Facility Effluent Monitoring Plan Determinations for the 400 Area Facilities

Prepared for the U.S. Department of Energy
Assistant Secretary for Environment,
Safety and Health

Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

Approved for Public Release

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

LEGAL DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

This report has been reproduced from the best available copy.
Available in paper copy and microfiche.

Available to the U.S. Department of Energy
and its contractors from
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831
(615) 576-8401

Available to the public from the U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

Printed in the United States of America

DISC: M-1 ChP (1-91)

Facility Effluent Monitoring Plan Determinations for the 400 Area Facilities

Environmental Assurance

Date Published
September 1991

Prepared for the U.S. Department of Energy
Assistant Secretary for Environment,
Safety and Health

**Westinghouse
Hanford Company**

P.O. Box 1970
Richland, Washington 99352

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

Approved for Public Release

MASTER

rb
DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

APPROVAL

Prepared by: 8-28-91
J. M. Nickels
Principal Engineer Date

Approved by: 8-28-91
L. P. Diediker 200 Area
Manager, Environmental
Protection Date

Approved by: 8/30/91
G. D. Carpenter
Manager, Environmental Quality
Assurance Date

Approved by: ^{and 8/30/91} 8/30/91
D. G. Farwick
Manager, Environmental
Quality Assurance Date

Approved by: 9-3-91
W. G. Ruff
Acting Director,
Facility Operations Date

400 AREA FACILITIES FACILITY EFFLUENT
MONITORING PLAN DETERMINATION

J. M. Nickels

ABSTRACT

*This Facility Effluent Monitoring Plan determination resulted from an evaluation conducted for the Westinghouse Hanford Company 400 Area facilities on the Hanford Site. The Facility Effluent Monitoring Plan determinations have been prepared in accordance with A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans (WHC 1991).**

Two major Westinghouse Hanford Company facilities in the 400 Area were evaluated: the Fast Flux Test Facility and the Fuels Manufacturing and Examination Facility. The determinations were prepared by Westinghouse Hanford Company. Of these two facilities, only the Fast Flux Test Facility will require a Facility Effluent Monitoring Plan.

*WHC, 1991, A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438, Westinghouse Hanford Company, Richland, Washington.

This page intentionally left blank.

CONTENTS

PART 1 - FAST FLUX TEST FACILITY, FACILITY EFFLUENT MONITORING PLAN DETERMINATION.

PART 2 - FUELS AND MATERIALS EXAMINATION FACILITY--427, 483B, 4802, AND 4862 BUILDINGS, FACILITY EFFLUENT MONITORING PLAN DETERMINATION.

This page intentionally left blank.

PART 1

FAST FLUX TEST FACILITY

**FACILITY EFFLUENT MONITORING
PLAN DETERMINATION**

This page intentionally left blank.

CONTENTS

1.0	INTRODUCTION	1
2.0	FACILITY DESCRIPTION	1
3.0	STATUS OF OPERATION	1
4.0	SOURCE TERM	4
4.1	INTRODUCTION	4
4.1.1	System Function and Area Exhausted	4
5.0	POTENTIAL UPSET-OPERATING CONDITIONS	12
6.0	SUMMARY	17
7.0	REFERENCES	17

ATTACHMENT

1	Determination of Facility Effluent Monitoring Plan Requirement . .	A1-1
---	--	------

LIST OF FIGURES

1	Fast Flux Test Facility	2
2	Fast Flux Test Facility Plant Arrangement	3
3	Containment Vessel	7
4	Typical Cross Section of Internal Structures Within the Containment Vessel	8
5	Reactor Containment Building Cutaway	10

LIST OF TABLES

1	Hazardous Substances Stored in Building	5
2	Anticipated Upset-Operating Release Condition	13
3	U.S. Environmental Protection Agency Requirements	14

1.0 INTRODUCTION

This Facility Effluent Monitoring Plan (FEMP) was prepared in accordance with *A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans* (WHC 1991) for the Fast Flux Test Facility (FFTF).

2.0 FACILITY DESCRIPTION

The FFTF is a 400-MW thermal sodium-cooled, fast neutron flux reactor plant designed specifically for irradiation testing of nuclear reactor fuels and materials for liquid metal fast breeder reactors. The reactor provides extensive capability for in-core irradiation testing, including eight core positions that may be used with independent instrumentation for the test specimens. Four of these positions may be used for independently cooled test loops. In addition to irradiation testing capabilities, the FFTF provides long-term testing and evaluation of plant components and systems for liquid metal fast breeder reactors.

The FFTF is a complex of buildings and equipment arranged around a reactor containment building. This arrangement includes the reactor itself, as well as equipment and structures for heat removal, containment, core component handling and examination, instrumentation and control, and for supplying utilities and other essential services, as shown in Figures 1 and 2.

The FFTF operates routinely in 100+ d full-power cycles. Between full-power cycles the reactor is shut down for several weeks for refueling. The Combined Exhaust is operated on a continuous basis during full-power cycles and refueling.

Future missions for the FFTF may include production of medically useful radioisotopes, conversion of radioactive waste to less hazardous material, nuclear weapons neutralization, materials testing for fusion and space reactors, and generation of electricity. Each of these activities will be evaluated, as it is engineered, for its effect on both radiological and chemical plant emissions.

3.0 STATUS OF OPERATION

The plant currently is operating at a full-power rating of 291 MW thermal (the plant does not produce electricity). This compares to a design full-power rating of 400 MW thermal. The lower value was established to limit temperatures in experimental fuel assemblies presently in the core and known as the Core Demonstration Experiment. The FFTF will continue to operate at 291 MW thermal for the foreseeable future, although it remains an option to return to the design full-power rating.

Figure 1. Fast Flux Test Facility.

Figure 2. Fast Flux Test Facility Plant Arrangement.

Photo P08974.2
PS-90-89

4.0 SOURCE TERM

4.1 INTRODUCTION

The primary source of effluent from the operation of the FFTF which could result in significant impact to the surrounding area as a result of normal or anticipated off-normal operations is the airborne effluent pathways. The inventory of hazardous substances (nonradiological) is listed in Table 1.

4.1.1 System Function and Area Exhausted

The FFTF design philosophy for radioactivity control is one of containment (i.e., closure of valves when excessive radiation is detected in plant exhaust systems). The significant result of this philosophy is that primary reliance is not placed on filters, as is often the case in other nuclear facilities, to ensure that radiation is not released to the atmosphere. However, both tested and nontested filters are incorporated into the exhaust systems. By the design philosophy, such filters are considered process devices rather than control devices; the filters' function is to remove radioactivity that otherwise would alarm the monitoring system and close the isolation valves.

More than 99% of the releases to the atmosphere are from the Combined Exhaust. Ventilation air from the Reactor Containment Building and its access control area, air from the unlined cells in the Reactor Service Building (RSB), and processed gas and air from the Radioactive Argon Processing System (RAPS) and Cell Atmosphere Processing System (CAPS) are combined and vented to the atmosphere through the Combined Exhaust. These four areas ventilated by the Combined Exhaust are described in the following sections.

4.1.1.1 Reactor Containment Building. The Reactor Containment System consists of a cylindrical carbon-steel reactor containment vessel 586.96 m high by 41.16 m in diameter, along with several principal structures and equipment pieces within the vessel (Figure 3). Steel-lined, reinforced concrete cells and pipeways that house the reactor components occupy the lower portion of the containment vessel (below the operating floor) from grade level (elevation 167.68 m) to approximately 23.78 m below grade. The reactor components are shown in Figure 4. Cells and pipeways that house piping and/or equipment containing primary-system sodium are provided with an inert atmosphere of nitrogen gas. Steel liners contain the inert atmosphere and protect the concrete from exposure to sodium in case of a spill. Figure 4 depicts a typical plan view and cross section of the lower portion of the containment vessel.

In the operating area a shielded operating floor is located at grade level. The central portion of the operating floor is occupied by a steel operating deck, which is directly above the reactor head compartment. A large fuel handling machine is located on the operating floor.

Table 1. Hazardous Substances Stored in Building. (2 sheets)

Product	Maximum quantity of product on hand	Regulated chemical in product	Quantity of regulated chemical (lb)	Quantity of chemical release per year (lb)	RQ for chemical (lb)	% of RQ on hand	Notes
Sodium (Na)	1,940,000 lb	Sodium (Na)	1,940,000	0	10	100	Currently stored in ASME coded systems
Waste Na	5 lb	RCRA Waste D001/D002/D003	5	0	10	50	Would likely use sodium RQ of 10 in the event of spill
Emergency batteries	3,179 lb	Sulfuric acid	3,179	0	1,000	100	Largest battery contains 47 lb
PCB	102,000 lb	PCB	102,000	0	1	100	Contained in 19 TSCA compliant PCB transformers
Solvent	2,856 lb	Potassium Hydroxide (10%)	286	1,144	1,000	28.56	
Freon (R-12) dichlorodi-fluoromethane	24,000 lb	Freon (R-12)	24,000	1,000	5,000	100	R-12 used in 8 chillers, each containing 3,000 lb
Sodium-potassium alloy	6,330 lb						
Lead (installed in facility and components)	666,000 lb						

Table 1. Hazardous Substances Stored in Building. (2 sheets)

Product	Maximum quantity of product on hand	Regulated chemical in product	Quantity of regulated chemical (lb)	Quantity of chemical release per year (lb)	RQ for chemical (lb)	% of RQ on hand	Notes
Diesel fuel	105,800 gal	NR					
Ethylene Glycol (45% Glycol, 55% Demineralized Water)	94,000 gal	NR					
Isopropyl alcohol	2 gal	NR					
1, 2 propanediol (propylene glycol)	4 gal	NR					
Algicide used in cooling towers	90 gal	NR					
Heat transfer oil	14,700 lb	NR					
Rheostat Electrolyte (3-4% sodium carbonate)	4,200 gal	NR					In six liquid rheostat

ASME = American Society of Mechanical Engineers

PCB = Polychlorinated biphenyl

RCRA = Resource Conservation and Recovery Act

RQ = reportable quantity

TSCA = Toxic Substances Control Act

NR = Not regulated

Figure 3. Containment Vessel.

Photo 8009034-2
PS-90-90

Figure 4. Typical Cross Section of Internal Structures Within the Containment Vessel.

A structural-steel mezzanine is located above the perimeter of the operating floor at an elevation of 173.78 m. The mezzanine provides additional work area plus space for heating and ventilation equipment and a number of control panels. Above the mezzanine a 200-ton polar gantry crane and a jib crane are provided to satisfy hoisting requirements. A cutaway of the Reactor Containment Building is shown in Figure 5.

The cell atmosphere and the argon cover gas used in the reactor vessel are processed by the CAPS and RAPS, respectively, to remove radioactive aerosols, particulates, and gas. The surrounding work areas are serviced by the Reactor Containment building heating and ventilation system. This system is supplied by outside air and is vented to the Combined Exhaust. The inert nitrogen cells are maintained slightly positive relative to containment to aid in limiting the oxygen content. The containment is maintained slightly negative relative to atmospheric pressure to limit the spread through the personnel airlock of radioactive contamination in the vent of an accidental release within containment.

Almost all of the radioactive releases from the Combined Exhaust originate from the RAPS and CAPS. With the exception of small amounts of tritium from the fusion Materials Open Test Assemblies glovebox and cesium at minimum detectable levels from the In-Containment CAPS Blowers, the containment heating and ventilation system releases no radioactivity.

4.1.1.2 Access Control Area. The area immediately outside the containment personnel airlock is called the Access Control Area, which is located in Auxiliary Equipment Building-East. Persons exiting containment are monitored for radioactivity in this area. The likelihood of a release from this area is small. The system is designed for a situation in which the containment becomes contaminated and there is the likelihood that personnel will carry radioactivity from the containment through the airlock. The Access Control Area heating and ventilation system is designed to maintain a slightly negative pressure with respect to adjacent rooms to limit airborne contamination to those areas.

4.1.1.3 Reactor Service Building Unlined Cells. The RSB is a structurally independent building with underground cells for offsite shipping cask loading and for storage and processing of radioactive gases and other solid and liquid wastes. The building's superstructure provides access for trucks and railroad cars to the containment's equipment air lock. The RSB contains a 100-ton bridge crane with an auxiliary 25-ton hook for handling equipment and materials. Liquid nitrogen stored in tanks in the RSB is used to cool the RAPS and CAPS cryogenic charcoal beds. The bottom loading transfer cask, which is used to move spent fuel from the containment, is stored in this building.

The cells and pipeways in the RSB include those for the CAPS, the RAPS, and the Radioactive Liquid Waste System. The Radioactive Liquid Waste System components housed in the RSB are part of the sodium removal system. This system's function is to wash sodium-wetted test articles removed from the reactor that are under study in the interim examination and maintenance cell. The interim examination and maintenance cell is a hot cell designed for remote handling of radioactive reactor components and is located in containment. The radioactive sodium hydroxide solution that results from sodium removal

Figure 5. Reactor Containment Building Cutaway.

Photo P09208-1
PS-90-96

operations is stored in tanks located in the RSB and is off-loaded as necessary to railcars and shipped for use in other processes on the Hanford Site. Argon gas from the system is vented to CAPS. The unlined cells (those that have a low potential for containing radioactive materials) in the RSB are interconnected and pressure controlled by the Special Cooling and Cell Atmosphere Control System which discharges to the Combined Exhaust. The unlined cells in the RSB do not normally contribute any radioactivity to the Combined Exhaust. The steel-lined RSB cells, those containing part of the RAPS components, are maintained at a negative pressure by the CAPS. These steel-lined cells are not normally vented with the unlined cells; however, during maintenance these steel-lined cells can be vented along with unlined cells to the Combined Exhaust.

4.1.1.4 Radioactive Argon Processing System and Cell Atmosphere Processing System. The RAPS processes the argon cover gas from the reactor. Releases from the RAPS comprise virtually all of the radioactivity that is exhausted to the atmosphere. Before processing the reactor cover gas contains radioactive sodium vapor and aerosols, ^{41}Ar which is an activation product of the reactor cover gas, and a number of species of the radioactive fission product gases krypton and xenon. In addition, the reactor cover gas contains vapors of radionuclides of cesium in quantities that vary greatly depending on the action of sodium purification equipment and the length of time since the last fuel pin release.

Tritium is produced in the reactor by ternary fission, by neutron reaction with boron in the control rods, and by neutron reaction with traces of lithium in the fuel and sodium coolant. Tritium is intentionally produced and measured by the Fusion Materials Open Test Assemblies experiment. Tritium readily moves from these sources to the sodium and is captured as sodium hydride. Sodium hydride is relatively insoluble in the sodium and tends to crystallize and be trapped in the FFTF's primary coolant purifier, the cold trap. Because of its ability to diffuse through metals, a small amount of tritium enters the secondary coolant loops via the intermediate heat exchangers. Some tritium enters the reactor cover gas. Small amounts of tritium are found in the Combined Exhaust. The majority of the tritium measured at the Combined Exhaust is believed to come from the Fusion Materials Open Test Assemblies analysis glovebox via the CAPS. The RAPS transports some tritium as well with the reactor cover gas it processes.

Before entering the RAPS, the effluent is processed by a sodium vapor trap to remove and return sodium aerosols and vapors as liquid to the reactor. The RAPS use a surge and delay tank, cryogenic unit, and particulate filter (located upstream of the compressors) to reduce the radionuclide concentration. The delay tanks and charcoal beds reduce the concentration of the noble gas radioisotopes by retaining them for intervals sufficiently long enough to permit their decay. Cesium species that might be present in the reactor cover gas are removed by the vapor trap, particulate filters, and charcoal beds.

The CAPS processes potentially contaminated nitrogen, air, or argon and discharges it to the atmosphere via the Combined Exhaust. Inert cell atmosphere purges are the primary source of gas to the CAPS, although several other sources contribute intermittent input to this system. The CAPS

equipment, other than the charcoal beds, is used continuously to maintain inert cell pressure control and to process waste gas from the fueling machines, the interim examination and maintenance cell, and other sources. The CAPS effluent normally has only trace quantities of radioisotopes.

The CAPS is similar to the RAPS; however, its charcoal beds are used infrequently. The primary function of its cryogenically cooled charcoal beds is to process the atmospheres of the inert cells in containment following an accident in which sodium and fission products are released from the primary system in those cells. Such an accident has never happened, nor is it expected to happen. The CAPS charcoal beds have a more realistic secondary use, as a backup unit for the RAPS.

5.0 POTENTIAL UPSET-OPERATING CONDITIONS

Activation of the reactor cover gas produces the radioisotope ^{41}Ar . Approximately 1,500 $\mu\text{Ci/s}$ of ^{41}Ar are produced when the plant is operating at power. The argon cover gas is processed by the RAPS reducing the amount of ^{41}Ar released to the atmosphere. The amount released to the atmosphere is 1.5 $\mu\text{Ci/s}$, which is 1×10^{-3} of the facility generation rate.

There is one anticipated event, which is nonroutine, that results in a release of the radioactivity to the atmosphere. This event is a fuel pin cladding breach, which results in the release of ^{85}Kr , a noble gas radioisotope that has a half-life of 10.76 h. The total activity in a fuel pin that has run three cycles (approximately 450 d) at 5.1 MW thermal (plant operating power of 291 MW thermal) is approximately 124,200 Ci. Total noble gas activity is approximately 7,700 Ci, primarily from krypton and xenon radioisotopes. Only 1 Ci of the noble gas ^{85}Kr is expected to be released to the atmosphere from a fuel pin cladding breach. Because the RAPS delays krypton for about 1 wk, ^{85}Kr is not decayed and is released via the Combined Exhaust. The other kryptons and zenons are short-lived radioisotopes, which are delayed by the RAPS a sufficient length of time to allow for their decay. Other fission products are either retained in the sodium or the RAPS.

There have been 12 fuel pin releases at the FFTF since the beginning of operation in April 1982. All of these events have been single fuel pin breaches with the exception of two fuel pin releases that occurred during the same time period. Generally, only one fuel pin breach occurs at a time; however, the plant systems are designed to operate with 1% breached fuel or about 160 breached fuel pins in the reactor core. See Table 2.

Table 2. Anticipated Upset-Operating Release Condition.

Radionuclide	Physical/chemical form	Quantity (Ci)	Quantity released	Projected (mrem)	Reportable quantity
⁴¹ Ar	Gas	3.7 E+04	3.7 E+01	See	10
⁸⁵ Kr	Gas	1.0 E+00	7.6 E-01	total	10
¹³¹ I	Vapor	N/A	1.0 E-05	below	0.01
¹³⁴ Cs	Particulate	3.1 E+00	-		1
¹³⁷ Cs	Particulate	6.0 E-01	1.5 E-05		1
Tritium	Tritiated exit signs	1,000 Ci Total	N/A	N/A	100
Total				6.3 E-04	

The available release information is based on the reactor operating and the release associated with the failure of one fuel element. Details of the basis and calculations are contained in DOE/RL-90-34 (DOE-RL 1990). The cesium quantity is based on concentration data from primary sodium analysis found in the fiscal year (FY) 88 release information as discussed in DOE/RL-90-34 (DOE-RL 1990). All recorded particulate values were assumed to be ¹³⁷Cs. Exit signs have tritium-filled glass tubes with approximately 19.997 Ci per sign. Fugitive tritium release is possible. The chance of more than one sign breaking within a 24-h period is considered unlikely. The reportable quantity for tritium is 100 Ci.

Table 3 is an evaluation against the U.S. Environmental Protection Agency (EPA) requirements and is based on all radioactive material not being containerized during normal operation, including the radioactive gas generated as a result of normal reactor operations (70% operational capacity).

Due to the active venting of the reactor cover gas to the Radioactive Argon Processing System during reactor operation, the primary coolant is not considered containerized. A cesium, manganese, and sodium activity quantity based on concentration data from primary sodium analysis was used as the source term in the 1,000,000 lb of primary sodium. The contributions described in Table 2 have been shown to be insignificant and have not been included for simplicity.

Using the Title 40, Code of Federal Regulations (CFR), Part 61, Subpart H, Appendix D, methodology (EPA 1990a), the potential offsite dose associated was calculated. This methodology assumes that all gas is released, 1/100th of all particulates or liquids are released, and 1/1,000,000th of all solids are released. Containerized material is not required to be included and if high-efficiency particulate air filtration exists on the facility, a filter efficiency of 99% can be assumed. Evaluation of the key hazardous substances within the facility are discussed this section. See Attachment 1.

Table 3. U.S. Environmental Protection Agency Requirements.

40 CFR 61, Subpart H, Appendix D, Determination							
Radionuclide	Power Level (MW)	Concentration (Ci/g)	Source (Ci)	Form	Release % (Assumed)	Offsite (Dose/Ci)	Dose (mrem)
²² Na	300	9 E-07	4 E+02	Liquid/part.	0.001%	2.56 E-02	9.7 E-05
⁵⁴ Mn	300	4 E-09	2 E+00	Liquid/part.	0.001%	7.29 E-03	1.8 E-07
¹³⁴ Cs	300	7 E-09	3 E+00	Liquid/part.	0.001%	4.15 E-02	1.4 E-06
¹³⁷ Cs	300	1 E-09	6 E-01	Liquid/part.	0.001%	3.17 E-02	2.0 E-07
		Ci/d	70%				
⁴¹ Ar	300	6 E+01	2 E+04	Gas	100%	1.65 E-05	2.6 E-01
						Total	2.6 E-01

Sodium

Normal Plant Operations and Controls

Molten sodium is used as a coolant in FFTF plant systems that are designed and maintained to standards. With the exception of the Dump Heat Exchangers located in concrete pits, secondary containment is provided for in the plant design either via guard vessels or cell liners. Much of the FFTF sodium is located within the FFTF Containment Building, which provides for an additional boundary to prevent release of the material to the environment. Access to the sodium system is normally limited to refueling operations which interface with the various sodium pool from above. The only normal withdrawal of sodium from the system is accomplished remotely in a dedicated sampling area.

Maintenance on the sodium system is performed in a configuration which provides two boundaries between the breaching of the system and any molten sodium. Due to the high sodium melting temperature, all maintenance is performed on frozen sodium systems.

Release History

The only breach of the FFTF sodium piping to occur in the 10-yr operating history of the FFTF was the result of failure of a small sodium pump. Approximately 600 lb of molten sodium were released to a lined nitrogen inerted cell. The cause of the event was investigated and determined to be unique to the particular pump in question.

Potential Release Events

Due to the nature of the system design and operation, the release of sodium from the FFTF systems due to a breach in the pressure boundaries associated with normal operations is very unlikely. A single boundary failure of any portion of the ASME pressure boundary should not be considered as the basis for an upset condition. All likely failure points (e.g., tanks and pumps) are provided with secondary containment either through the use of guard vessels or cell containment systems.

EVALUATION OF FFTF HAZARDOUS SUBSTANCE RELEASE POTENTIAL

Dichlorodifluoromethane (R-12)

Normal Plant Operations and Controls

Eight centrifugal R-12 chillers are used at FFTF to provide cooling for personnel and equipment. Each chiller contains a maximum of 3,000 lb of refrigerant R-12. R-12 is a vapor at room temperature and any leaks from the equipment represent an airborne fugitive emission. The equipment is constructed of flanged steel joints and copper side stream refrigerant processing loops.

Release History

Fugitive release of refrigerant from the equipment requires the addition of refrigerant to the machine periodically. These releases can be divided into three categories.

1. Catastrophic pressure boundary (copper tubing) failure which results in the releases of the entire charge. This has occurred on several occasions during the plant's operating history.
2. Releases associated with normal equipment maintenance. Periodic maintenance on the machines requires removal of the refrigerant and complete disassembly of the compressor unit. Residual refrigerant remaining in the machine after transferring the refrigerant to storage tanks is released on disassembly.
3. Releases that occur as a result of leakage from joints and valves on the chillers.

The first release event represents the source of significant release from the chillers. The release rate of 1,000 lb/yr is an estimate based on the average quantity of refrigerant added to the machines over the past few years which are not related to replacement of refrigerant associated with the first type of release.

Potential Release Events

The release of the entire charge of R-12 from the chiller can be considered a likely upset condition due to operating experience. Since the total quantity of refrigerant in one machine is less than a RQ value and the chillers are not interconnected on the refrigerant side, no one failure could result in exceeding an RQ in a 24-h period.

Sulfuric Acid

Normal Plant Operations and Controls

Sulfuric acid is used in the lead acid batteries at the FFTF backup electrical supply to plant systems.

Release History

There is no normal operation that results in the routine release of this material to the environment. Failure of individual cells has occurred which have resulted in the spillage of a small quantity of material within the plant.

Potential Release Events

The largest volume potentially released in any single failure is 47 lb, which is the quantity in the largest storage battery cell.

Polychlorinated Biphenyl (PCB)

Normal Plant Operations and Controls

The PCBs are used in 19 electrical transformers within the FFTF. The transformers are currently compliant with all *Toxic Substances Control Act* (TSCA) regulations. Storage of flammables in the vicinity of the transformers is not allowed and administrative controls are in place to restrict activity in the area of the transformers. All transformer drain valves are plugged to prevent inadvertent spillage of the fluid.

Release History

There are normal operations that result in the routine release of this material to the environment. Past releases from the transformers involved limited seepage from sample ports due to improperly installed fittings.

Potential Release Events

Each of the transformers contain about 5,000 lb of PCBs. The largest transformer contains approximately 5,600 lb. Catastrophic failure and release of the bulk transformer fluid is likely in only two events: fire and accidental rupture of the system, both of which are outside the scope of a normal upset condition as the failure of the engineered confinement system. Administrative controls are in place to reduce the risk of these events.

In accordance with TSCA regulations periodic visual inspections of the transformers are required to ensure no leakage or transformer degradation. Secondary containment of PCB transformers is not required in accordance with the TSCA, as demonstrated by the fact that mounting PCB transformers on a power pole is still allowed by TSCA. Should a leak occur the transformer may not be repaired and must be taken out of service. While it is recognized that failure of the transformer boundary would likely result in a release exceeding the RQ, based on the lack of regulatory emphasis preparation for the boundary failure it is concluded that this type of failure represents a highly unlikely occurrence as compared to other accidents such as fire.

6.0 SUMMARY

The projected offsite dose based on the anticipated off normal (one fuel pin failure) is less than 0.6% of the 0.1 mrem limit, while the offsite dose based on 40 CFR 61, Subpart H, Appendix D (EPA 1990a), methodology base on materials in process is 0.26 mrem. Although it is recognized that, by design, there is no process upset condition that could result in such a release, the FFTF does manage materials in sufficient quantity to represent an offsite risk. Therefore, a FEMP is required for airborne releases.

Four substances are managed at FFTF in quantities exceeding the 40 CFR 302 (EPA 1990b) RQ value: Sodium, freon (R-12), PCBs, and sulfuric acid. Based on the attached discussion of facility configuration and the scope of normal operations, the release of any of these materials in excess of RQ values as a result of normal or anticipated upset conditions is unlikely. Single point failures in both the sodium systems and the PCB transformer could potentially result in a release in excess of an RQ but, based on the information attached, these events are considered less likely than postulated accidents.

7.0 REFERENCES

- DOE-RL, 1990, *State of Washington Department of Health Radioactive Air Emissions Permit FF01 Supplemental Information*, DOE/RL-90-34, U.S. Department of Energy Field Office, Richland, Richland, Washington.
- EPA, 1990a, "National Emission Standards for Hazardous Air Pollutants," Title 40, Code of Federal Regulations, Part 61, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1990b, "Designation, Reportable Quantities, and Notification," Title 40, Code of Federal Regulations, Part 302, U.S. Environmental Protection Agency, Washington, D.C.

Toxic Substances Control Act of 1976, as amended, 15 USC 2601 et seq.

WHC, 1991, *A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans*, WHC-EP-0438, Westinghouse Hanford Company, Richland, Washington.

ATTACHMENT 1

**DETERMINATION OF FACILITY EFFLUENT
MONITORING PLAN REQUIREMENT**

This page intentionally left blank.

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY FFTFDISCHARGE POINT All Facility Discharges

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide Dose	Physical/Chemical Form	(Curies)	Quantity Released	Quantity (mrem)	Projected (mrem)
1. ^{22}Na	liq/part.	3.7 E+04	3.7 E+01	N/A	9.7 E-05
2. ^{54}Mn	liq/part.	1.0 E+00	7.6 E-01	N/A	1.8 E-07
3. ^{134}Cs	liq/part.	N/A	1.0 E-05	N/A	1.4 E-06
4. ^{137}Cs	liq/part.	3.1 E+00	1.5 E-06	N/A	2.0 E-07
5. ^{41}Ar	gas	6.0 E-01	N/A	N/A	2.6 E-01
Total					2.6 E-01

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated Material	Quantity (lbs)	Quantity Released	Reportable Quantity (lbs)	% of Reportable Quantity/Year
1. Sodium	600		10	> 100%
2. Dichlorodi- fluoromethane	3,000		5,000	~ 75%
3. Sulfuric acid	47		1,000	< 0.05%
4. PCL	5,000		100	> 100%

Identification of Reference Material

See Table 2.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required xFEMP is not required EVALUATORS JP Newman, RW BloomDATE 4/11/91MANAGER, QUALITY ASSURANCE A. J. FisherDATE 5/3/91MANAGER, ENVIRONMENTAL Eric M. GregerDATE 4/11/91FACILITY MANAGER DATE 6/28/91

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY FFTFDISCHARGE POINT All Facilities (Potential Upset-Operating Condition)

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide Dose	Physical/Chemical Form	(Curies)	Quantity Released	Quantity (mrem)	Projected (mrem)
1. ²² Na	liq/part.	4 E+02	0.001%	N/A	9.7 E-05
2. ⁵⁴ Mn	liq/part.	2 E+00	0.001%	N/A	1.8 E-07
3. ¹³⁴ Cs	liq/part.	3 E+00	0.001%	N/A	1.4 E-06
4. ¹³⁷ Cs	liq/part.	6 E+01	0.001%	N/A	2.0 E-07
5. ⁴¹ Ar	gas	2 E-04	100%	N/A	2.6 E-01
Total					2.6 E-01

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated Material	Quantity (lbs)	Quantity Released	Reportable Quantity (lbs)	% of Reportable Quantity/Year
1. No hazardous materials present				
2.				
3.				
4.				

Identification of Reference Material

See Table 3.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required x FEMP is not required

EVALUATORS JP Newman, RW Bloom [Signature] DATE 4/11/91
 MANAGER, QUALITY ASSURANCE [Signature] DATE 5/3/91
 MANAGER, ENVIRONMENTAL Eric M. Greager DATE 4/11/91
 FACILITY MANAGER [Signature] DATE 6/28/91

PART 2

**FUELS AND MATERIALS EXAMINATION
FACILITY--427, 483B, 4802, AND 4862 BUILDINGS**

**FACILITY EFFLUENT MONITORING
PLAN DETERMINATION**

This page intentionally left blank.

CONTENTS

1.0	INTRODUCTION	1
2.0	FACILITY DESCRIPTION/STATUS OF OPERATION	1
3.0	SOURCE TERM	2
4.0	POTENTIAL UPSET-OPERATING CONDITIONS	2
5.0	SUMMARY	5
6.0	REFERENCES	5

ATTACHMENT

1	Determination of Facility Effluent Monitoring Plan Requirement	A1-1
---	---	------

LIST OF TABLES

1 Hazardous Substances Stored in Building	3
---	---

1.0 INTRODUCTION

This Facility Effluent Monitoring Plan (FEMP) determination was prepared in accordance with *A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans* (WHC 1991) for the Fuels and Materials Examination Facility (FMEF).

2.0 FACILITY DESCRIPTION/STATUS OF OPERATION

The FMEF, of which the Fuel Assembly Area (FAA) is a part, is located in the south-central portion of Washington State on the U.S. Department of Energy's (DOE) Hanford Site. The Hanford Site is located north of the City of Richland in Benton County. The FMEF site is located about 7.2 km (4.5 mi) from the nearest point on the Hanford Site boundary, the west bank of the Columbia River, and 7.2 km (4.5 mi) northeast of the nearest public highway, State Highway 240. The Richland City limits are about 9.6 km (6 mi) to the south of the FMEF site.

The facility is located in the portion of the Hanford Site designated as the 400 Area, which is shared by three other major facilities: the Fast Flux Test Facility (FFTF), the Fuel Storage Facility, and the Maintenance and Storage Facility. These facilities are operated for the DOE by Westinghouse Hanford Company. The FAA is located in the southeast portion of the FMEF. Other facilities in the area are for engineering support (offices), maintenance (shops), utilities, and security (guard stations).

The FMEF is a secure, protected facility that has capabilities for handling and processing radioactive materials. The plant provides engineered controls for radiological protection of the operators, the general public, and the environment. The primary function will be to produce fuel and test assemblies for the FFTF. Uranium and plutonium oxide powders prepared at other facilities are manufactured into sintered pellets. The uranium and plutonium oxide pellets are clad with stainless steel tubing for fuel pins that are used in standard driver fuel and special test assemblies for the FFTF's fuel supply.

The plant's design capacities are as follows:

- The annual processing capability of mixed oxide driver fuel is 33 assemblies per yr
- The fabrication capability of the Test Pin Line is 10 to 12 test assemblies per yr
- A storage pit contains 301 spaces for powder, pellets, pins, and completed assemblies.

Materials furnished to the plant include uranium and plutonium oxide powders, fuel pin cladding tubing, uranium oxide insulator or blanket pellets,

reflector slugs, nonnuclear internal components, fuel assembly ducts and hardware, and special instrumentation and hardware for experimental assemblies. The plant will produce fuel assemblies that can be loaded directly into the FFTF reactor.

Work areas in the plant include enclosures for powder and pellet processing, gloveboxes for fuel pin fabrication, work stations for assembly of fuel elements, and an area of nondestructive fuel assay for accountability and repacking of special nuclear material. Storage facilities, which provide secure locations and preclude criticalities, are provided for special nuclear materials, including oxide powders, pellets, fuel pin lots, experimental assemblies, and driver assemblies.

The FMEF provides utilities and support systems required for fuel fabrication operations in the FAA. The facility is close to waste handling services and central materials warehousing on the Hanford Site, which permits a high level of support for final waste disposal.

The facility is separated into three security areas to ensure safeguards for all the forms of materials handled. This fairly new facility has never been used yet.

3.0 SOURCE TERM

This new facility does not contain or store radioactive materials. The only inventory of radioactive materials available are exit signs containing tritium-filled glass tubes. These tubes have approximately 19.997 Ci/sign. See Attachment 1.

All substances listed on the hazardous substances listing (40 CFR 302) (EPA 1990) that are present in the FMEF are described in Table 1.

4.0 POTENTIAL UPSET-OPERATING CONDITIONS

There are no credible potential upset-operating conditions except for a possible fugitive tritium release from the exit signs in the facility. The chance of more than one sign breaking within a 24-h period is considered unlikely. The reportable quantity (RQ) for ^3H is 100 Ci. The total inventory of ^3H exit signs totals 2,000 Ci.

Table 1. Hazardous Substances Stored in Building. (2 sheets)

Product	Maximum quantity of product on hand (lb)	Regulated chemical in product	Quantity of regulated chemical (lb)	Quantity of chemical released	RQ for chemical (lb)	% of RQ per year	Notes
28% Ammonium hydroxide in water solution	51	Ammonium hydroxide	14.28	8.16	1,000	0.84	Fugitive emission decrease assumes 28% to 12% change
Waste ammonium hydroxide solution (12%)	88	D002 Waste (12% ammonium hydroxide)	11	0	100	0	Spent solution from blue print machine
Emergency batteries	2,492	Sulfuric acid	2,492	0	1,000	0	Largest battery contains 42 lb
Solvent	2	Toluene	2	0	1,000	0	Cleaning solvent
Solvent	1,160	Potassium hydroxide (10%)	116	100	1,000	10	Water treatment chemical
Trichloro-fluoromethane (R-11)	2,700	Trichloro-fluoromethane (R-11)	2,700	300	5,000	6	Released amount is an estimate of release during overhaul
Solvent	425	Benzene (<0.01%)	<0.0425	<0.0425	10	<0.425	Cleaning solvent
Lead (bricks and sheet)	128,387	NR					
Diesel fuel	21,010	NR					
Ethylene Glycol (40% Glycol, 60% Demineralized Water)	91,695	NR					
Halon (used in fire extinguisher)	1,820	NR					

Table 1. Hazardous Substances Stored in Building. (2 sheets)

Product	Maximum quantity of product on hand (lb)	Regulated chemical in product	Quantity of regulated chemical (lb)	Quantity of chemical released	RQ for chemical (lb)	% of RQ per year	Notes
Mineral oil (used in capacitors in pulse magnetic welder)	750	NR					
Nitrogen gas (in "K" bottles used as covergas on ethylene glycol systems)	1,500 ft*	NR					
1, 2 Propanediol (Propylene glycol)	17	NR					
Algicide used in cooling towers	734	NR					
Hydraulic oil	64	NR					
Lubricating oil	2,748	NR					
Algicide in diesel fuel	33	NR					
Desiccant in the air dryers	740	NR					

RQ = reportable quantity

* = air cylinder

NR = not regulated

5.0 SUMMARY

Since there are no process-related radioactive emissions associated with this facility, no projected offsite dose from radionuclides can be calculated for this facility. The only potential off-normal event to occur that could result in the release of a radioactive material is the breakage of one emergency exit sign. This would result in the release of less than 20% of an RQ of tritium. The only chemical product currently associated with the facility that exceeds an RQ value is associated with the building emergency batteries. The largest single failure would involve less than 5% (42 lbs) of an RQ of sulfuric acid. Since all other materials are present in quantities less than an RQ, no potential material discharged from the facility is in excess of a RQ. Therefore, a FEMP is not required for this facility.

6.0 REFERENCES

- EPA, 1990, "Designation, Reportable Quantities, and Notification," Title 40, Code of Federal Regulations, Part 302, U.S. Environmental Protection Agency, Washington, D.C.
- WHC, 1991, *A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans*, WHC-EP-0438, Westinghouse Hanford Company, Richland, Washington.

This page intentionally left blank.

ATTACHMENT 1

**DETERMINATION OF FACILITY EFFLUENT
MONITORING PLAN REQUIREMENT**

This page intentionally left blank.

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY FMEF _____

DISCHARGE POINT N/A

(Storage Inventory On Hand)

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

	Radionuclide Dose	Physical/Chemical Form	Quantity (Curies)	Quantity Released	Reportable quantity	Projected
1.	Tritium	Tritiated exit sign	2,000	2,000	100 Ci	< 0.1 mrem
2.						
3.						
4.						
5.						

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

	Regulated Material	Quantity (lbs)	Quantity Released	Reportable Quantity (lbs)	% of Reportable Quantity/Year
1.	See Table 1				
2.					
3.					
4.					

Identification of Reference Material

40 CFR 302

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____

FEMP is not required x

EVALUATORS JP Newman, RW Bloom [Signature] DATE 4/11/91
 MANAGER, QUALITY ASSURANCE [Signature] DATE 5/3/91
 MANAGER, ENVIRONMENTAL Eric M. Greager DATE 4/11/91
 FACILITY MANAGER [Signature] DATE 6/28/91

This page intentionally left blank.

APPENDIX

**UNIT DOSE CONVERSION FACTORS PREPARED BY PACIFIC NORTHWEST
LABORATORY TO BE USED IN OFFSITE DOSE CALCULATIONS**

This page intentionally left blank.

UNIT DOSE CALCULATIONS FOR WHC FACILITY EFFLUENT MONITORING PLANS

K. Rhoads

January 3, 1991

INTRODUCTION

Dose calculations for unit (1 Ci) radionuclide releases were performed in support of efforts by Westinghouse Hanford Company (WHC) to develop Effluent Monitoring Plans for all WHC facilities on the Hanford site. Atmospheric releases from generic locations in the 100, 200 E, 200 W, and 300 areas were modeled for both elevated and ground-level releases; 400 area releases were modeled for ground level only. Impacts of liquid releases were evaluated for individuals at Ringold (100 and 200 area effluents) and Riverview (300 Area effluents). Both the CAP-88 (Beres 1990) and GENII (Napier et al 1988) code packages were used to model atmospheric releases in order to satisfy requirements of the U. S. Environmental Protection Agency (USEPA 1989) and the U. S. Department of Energy. The GENII code was used to model liquid releases.

METHODS

Standard parameters for Hanford dose calculations were included in the calculations where possible (McCormack, et al 1984). Meteorology data were collected at weather stations in each of the Hanford operating areas and represent the five-year average of data taken between 1983 and 1987. The location of the maximally exposed individual for each area is included in the attached tables with results of the dose calculations. Individual locations were based on the site boundary location having the greatest radionuclide air concentration under average atmospheric conditions. Doses were calculated as 50-year committed effective dose equivalents for all internal deposition pathways using the EPA model specified in 40 CFR 61. Default solubility classes were used for all radionuclides in these preliminary calculations. These should be appropriate for most facilities evaluated, except where plutonium or uranium are released in soluble form and contribute substantially to the overall dose from a given facility. Default classes for uranium and plutonium assume these radionuclides are released as insoluble compounds; this will result in a lower overall dose than would be the case if they were released in more soluble form.

RESULTS

Results of the evaluation are presented in Tables 1 - 11, and represent the 50-year committed dose equivalent following a chronic annual release of 1 Ci of each radionuclide. The CAP-88 and GENII codes handle ingrowth of long-lived radioactive daughter products differently, as noted in the tables. GENII calculates doses for all radionuclides in each decay chain, therefore the doses reported in Tables 1 - 6 include contributions from both parent and ingrown daughters. CAP-88 does not calculate activities for ingrowth of daughter radionuclides following release of the parent, but will estimate the dose from very short-lived daughters where the parent-to-daughter activity ratio is effectively 1:1. CAP-88 doses reported in Tables 7 - 11 are for the parent nuclide only, except in the case where very short-lived daughters have been included in the parent dose as noted. CAP-88 doses including contributions from daughter ingrowth should be estimated using the fractional contribution from the parent nuclide reported in the GENII results.

The total dose expected from emissions at a given facility can be obtained by multiplying the release quantity in Ci for each radionuclide by the corresponding unit dose factor in the tables, and summing the contributions for all nuclides in the effluent stream. Please note that doses calculated using the GENII code are reported as rem to the maximum individual from an annual release; those from CAP-88 are reported in mrem. Values in the tables were taken directly from code outputs, and have been left in the units reported by each code to avoid transcription errors.

REFERENCES

Beres, D. A., 1990. The Clean Air Act Assessment Package -1988 (CAP-88). A Dose and Risk Assessment Methodology for Radionuclide Emissions to Air. Vols. 1-3, U. S. Environmental Protection Agency, Washington, D. C.

McCormack, W. D., J. V. Ramsdell, and B. A. Napier. 1984. Hanford Dose Overview Program: Standardized Methods and Data for Hanford Environmental Dose Calculations. PNL-3777, Rev. 1, Pacific Northwest Laboratory, Richland, Washington.

Napier, B. A., R. A. Peloquin, D. L. Streng, and J. V. Ramsdell. 1988. GENII - The Hanford Environmental Radiation Dosimetry Software System. PNL-6584, Vols. 1-3. Pacific Northwest Laboratory, Richland, Washington.

U. S. Environmental Protection Agency. 1989. National Emission Standards for Hazardous Air Pollutants; Radionuclides; Final Rule and Notice of Reconsideration. 40 CFR Part 61, Federal Register 54 (240):51654-51715.

TABLE 5. GENII DOSE ESTIMATES FOR 1 Ci RADIONUCLIDE RELEASES - 400 AREA
Location to the individual: 8100 METERS SOUTH

NUCLIDE	GROUND LEVEL DOSE EQUIVALENT (REM)*
H 3	3.0E-08
NA 22	2.6E-05
AR 41	9.6E-09
CR 51	3.0E-08
MN 54	1.5E-06
FE 59	1.6E-06
CO 57	5.8E-07
CO 58	1.3E-06
CO 60	1.3E-05
ZN 65	1.8E-05
KR 83M	2.3E-11
KR 85M	1.7E-09 (100)*
KR 85	2.1E-11
KR 87	5.0E-09 (100)
KR 88	2.1E-08 (70)
SR 90	5.0E-05 (94)
NB 95	6.1E-07
I 131	7.6E-05 (100)
XE 131M	2.4E-10
XE 133M	5.0E-10 (100)
XE 133	5.4E-10
XE 135M	6.3E-10 (89)
XE 135	2.8E-09
CS 134	4.4E-05
CS 137**	3.2E-05
TA 182	3.0E-06
PU 239	9.4E-03

* Doses calculated with GENII include contributions from the parent nuclide, long-lived daughter chains, and short-lived daughters. Numbers in parenthesis indicate percent of the total dose attributable to the parent nuclide in chains with long-lived daughters.

** Short-lived daughters are included in dose from parent nuclide.

TABLE 11. CAP-88 DOSE ESTIMATES FOR 1 Ci RADIONUCLIDE RELEASES - 400 AREA
Location to the individual: 8100 METERS SOUTH

<u>NUCLIDE</u>	<u>10 m STACK DOSE EQUIVALENT (MREM)*</u>
H-3	2.83E-05
NA-22	2.56E-02
AR-41	1.65E-05
CR-51	8.37E-05
MN-54	7.29E-03
FE-59	4.24E-03
CO-57	1.63E-03
CO-58	4.27E-03
CO-60	3.85E-02
ZN-65	1.23E-02
KR-83M	2.97E-09
KR-85M	2.53E-06
KR-85	6.31E-08
KR-87	9.48E-06
KR-88	3.25E-05
SR-90	5.80E-02
NB-95	2.33E-03
I-131	2.72E-02
XE-131M	1.79E-07
XE-133M	5.65E-07
XE-133	6.57E-07
XE-135M	9.53E-07
XE-135	4.26E-06
CS-134	4.15E-02
CS-137**	3.17E-02
TA 182	***
PU-239	1.15E+01

* Doses calculated with CAP88 are for the parent nuclide only, and do not include contributions from long-lived daughter chains.

** Short-lived daughters are included in dose from parent nuclide.

*** Dose factors not included in code radionuclide library.

DISTRIBUTION

Number of CopiesOFFSITE

1	<u>U.S. Environmental Protection Agency,</u> <u>Region X</u> 1200 Sixth Avenue Seattle, Washington 98081 G. O'Neal	AT-081
1	<u>U.S. Environmental Protection Agency,</u> <u>Region X</u> 712 Swift Boulevard, Suite 5 Richland, Washington 99352 P. T. Day	
3	<u>Westinghouse Idaho Nuclear Company</u> PO Box 4000 Idaho Falls, Idaho 83403 K. Kouri	32-02
2	<u>Washington State</u> <u>Department of Health</u> <u>Radiation Protection Division</u> Airdustrial Park, Bldg 5 Olympia, Washington 98504 A. Conklin	LE-13

ONSITE

8	<u>U.S. Department of Energy</u> <u>Field Office, Richland</u> G. M. Bell R. F. Brich S. S. Clark E. B. Dagan L. A. Huffman T. P. Pietrok S. D. Stites Public Reading Room	A5-52 A5-55 A6-55 A5-19 A6-55 A5-19 A5-19 A1-65
---	---	--

DISTRIBUTION (continued)

Number of CopiesONSITE

1	<u>Hanford Environmental Health Foundation</u>	
	L. J. Maas	B2-75
1	<u>Kaiser Engineers Hanford</u>	
	P. G. Bodily	E2-10
8	<u>Pacific Northwest Laboratory</u>	
	W. J. Bjorklund	P7-68
	T. D. Chikalla	P7-75
	R. E. Jaquish	K1-30
	D. L. Klages	P7-68
	A. K. Stalker	P7-60
	M. J. Sula	P7-78
	R. K. Woodruff	K6-13
	Technical Files	K1-11
41	<u>Westinghouse Hanford Company</u>	
	S. E. Albin	T1-06
	S. M. Anthony	N3-05
	R. J. Bliss	B3-04
	R. E. Bolls	N3-13
	M. J. Brown	T1-30
	G. D. Carpenter	B2-16
	G. J. Carter	T1-06
	L. P. Diediker (2)	T1-30
	J. J. Dorian	B2-16
	J. A. Eacker	R1-51
	D. G. Farwick	H4-16
	K. A. Gano	X0-21
	L. A. Garner	T5-54
	E. M. Greager	L6-60
	K. A. Hadley	N1-35
	N. S. Hale	B4-53
	M. J. Hall	B2-19
	D. R. Herman	S4-01
	K. R. Jordan	B3-51
	E. J. Kosiancic	S0-61
	R. J. Landon	B2-19
	R. E. Lerch	B2-35
	G. J. Miskho	R2-50
	J. M. Nickels (2)	T1-30

DISTRIBUTION (continued)

Number of Copies

ONSITE

Westinghouse Hanford Company

R. A. Paasch	B2-20
M. M. Pereira	S6-70
K. N. Peterson	S6-70
D. R. Pratt	T1-30
R. J. Thompson	S6-01
R. R. Thompson	L4-88
L. W. Vance	H4-16
D. J. Watson	X0-41
C. D. Wollam	S6-19
Document Processing and Distribution (2)	L8-15
Central Files	L8-04
Information Release Administration (3)	R1-08

This page intentionally left blank.

END

**DATE
FILMED**

12/11/91