure that a single failure does not result in the loss of capability of a safety class system to perform its safety function	WHC-SD-WM-FDC 048 Rev. 0 (WHC 1995a)	HNF-SD-WM SAD-035 Rev 0b	3 Safety/AB	Secondary control valve and panel guards reduce likelihood of inadvertent valve operation.	Spring close/air open fail safe design feature		H-2-690138	HNF-4292, Test Plan and Report for MXIDRILL Model 3030 Footclamp Work Package 2H9903622	RPP-5628
6	Complies with 29 CFR 1910	DOE Order 5480.4		3 Safety/AB	Inadvertent pinch points eliminated	Hole size and distance from opening to jaws.		H-2-690138	Drawing evaluation	RPP-5628
7	Mechanical tooling, equipment and materials (including lubricants, adhesives, gaskets, corrosion inhibitors, epoxies, etc.) shall be constructed of spark resistant material, or shall be rendered incapable of sparking with sufficient energy to combust hydrogen, or shall have been analyzed and evaluated to be incapable of sparking with sufficient energy to combust hydrogen under the applied conditions. Material compatibility shall be evaluated for thermite reaction potential.	HNF-SD-WM-TSR-006 Rev. 1c (CHG 1998c)	HNF-SD-WM SAR-067 Rev. 1d (CHG 1999c)	3 Safety/AB	Material compatiblity shall be evaluated for thermite reaction potential. Ignition Sources - Mechanical components in contact with the tank airstream or waste will meet the criterion listed or shall be approved for the application by the FGEAB. Jaws move at a rate less than or equal to one foot per second.	Cv of valve restricts air release thereby restricting velocity of jaw motion.	System	H-2-690138	HNF-4292, Test Plan and Report for MXIDRILL Model 3030 Footclamp Work Package 2H9903622 Close rate to be re-tested in Work Package ES-99-00304	RPP-5628
8	Does not provide breach in tank envelope confinement/containment		Engineering Judgement	4 Environemental	When drill string is not in pipe wiper (frisbee) then a plug provides sealing function.	Seals to frisbee and drill rod spray washer.	System	H-2-821457	Drawing evaluation	RPP-5628