

Facility Effluent Monitoring Plan for K Area Spent Fuel Storage Basin

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**FACILITY EFFLUENT MONITORING PLAN FOR
K AREA SPENT FUEL STORAGE BASIN**

ABSTRACT

A facility effluent monitoring plan is required by the U.S. Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document was prepared using the specific guidelines identified in WHC-EP-0438-1**, A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, and assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements.*

This facility effluent monitoring plan is a revision to the first annual report. Long-range integrity of the effluent monitoring systems shall be ensured with updates of this report whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated at a minimum of every three years.

*General Environmental Protection Program, DOE Order 5400.1, U.S. Department of Energy, Washington D.C., 1991.

**A Guide to Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438-1, Westinghouse Hanford Company, Richland, Washington.

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LIST OF TERMS

ANSI	American National Standards Institute
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>
CFR	<i>Code of Federal Regulations</i>
DOE	U.S. Department of Energy
DOP	Diocetyl phthalate (test)
DOT	Department of Transportation
EDE	Effective Dose Equivalent
EM	Effluent Monitoring
EMP	Environmental Monitoring Plan
EPA	U.S. Environmental Protection Agency
ES&H	Environmental Protection, Safety, and Health
FEMP	Facility Effluent Monitoring Plan
HEPA	High-Efficiency Particulate Air
K Area	K Area Spent Fuel Storage Basin
MDC	Minimal Detectable Concentration
NESHAP	National Emission Standards for Hazardous Air Pollutants
NOC	Notice of Construction
NPDES	National Pollutant Discharge Elimination System
OEMP	Operational Environmental Monitoring Program
QA	Quality Assurance
QAPjP	Quality Assurance Project Plan
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
RCW	Revised Code of Washington
RL	Radioactive Liquid
RL	U.S. Department of Energy Richland Operations Office
SQA	Safety and Quality Assurance
TLD	Thermoluminescent Dosimeter
TSD	Treatment, Storage and Disposal
WAC	<i>Washington Administrative Code</i>
WHC	Westinghouse Hanford Company

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1.0 K AREA SPENT FUEL STORAGE BASIN

1.1 INTRODUCTION

The purpose of this section is to provide information on the policy, purpose, and scope of the K Area Spent Fuel Storage Basin (K Area) Facility Effluent Monitoring Plan (FEMP). This section also provides background information on the preparation of the FEMP.

1.1.1 Policy

It is the policy of the U.S. Department of Energy (DOE) and Westinghouse Hanford Company to conduct effluent monitoring to determine whether the public and the environment are adequately protected during DOE operations at the Hanford Site, and whether those operations are in compliance with DOE and other applicable federal, state, and local emission standards and requirements. It is also the policy of DOE and Westinghouse Hanford Company that effluent monitoring programs meet high standards of quality and credibility.

1.1.2 Purpose

The purpose of this FEMP is to assess the magnitude of routine and potential liquid and airborne effluent releases from the K Area to determine the compliance and verify that the effluent monitoring systems and sampling programs meet applicable federal, state, and local regulations. Where potential environmental problems are identified from monitoring, an evaluation is needed to determine if any remedial actions or mitigation measures are required.

1.1.3 Scope

The scope of this document includes program plans for monitoring and characterizing radioactive and nonradioactive hazardous materials discharged in the K Area effluents. This FEMP includes complete documentation for both airborne and liquid effluent monitoring systems that monitor radioactive and nonradioactive hazardous pollutants that could be discharged to the environment under routine and/or upset conditions. This documentation is provided for each K Area facility that uses, generates, releases, or manages significant quantities of radioactive and nonradioactive hazardous materials that could impact public and employee safety and the environment. This FEMP describes the airborne and liquid effluent paths and the associated sampling and monitoring systems of the K Area facilities. Sufficient information is provided on the effluent characteristics and the effluent monitoring systems so that a compliance assessment against requirements may be performed. Adequate details are supplied such that radioactive and hazardous material source terms may be related to specific

effluent streams which are, in turn, related to discharge points and finally compared to the effluent monitoring system capability. Details are provided only for those streams determined previously, in *Facility Effluent Monitoring Plan Determination for the 100 Area Facilities* (WHC 1991a), to require a FEMP.

1.1.4 Discussion

The characterization of the radioactive and nonradioactive hazardous constituents in each effluent stream provides the underlying rationale for the sampling and monitoring programs. The method of characterization discussed in this FEMP identifies potential pollutants at the point of generation and tracks the constituents in effluent streams as they move from their generation point to the point of discharge. Information from the *Facility Effluent Monitoring Plan Determination for the 100 Area Facilities* (WHC 1991a) is included. The determinations were made in accordance with *A Guide for Preparing Hanford Facility Effluent Monitoring Plans* (WHC 1992). The evaluations were made based upon information obtained in documents, interviews with cognizant engineers, and personal observations.

During 1994, an assessment of potential emissions from the Hanford Site registered stacks was made to determine the compliance of the resulting doses with the "National Emission Standards for Hazardous Air Pollutants (NESHAP)," (40 CFR 61), Subpart H. Stacks were designated as major or minor based on whether their potential emissions would cause an effective dose equivalent (EDE) to the maximum exposed individual of >0.1 millirems per year (mrem/yr).

Criteria are set for record sampling based on the dose from potential stack emissions. For a dose >0.1 mrem/year, continuous sampling/monitoring of stack emissions is required based on the requirements in 40 CFR 61, Subpart H. When the dose is <0.1 mrem/year, periodic confirmatory measurements of stack emissions are required. No definitive methods are listed in 40 CFR 61, Subpart H, for performing periodic confirmatory measurements.

With this information the radionuclide effluent release points at K Area are classified as minor stack emission points. This FEMP revision reflects the stack status change of being a minor stack emission point.

Radionuclides are emitted from K Area at nine locations for air emissions and one liquid effluent discharge.

Radionuclides are discharged to the air from: (1) the 105 KE Spent Fuel Storage Basin; (2) the 105 KW Spent Fuel Storage Basin; and (3) the Engineering and Environmental Demonstration Laboratory 1706 KE complex. The 1706 KE Complex has the following discharge points: (1) 1706 KE (main floor, 0-foot [ft] level); (2) 1706 KE (basement, minus 13-ft level); (3) 1706 KE (sub-basement, minus 27-ft level); (4) 1706 KER (main floor, 0-ft level); (5) 1706 KER (minus 27-ft level); (6) 1706 KER Tunnel Exhaust (minus 27-ft level); and (7) 1706 KEL (laboratory space 0-ft level). The 1706 KE complex is slated to close by

December 1995 and be turned over for decommissioning and deactivation. The next revision to this FEMP will eliminate the 1706 KE complex as a facility that is discharging radionuclides to the air.

It was determined that nonradioactive hazardous air pollutants are not present in the airborne releases from the K Area. Therefore, radionuclides are the only hazardous air pollutants considered in this FEMP.

Radionuclides are discharged at the Columbia River from one discharge point located at the 1908 KE Outfall, also known as National Pollutant Discharge Elimination System (NPDES) Outfall 004. Analysis of the 1908 KE Outfall effluent indicates no release of nonradioactive hazardous material. Therefore, radionuclides are the only hazardous liquid pollutants considered in this FEMP.

This revision to the FEMP includes two off-normal releases. These off-normal events are: (1) pipe break in the 105 KE or KW building causing overflow of the fuel storage basin water, with possible release of radioactivity to the environment; and (2) fuel storage basin leak at the construction joint connecting the basin with the reactor building. Most likely the off-normal would be less severe than either of the two events listed above, because the consequences of either event do not take operator response actions into consideration.

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2.0 FACILITY DESCRIPTION

The 100 K Area is located on the Hanford Site approximately 25 miles northwest of Richland, Washington, as shown in Figure 2-1. The 100 K Area itself is shown in Figure 2-2. Two identical reactors are located in this area. The easternmost reactor is designated 105 KE, and the westernmost, 105 KW.

The KE and KW Reactors were identical reactors built approximately 0.64 km (0.25 mi) apart. They both used once-through cooling. Each system included a pumphouse, filtration plant, clearwell, combined outfall, and a large basin for storing irradiated fuel. The reactors and their support facilities were constructed between 1952 and 1954. The reactors began service in 1955, with KW ceasing operation in February 1970, and KE in February 1971.

Following shutdown of the KE and KW reactors, the stored irradiated fuel was shipped to the 200 East Area for processing. Following deactivation of the reactors, approximately one year was spent cleaning and modifying the fuel storage basins located within the 105 KE and 105 KW fuel storage basins for storage of N Reactor irradiated fuel. Additional modifications and repairs of the fuel storage basin system included modification of the basin cooling systems to a closed system and repair of a leak in the 105 KE Basin. Actual storage of N Reactor irradiated fuel began in 1975 in 105 KE and in 1981 in 105 KW and continues at present. Shipments of fuel to the basins from N Reactor for storage ceased in 1989.

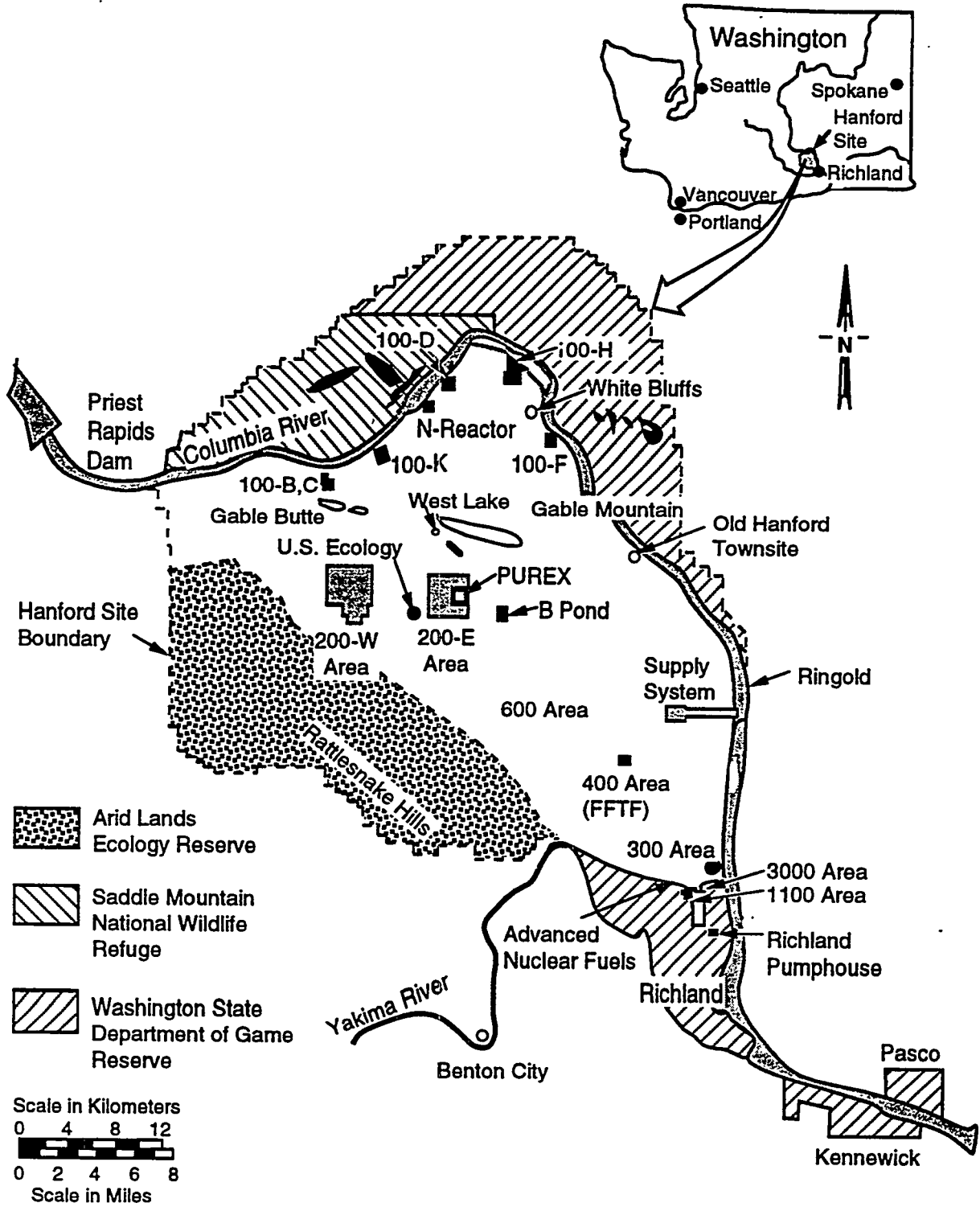
2.1 FACILITY PHYSICAL DESCRIPTION

This FEMP covers the K Area Fuel Storage Basins (105 KE and 105 KW), the Engineering and Environmental Demonstration Laboratory, the 1706 KE Complex (1706 KE, KEL, and KER), the 1908 KE Outfall (NPDES Outfall 004), and the 181 KE Filter Screen Backwash Discharge (NPDES Outfall 003 -- not operational).

2.1.1 Fuel Storage Basins Physical Description

The 105 KE and 105 KW Fuel Storage Basins are in most respects identical. Since their construction, minor modifications have resulted in slight differences. The basins are both constructed of reinforced concrete. They are rectangular, 38 meters (m) (125 feet [ft]) long by 20 m (67 ft) wide by 6.4 m (21 ft) deep. The pools are divided into three sections by concrete walls that are open at each end, as shown in Figure 2-3. Water is maintained in each basin to a depth ranging from 4.6 m (15 ft 4 in.) to 5 m (16 ft 8 in.) The bottoms of the pools are approximately 6 m (20 ft) below grade. Each basin was modified to include a recirculation system for the basin water including in-line filters, an ion exchange system, a sand filter system, heat exchanger, and instrumentation to monitor radiation levels, heat

Figure 2-1. Hanford Site Location.



29104018.1

Figure 2-2. 100 K Area.

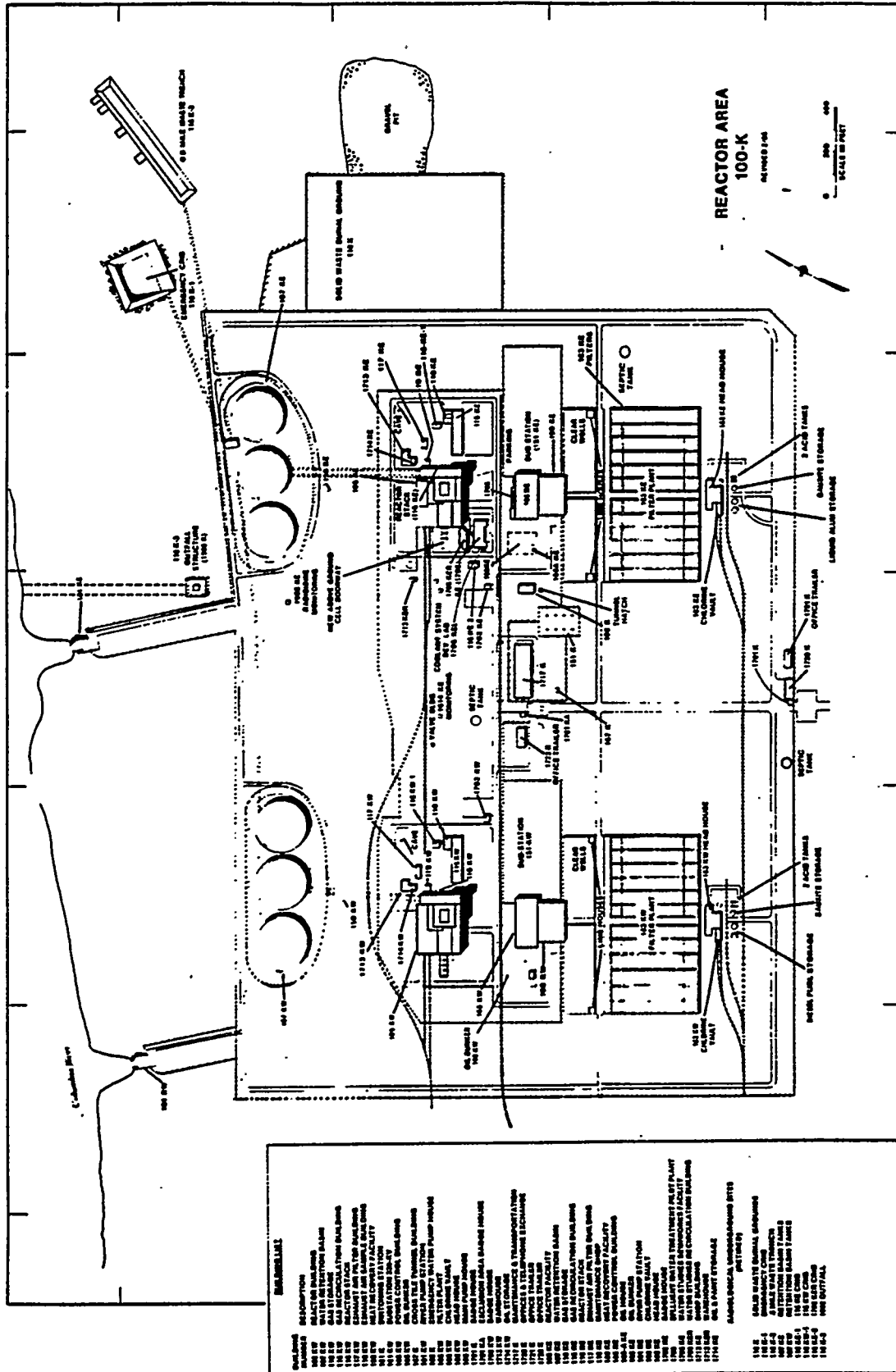
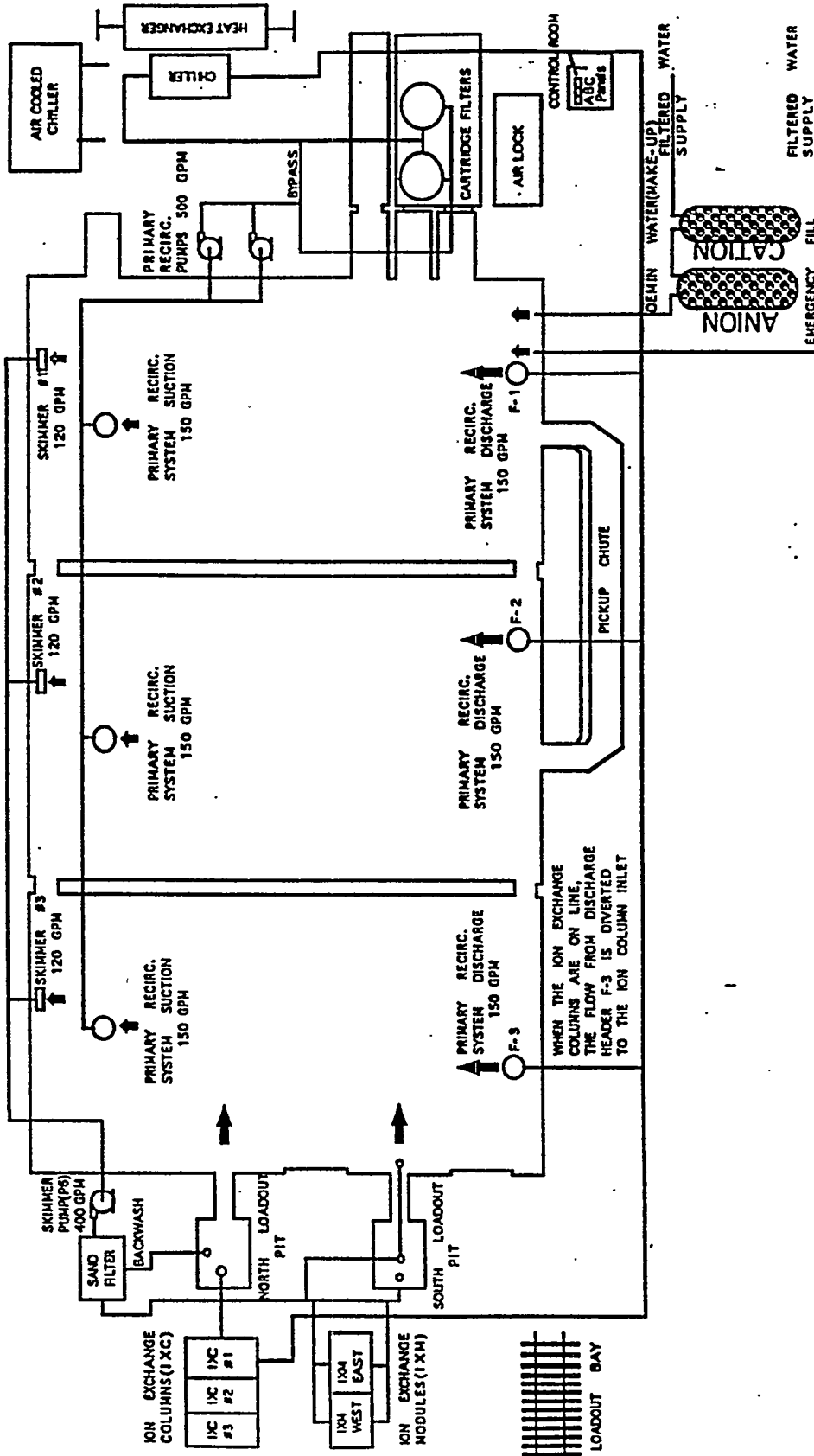


Figure 2-3. Fuel Storage Basins Construction.



generation rate, and basin water level. Both basins have racks installed for storing the N Reactor fuel canisters. Radioactively contaminated or potentially radioactively contaminated building service drains within the facilities have been intercepted and routed to building sumps. Unused drains have been plugged and sealed with concrete. The 105 KW Basin floor and walls were coated with a pliable epoxy sealant, and only encapsulated fuel canisters are stored in the basin. An underbasin leakage collection system composed of an asphalt membrane and a pipeline that previously went to a dispersion tile field that would route any contaminated leakage to a sump that pumps back to the basin.

2.1.2 Engineering and Environmental Demonstration Laboratory (1706 KE Complex) (Closed by December 1995)

The Engineering and Environmental Demonstration Laboratory is located in the 1706 KE Complex in the 100 K Area. The complex consists of the following buildings.

- 1706 KE: Office space and laboratories
- 1706 KEL: *Resource Conservation and Recovery Act of 1976 (RCRA)* decontamination facility and laboratory
- 1706 KER: Storage and laboratory

The 1706 KE and 1706 KER Buildings were constructed in 1954 as part of the 100 K Reactor production site. The original mission of the laboratory was to conduct prototype studies on reactor coolant recirculation cooling systems that were tied to the KE Reactor core. The facility provided cooling water to eight single-pass process tubes and four recirculation process tubes in the 100 KE Reactor core. In addition, 22 out of reactor test loops, designed to simulate various reactor operating parameters, were located within the 1706 KE Complex. All the in-core test facilities were deactivated when the 100 KE Reactor shut down in 1971. All but three of the test loops (TF-7, TF-9, and TF-15) have since been removed from the facility.

The main floor (0-ft level) of the 1706 KE Building contains office space, store rooms, lunch room, locker room and laboratories. Also located on this level are two test loops (TF-9 and TF-15) and a deactivated demineralizer plant that once supplied make-up water to the 105 KE and 105 KW Fuel Storage Basins.

The basement (4-m [13-ft] level) of the 1706 KE Building is mostly open work area containing one test loop, several water treatment test units, a reverse osmosis water system, and the in-reactor control room.

The sub-basement (8-m [27-ft] level) of the 1706 KE Building contains deactivated low- and high-pressure pumps that supplied eight single-pass process tubes in the 100 K Reactor core. Also located at this level are four clearwells, each with approximately a 75,708-L (20,000-gal) capacity. Clearwells No. 1 and No. 2 were used until recently for the temporary storage and neutralization of regeneration waste from the demineralizer plant. Clearwell No. 3 is not used and Clearwell No. 4 is used to store demineralizer water. The only active systems on this level are the recirculation pumps for the reverse osmosis water system.

The 1706 KER Building (0-ft level) is not occupied. This building is used for storage and contains a portion of the 1706 KE Complex switch gear.

The 1706 KER Building (8-m [27-ft] level) is accessed via a stairway leading from the 4-m (13-ft) level of the 1706 KE. Located on this level is a laboratory used for radiological work and four cells. The cells contain deactivated pumps, and heat exchangers associated with the recirculating process tubes in the 100 KE Reactor core.

The 1706 KEL Building was added to the 1706 Building in 1961 to provide additional laboratory space. The portion of the building that was formerly the hot laboratory has been modified to accommodate the RCRA decontamination facility. The portion of the facility that was formerly in the cold laboratory is currently being used for the radioactive pilot plant and bench scale studies.

2.1.3 1908 KE Outfall Physical Description

The primary liquid effluent discharge point at the 100 K Area is the 1908 KE Outfall. The outfall itself is a pair of 213-centimeter (cm) (84-in.)-diameter pipes that extends from the 1908 KE Building (approximately 229 m [750 ft] from the river) and discharges beneath the surface of the Columbia River one-third of the way across the river. The outfall itself is covered in rip-rap (large stones) to strengthen the outfall pipe and protect the pipes from the effects of the current.

2.1.4 181 KE Outfall Physical Description (Not Operational)

The 181 KE Outfall is located adjacent to the 181 KE Building. The outfall discharges the traveling filter screen backwash water. The outfall is a 30.4-cm (12-in.) diameter pipe. It travels downward from the filter screens into the ground just west of the 181 KE Building. The pipe then bends toward the middle of the Columbia River. The discharge is approximately 175 m (575 ft) toward the center of the channel from the 181 KE Building. The traveling filter screen is used infrequently. When the screen is backwashed, it is trucked to a settled basin at 183 KE. No discharge occurs to the Columbia River at present.

2.2 FACILITY PROCESS DESCRIPTION

2.2.1 Fuel Storage Basins Process Description

The 105 KE and 105 KW Reactors were shut down in February 1970 and February 1971, respectively. Their fuel storage facilities, the 105 KE and 105 KW Basins, provided shielding and cooling for the irradiated fuel during operation. In the mid-1970's and early 1980's, the 105 KE and 105 KW Basins were modified to provide for the temporary storage of N Reactor fuel until it was processed at the PUREX plant. In 1989 all the remaining fuel assemblies in the N Reactor Fuel Storage Basin were encapsulated and shipped to the 105 KW Basin.

The 105 KE Basin currently contains 3,668 open-top canisters, filled primarily with N Reactor fuel, and two baskets (the equivalent of five canisters) filled with aluminum-clad fuel assemblies from the retired single-pass reactors. However, because the primary barrier (cladding) of the stored fuel has been breached, fission products have escaped from these fuel assemblies, contaminating the basin cooling water.

The 105 KW Basin contains 3,821 sealed (MK I and II) canisters filled with N Reactor fuel. The MK I and II canisters provide a barrier to limit the release of fission products from the damaged fuel assemblies, and the basin cooling water provides a secondary barrier to the potential release of radioactive materials to the environment.

Water levels are maintained in each basin at a sufficient depth above the irradiated fuel to cool the fuel and provide radiological shielding for personnel working in the facility. Filters and ion exchange systems maintain basin water clarity and remove radionuclides.

2.2.2 Engineering and Environmental Demonstration Laboratory (1706 KE Complex)

The Engineering and Environmental Development Laboratory facility was originally designed as a testing complex. This laboratory functions as a development laboratory, and has most recently been used for testing different water treatment systems.

2.2.3 1908 KE Outfall Process Description

Effluent to the 1908 KE Outfall comes from four sources. The first (and largest) of these sources is the 183 KE Water Plant. Approximately 7,570,800 liters (L) (2,000,000 gallons [gal]) of river water per day are cycled through the 183 KE Basin for fish rearing and back to the Columbia River. The second effluent source is the filter backwash from 183 KE, which goes to a settling basin and then, after settling, to the outfall. The only chemicals

going to this outfall are those resulting from water treatment, and none are hazardous. The third effluent contributor to the 1908 KE Outfall is the cooling water used as a backup to the air chiller of each basin to maintain the basin water temperature. The water chillers only operate as backup to the air chillers that were installed in 1994, so contribution to the outfall from this source has diminished. The water chillers are not operational at this time.

The fourth contributor is the 1706 KE Complex discharges, which include the concentrate stream from the building reverse osmosis system. This system only operates in batch mode, and discharges approximately 56,781 L/year (15,000 gal/year). The complex also discharges non-routine waters that have been designated non-regulated and meet the NPDES permit requirements. This discharge is only done with permission from Environmental Services and Facility Compliance on a case-by-case stream. This activity discharges approximately 11,356 L/year (3,000 gal/year).

2.2.4 181 KE Outfall Process Description

The 181 KE Building is the water supply pumphouse for ongoing operations at the 100 K Area. The outfall from this facility is the filter screen backwash. The building is equipped with travelling filter screens that remove debris and larger particulate from the river water being drawn into the pump building intakes. These screens are periodically backwashed to flush accumulated debris from the screens. The water used to wash the screens (when they are operational) is then returned to the river via NPDES Outfall 003. Due to silting of the screens, the backwash is collected and trucked to a settling basin where it is evaporated. There is no possibility of the discharge from this outfall containing radionuclides or contaminants from operations in the 100 K Area.

2.3 IDENTIFICATION AND CHARACTERIZATION OF POTENTIAL SOURCE TERMS

2.3.1 KE Fuel Storage Basin Source Term

The KE Basin contains approximately 1,150 metric tons of irradiated fuel. A source term for the KE Basin was calculated using knowledge of the radionuclide inventory at the end of the fuel cycle, and the fact that the fuel is at least 10 years old.

As shown in Table 2-1, the inventory in one full reactor load of fuel is approximately 4.11×10^{09} curies (Ci) (WHC 1990a). This inventory is a conservative approach to the number of curies produced by fission in the reactor. It assumes the entire fuel core is in equilibrium at the end of the fuel cycle; in actuality, only about one-third of the core reaches equilibrium.

Table 2-1. Fission Product Inventory in K Area Fuel Storage Basins.

Radionuclide	Activity per reactor load ^{1,5} (Ci)	Half-Life (year)	KE Basin current activity ² (Ci)	KW Basin current activity ³ (Ci)
⁸⁵ Kr	1.113 x 10 ⁰⁵	10.7	2.603 x 10 ⁰⁵	1.289 x 10 ⁰⁵
^{85m} Kr	4.271 x 10 ⁰⁷	0.0005137	0	0
⁸⁷ Kr	8.229 x 10 ⁰⁷	0.00014517	0	0
⁸⁸ Kr	1.164 x 10 ⁰⁸	0.00031963	0	0
⁸⁶ Rb	8.564 x 10 ⁰³	0.05123288	0	0
⁸⁹ Sr	9.672 x 10 ⁰⁷	0.13835616	0	0
⁹⁰ Sr	9.170 x 10 ⁰⁵	28.8	2.524 x 10 ⁰⁶	1.731 x 10 ⁰⁶
⁹¹ Sr	1.927 x 10 ⁰⁸	0.00108447	0	0
⁹⁰ Y	8.906 x 10 ⁰⁵	0.00732877	0	0
⁹¹ Y	1.095 x 10 ⁰⁸	0.16164384	1.184 x 10 ⁰¹	0
⁹⁵ Zr	1.138 x 10 ⁰⁸	0.17808219	5.990 x 10 ⁰¹	0
⁹⁷ Zr	2.033 x 10 ⁰⁸	0.00194064	0	0
⁹⁵ Nb	5.865 x 10 ⁰⁷	0.09863014	0	0
⁹⁹ Mo	2.109 x 10 ⁰⁸	0.00753425	0	0
^{99m} Tc	1.820 x 10 ⁰⁸	0.00068493	0	0
¹⁰³ Ru	8.103 x 10 ⁰⁷	0.10794521	0	0
¹⁰⁵ Ru	4.933 x 10 ⁰⁷	0.00049543	0	0
¹⁰⁶ Ru	2.431 x 10 ⁰⁶	1.00547945	4.677 x 10 ⁰⁵	1.568 x 10 ⁰³
¹⁰⁵ Rh	4.261 x 10 ⁰⁷	0.00410959	0	0
¹²⁷ Sb	5.564 x 10 ⁰⁶	0.01068493	0	0
¹²⁹ Sb	2.448 x 10 ⁰⁷	0.0005137	0	0
¹²⁷ Te	4.830 x 10 ⁰⁶	0.28767123	9.562 x 10 ⁰²	0
^{127m} Te	2.700 x 10 ⁰⁵	0.00106164	0	0
¹²⁹ Te	2.200 x 10 ⁰⁷	0.09315068	0	0
^{129m} Te	4.607 x 10 ⁰⁵	0.00012747	0	0
^{131m} Te	1.340 x 10 ⁰⁷	4.7565 x 10 ⁻⁰⁵	0	0
¹³² Te	1.483 x 10 ⁰⁸	0.00890411	0	0
¹³¹ I	9.979 x 10 ⁰⁷	0.02191781	0	0
¹³² I	1.493 x 10 ⁰⁸	0.00026256	0	0

Table 2-1. Fission Product Inventory in K Area Fuel Storage Basins.

Radionuclide	Activity per reactor load ^{1,5} (Ci)	Half-Life (year)	KE Basin current activity ² (Ci)	KW Basin current activity ³ (Ci)
¹³³ I	2.340 x 10 ⁰⁸	0.00238584	0	0
¹³⁴ I	2.613 x 10 ⁰⁸	0.00010084	0	0
¹³⁵ I	2.184 x 10 ⁰⁸	0.06917808	0	0
¹³³ Xe	2.332 x 10 ⁰⁸	0.01438356	0	0
¹³⁵ Xe	3.641 x 10 ⁰⁷	0.00103881	0	0
¹³⁴ Cs	3.853 x 10 ⁰⁴	2.1	3.119 x 10 ⁰³	6.878 x 10 ⁰²
¹³⁶ Cs	9.395 x 10 ⁰⁵	0.03561644	0	0
¹³⁷ Cs	9.395 x 10 ⁰⁵	30	2.260 x 10 ⁰⁶	1.674 x 10 ⁰⁶
¹⁴⁰ Ba	2.103 x 10 ⁰⁸	0.03506849	0	0
¹⁴⁰ La	2.103 x 10 ⁰⁸	0.00460046	0	0
¹⁴¹ Ce	1.548 x 10 ⁰⁸	0.0890411	0	0
¹⁴³ Ce	2.011 x 10 ⁰⁸	0.00376712	0	0
¹⁴⁴ Ce	2.864 x 10 ⁰⁷	0.77808219	1.176 x 10 ⁰⁴	1.138 x 10 ⁰²
¹⁴³ Pr	1.946 x 10 ⁰⁸	0.03753425	0	0
¹⁴⁷ Nd	6.670 x 10 ⁰⁷	0.03041096	0	0
²³⁹ Pu	5.380 x 10 ⁰⁴	24360	1.630 x 10 ⁰⁵	1.355 x 10 ⁰⁵
TOTAL	4.11 x 10 ⁰⁹		4.81 x 10 ⁰⁶	3.53 x 10 ⁰⁶

Notes:

Source of this table: WHC 1990a

¹At end of cycle.

²KE Basin contains approximately 3.03 reactor loads⁴ of fuel aged 10 years.

³KW Basin contains approximately 2.52 reactor loads⁴ of fuel aged 15 years.

⁴Fuel quantities from K Basin accountability records.

⁵WHC 1990b

To calculate the current KE Basin source term, the inventory was broken down by radionuclide and decayed for 10 years, using standard radioactivity decay calculations. This inventory was then multiplied by the number of reactor loads of fuel in the basin, giving a current radionuclide inventory in KE Basin, which was calculated to be approximately 4.81×10^6 Ci, as shown in Table 2-1.

Table 2-2 shows that the inventory in the water is approximately 56 Ci (Rokkan 1990).

2.3.2 KW Fuel Storage Basin Source Term

The KW Basin contains approximately 956 metric tons of uranium, or approximately 2.5 full reactor loads. By using the knowledge of N Reactor core fission products inventory for a single reactor load of fuel at the end of the fuel cycle, a source term for KW Basin can be calculated by taking into consideration that the fuel at KW has decayed for at least 15 years, and by multiplying the remaining inventory amounts by 2.5.

The methodology used for this calculation was the same as that used for KE Basin. The resulting inventory obtained for the fuel stored in KW Basin was 3.53×10^6 Ci as shown in Table 2-1. The fuel in the KW Basin is stored in closed aluminum and steel canisters; therefore, only a very small amount of fission products has dissolved into the basin water. For the KW Basin, the amount of radioactivity in the water is about 2.9 Ci as shown in Table 2-2 (Rokkan 1990).

2.3.3 Potential Nonradioactive Source Terms

The potential for hazardous process chemicals currently stored at 100 K Area to be released via the airborne or liquid effluent pathway has been reviewed in the *Operational Facility Effluent Monitoring Plan Determination for the 100 Area Facilities* (WHC 1991a) and the annual Emergency Planning and Community Right-to-Know Act chemical inventory and release reports. This review has determined that there is insignificant potential for these chemicals to be released via any of the effluent release points.

The potential nonradioactive hazardous air pollutants that were considered in the operational FEMP determination for 100 K Area were those listed in 40 CFR Part 61.01(a) and 40 CFR Part 61.01(b). It was determined, after a thorough review of the 105 KE/KW Operating Facilities, that none of the chemicals listed in either 40 CFR Part 61.01(a) or (b), with the exception of radionuclides, are present in the airborne releases from 105 KE or KW. Therefore, radionuclides are the only hazardous air pollutant considered in this FEMP.

For the 105 KE and KW operating facilities, the single liquid release point to the Columbia River was reviewed to determine the potential to release hazardous waste. The 1908 KE Outfall and 181 KE Outfall are permitted NPDES outfalls, and the analysis performed on these outfalls for the permit does not indicate any release of hazardous waste.

There are no other hazardous waste materials released by KE and KW operating facilities via either the air emissions pathway or the liquid effluent pathway.

Table 2-2. Fission Product Inventory in KE/KW Storage Basin Water.

KE/KW Basin radionuclide	KE Basin water (Ci)	KW Basin water (Ci)
³ H	2.1×10^{01}	7.9×10^{-01}
⁵⁴ Mn	6.2×10^{-02}	9.1×10^{-04}
⁶⁰ Co	4.7×10^{-02}	2.2×10^{-03}
⁹⁰ Sr	1.5×10^{01}	1.8×10^{00}
¹²⁵ Sb	1.5×10^{-01}	NA
¹³⁴ Cs	6.8×10^{-02}	5.0×10^{-03}
¹³⁷ Cs	1.9×10^{01}	3.5×10^{-01}
²³⁸ Pu	1.6×10^{-02}	9.7×10^{-06}
²³⁹ Pu	9.1×10^{-02}	5.0×10^{-05}
Total	5.6×10^{01}	2.9×10^{00}

Note:

Source of table: Rokkan (1990)

3.0 APPLICABLE REGULATIONS

Conditions and requirements for monitoring existing or potential releases of radioactive and other chemicals to the environment are contained in DOE orders and federal, state and local laws, regulations, and permits. Table 3-1 gives a brief summary of the regulations and standards applicable to this FEMP.

3.1 U.S. DEPARTMENT OF ENERGY ORDERS

3.1.1 General Environmental Protection Program (DOE Order 5400.1)

The DOE Order 5400.1, *General Environmental Protection Program* (DOE 1988), requires a written environmental monitoring plan for each site, facility, or process that uses, generates, releases, or manages significant pollutants or hazardous materials. The plan must include the rationale and design criteria for the monitoring program, as well as describe the extent and frequency of the monitoring analysis. The plan also must contain quality assurance requirements, program implementation procedures, directions for preparation and implementation of reports, and directions for identifying and discussing effluent monitoring and environmental surveillance.

The effluent monitoring portion of the plan must verify compliance with applicable regulations and DOE orders. It also should: (1) evaluate the effectiveness of treatment; (2) identify potential environmental problems; (3) evaluate the need for remedial action or mitigation measures; (4) support permit revision and/or reissuance; and (5) detect, characterize, and report unplanned releases.

3.1.2 Radiation Protection of the Public and Environment (DOE Order 5400.5)

The DOE Order 5400.5 (DOE 1990a) requires a monitoring plan that complies with the requirements of DOE Order 5400.1 (DOE 1988). Compliance with the requirements of DOE Order 5400.5 may be demonstrated based on calculations from monitoring and surveillance program information.

Table 3-1. Applicable Regulations, Standards, and Permits.

Agency/Originator	Regulation, Standard, or Permit	HA	HL	RA	RI	Summary/Application
U.S. Department of Energy (DOE), Washington, D.C.	DOE Order 5400.1 (DOE 1988) General Environmental Protection Program	X	X	X	X	Outlines effluent monitoring requirements
	DOE Order 5400.5 (DOE 1990a) Radiation Protection of the Public and Environment			X	X	Protects public/environment from radiation associated with DOE operations
	DOE Order 5480.4 (DOE 1989) Environmental Protection, Safety, and Health Protection Standards	X	X	X	X	Sets requirements for the application of the mandatory environmental protection, safety, and health (ES&H) standards; lists reference ES&H standards
	DOE Order 5484.1 (DOE 1981) Environmental Protection, Safety, and Health Protection Information Reporting Requirements	X	X	X	X	Sets requirements for reporting information having environmental protection, safety and health protection significance
	DOE Order 5820.2A (DOE 1990d) Radioactive Waste Management	X	X	X	X	Sets radioactive waste management requirements
	DOE/EH-0173T (DOE 1991b) Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance			X	X	Provides guidance for effluent sampling and monitoring.
	U.S. Environmental Protection Agency (EPA), Washington, D.C.	40 CFR 61 National Emission Standards for Hazardous Air Pollutants	X		X	
40 CFR 61 Subpart A General Provisions		X				Regulates hazardous pollutants
40 CFR 61 Subpart H National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities				X		Sets emissions standards/monitoring requirements for radionuclides

Table 3-1. Applicable Regulations, Standards, and Permits.

Agency/Originator	Regulation, Standard, or Permit	HA	HL	IRA	RL	Summary/Application
EPA (Cont'd)	40 CFR 70 State Operating Permit Program	X		X		Requires air operating permit programs for states; Washington State program regulated under WAC 173-401
	40 CFR 122 EPA Administered Permit Programs: The National Pollutant Discharge Elimination System		X			Governs release of nonradioactive liquids
	40 CFR 141 National Primary Drinking Water Regulations		X		X	Sets maximum contaminant levels in public water systems
	40 CFR 191 Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes				X	Regulates radioactive waste disposal
	40 CFR 261 Identification and Listing of Hazardous Waste		X			Identifies and lists hazardous wastes
	40 CFR 302 Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA): Designation, Reportable Quantities and Notification	X	X		X	Designates hazardous materials, reportable quantities, notification process
	40 CFR 355 Superfund Amendments and Reauthorization Act of 1986 (SARA): Emergency Planning and Notification	X	X			Identifies threshold planning quantities for extremely hazardous substances
	40 CFR 401-471 Effluent Guidelines Standards		X			Sets pretreatment standards for wastewater discharge to owned lands publicly

Table 3-1. Applicable Regulations, Standards, and Permits.

Agency/Originator	Regulation, Standard, or Permit	HA	HL	PA	RL	Summary Application
American National Standards Institute, (ANSI) New York, New York	N 13.1* (ANSI 1969) Guidance to Sampling Airborne Radioactive Materials in Nuclear Facilities				X	Sets standards for effluent monitoring systems
	N 42.18* (ANSI 1974) Specification and Performance of On-site Instrumentation for Continuously Monitoring Radioactivity in Effluents				X	Recommendations for the selection of instrumentation for the monitoring of radioactive effluents
Washington State Department of Ecology, Olympia, Washington	WAC 173-200 Water Quality Standards for Groundwater		X		X	Establishes groundwater quality standards for the protection of that resource
	WAC 173-216 State Waste Discharge Permit Program		X		X	Governs discharges to ground and surface waters
	WAC 173-218 Underground Injection Control Program		X		X	Governs discharges to wells that would affect groundwater
	WAC 173-220 National Pollutant Discharge Elimination system Permit		X		X	Governs wastewater discharges to navigable waterways; controls NPDES permit process
	WAC 173-225 Federal Water Pollution Control - Establishment of Implementation Procedures of Application for Certification		X		X	Governs the state certification program for discharges to navigable waterways
	WAC 173-240 Submission of Plans and Reports for Construction of Wastewater Facilities		X			Controls release of nonradioactive liquids
	WAC 173-303 Dangerous Waste Regulations		X			Regulates dangerous wastes; prohibits direct release to soil columns
	WAC 173-400 General Regulations for Air Pollution Sources	X				Sets emissions standards for hazardous air pollutants
	WAC 173-401 Air Operating Permit Program	X			X	Establishes an operating permit for hazardous (regulated) air pollutants, including radionuclides

Table 3-1. Applicable Regulations, Standards, and Permits.

Agency/Originator	Regulation, Standard, or Permit	HA	HL	RA	RE	Summary/Application
Washington State Department of Ecology, Olympia, Washington (Cont'd)	WAC 173-460 Control for New Sources of Toxic Air Pollutants	X				Sets standards or new sources of toxic air pollutants
	WAC 173-480 Washington State Ambient Air Quality Standard and Emission Limits for Radionuclides.	X		X		Endorses the 10 mrem/year EDE-EPA standards (40 CFR 61, Subpart H)
Washington State Department of Health, Olympia, Washington	WAC 246-247 Radiation Protection - Air Emissions	X		X		Sets standards for registration, permitting, notification, new sources, review, monitoring, and reports.
Benton County Air Pollution Control Authority, (APCA) Richland, Washington	General Regulation 80-7/Proposed Regulation	X				Regulates air quality
U.S. Environmental Protection Agency (EPA)	WAR-10-000F (EPA 1992a) Authorization to Discharge under NPDES for Stormwater Discharges Associated with Construction Activities		X		X	Construction which will disturb more than 5 acres of land where stormwater run-off could discharge to the Columbia River would require a facility-specific stormwater permit
	WAR-00-000F (EPA 1992b) Authorization to Discharge under NPDES for Stormwater Discharges for Industrial Activities		X		X	A point source stormwater discharge associated with industrial activities that could discharge to the Columbia River would require a facility-specific stormwater permit
	WA-000374-3 (EPA 1981) NPDES permit for Outfalls 003 and 004		X		X	Discharges of water to the Columbia River require a facility-specific NPDES permit
	FF-01 Radioactive Airborne Emissions (DOH 1993c)			X		Collective emissions from registered sources shall meet the emissions requirements of WAC 173-480

Table 3-1. Applicable Regulations, Standards, and Permits.

Agency/Originator	Regulation, Standard, or Permit	HA	HL	RA	RL	Summary/Application
Washington State Department of Health, Olympia, Washington	Notice of Construction (DOH 1993a, DOH 1993b)			X		Establish the ¹³⁷ Cs concentration for underwater work in 105 KE basin

Notes:

HA = hazardous airborne.
 HL = hazardous liquid.
 RA = radioactive airborne.

RL = radioactive liquid.

*Refers to standards that are referenced in the DOE and EPA regulations.

3.1.3 Environmental Protection, Safety and Health Protection Standards (DOE Order 5480.4)

To specify and provide requirements for the application of the mandatory environmental protection, safety and health (ES&H) standards applicable to all DOE and DOE contractor operators, to provide a listing of reference ES&H standards; and to identify the sources of the mandatory and reference ES&H standards.

3.1.4 Environmental Protection, Safety, and Health Protection Information Reporting Requirements (DOE Order 5484.1)

This order establishes the requirements and procedures for the investigation of occurrences having environmental protection, safety, or health protection significance, and for efficient and environmental monitoring of DOE operations.

3.1.5 Radioactive Waste Management (DOE Order 5820.2A)

To establish policies, guidelines, and minimum requirements by which the DOE manages its radioactive and mixed waste and contaminated facilities.

3.1.6 Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE/EH-0173T)

The purpose of the regulatory guide is to specify the necessary elements for effluent monitoring and environmental surveillance of radioactive materials at DOE facilities for compliance with both applicable federal regulations and DOE policy.

3.2 FEDERAL REGULATIONS

3.2.1 National Emission Standards for Hazardous Air Pollutants (40 CFR 61)

Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities," establishes exposure limits and monitoring requirements. The exposure limits, for members of the public, from radionuclide emissions is an EDE not to exceed 10 mrem/year. Compliance with this standard is measured by calculating the highest EDE where a person resides or abides using an EPA-approved method.

Emissions of radionuclides must be measured at all release points that have a potential to discharge radionuclides into the air in quantities that could cause an EDE in excess of 1% of the standard. If the EDE caused by all emissions is less than 1% of the standard, the facility is exempt from the EPA monitoring requirements. All radionuclides that could contribute greater than 10% of the potential EDE for a release point shall be measured individually. With prior EPA approval, DOE may determine these emissions through alternative procedures. For other release points that have a potential to release radionuclides into the air, periodic confirmatory measurements shall be made to verify low emissions.

To determine whether a release point is subject to emission measurement requirements, it is necessary to evaluate the potential for radionuclide emissions for that release point. In evaluating the potential of a release point to discharge radionuclides into the air, the estimated radionuclide release rates shall be based on the discharge of the effluent stream that would result if all pollution control equipment did not exist, but the facility operations were otherwise normal.

Subpart H also states that effluent streams shall be directly monitored continuously with an in-line detector or representative samples of the effluent stream shall be withdrawn continuously from the sampling site following the guidance presented in American National Standards Institute (ANSI) N13.1 (ANSI 1969). The requirements for continuous sampling are applicable to batch processes when the unit is in operation. Periodic sampling (grab samples) may be used only with EPA's prior approval. Such approval may be granted in cases where continuous sampling is not practical and radionuclide emission rates are relatively constant. In such cases, grab samples shall be collected with sufficient frequency to provide a representative sample of the emissions.

3.2.2 State Operating Permit Program (40 CFR 70)

This regulation defines the minimum elements required by the *Federal Water Pollution Control Act of 1972* for state operating permit programs and corresponding standards and procedures by which the administrator will approve, oversee, and withdraw approval of state operating permit programs.

3.2.3 EPA-Administered Permit Programs: The National Pollutant Discharge Elimination System (40 CFR 122)

This regulation covers basic EPA permitting requirements and procedures for EPA processing of permit applications and appeals.

3.2.4 National Primary Drinking Water Regulations (40 CFR 141)

This regulation establishes that the primary drinking water average annual concentration of beta particle and photon radioactivity from manmade radionuclides in drinking water shall not produce an annual dose equivalent of the total body or any internal organ greater than 4 mrem/yr.

3.2.5 Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes (40 CFR 191)

Radiation doses received by members of the public as a result of the management and storage of spent nuclear fuel or high-level or transuranic radioactive wastes at any facility shall not exceed 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other critical organ.

3.2.6 Identification and Listing of Hazardous Waste (40 CFR 261)

This part identified those solid wastes which are subject to regulation as hazardous waste.

3.2.7 Designation, Reportable Quantities, and Notification (40 CFR 302)

The regulations in "EPA Designation, Reportable Quantities, and Notification Requirements for Hazardous Substances Under CERCLA" (40 CFR 302) designate hazardous substances and identify reportable quantities and notification requirements for release of these hazardous substances under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)* and the *Safe Drinking Water Act of 1974*, as amended.

Any unpermitted release of any of these designated hazardous substances must be reported. Therefore, if the possibility exists for a facility to release any of the designated substances, waste streams must be monitored for their presence and monitoring practices must be provided in a FEMP.

3.2.8 Emergency Planning and Notification (40 CFR 355)

This regulation establishes the list of extremely hazardous substances, threshold planning quantities, and facility notification responsibilities necessary for the development and implementation of state and local emergency response plans under the *Superfund Amendment and Reauthorization Act of 1986*, as amended.

3.2.9 Effluent Guidelines Standards (40 CFR 401-471)

The regulations in 40 CFR 401-471 prescribe effluent limitations guidelines for existing sources, standards of performance for new sources and pretreatment standards for new and existing sources pursuant to the *Federal Water Pollution Control Act of 1972*. Point services of discharges of pollutants are required to comply with these regulations, where applicable and permitted under an NPDES permit.

3.3 INDUSTRY STANDARDS UNDER AMERICAN NATIONAL STANDARDS INSTITUTE

3.3.1 Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities (ANSI N13.1-1969)

The primary objective for sampling airborne radioactivity in effluents is to measure the release of radioactive materials to the environment. This is accomplished through sampling near the point of release.

The objective of ANSI N13.1-1969 is to set forth the principles that apply in obtaining valid samples of airborne radioactive materials and to prescribe acceptable methods and materials for gaseous and particulate sampling. ANSI N13.1-1969 is limited to the collection of samples and does not address measurement of the radioactive materials collected.

3.3.2 Specification and Performance of Onsite Instrumentation for Continuously Monitoring Radioactivity in Effluents (ANSI N42.18-1980)

The objective of continuously monitoring instrumentation is to measure the quantity, and/or the rate of release of radionuclides in the effluent stream and to provide useful documentation for scientific and logical purposes.

This standard applies to continuous monitors that measure normal releases, detect inadvertent releases, show general trends, and annunciate radiation levels that have exceeded predetermined values.

This standard specifies detection capabilities, physical operating limits, reliability, and calibration requirements and sets forth minimum performance requirements for effluent monitoring.

3.4 WASHINGTON STATE REGULATIONS

3.4.1 Water Quality Standards for Groundwater (WAC 173-200)

The water quality standards to protect groundwater to the level of drinking water standards is contained in "Water Quality Standards for Groundwaters of the State of Washington (WAC 173-200). These standards limit exposure to gross alpha, gross beta, tritium, ⁹⁰Sr, and ^{226, 228}Ra. For radionuclides that are not specifically listed, exposures are limited by the federal standard to an EDE not to exceed 4 mrem/year.

3.4.2 State Waste Discharge Permit Program (WAC 173-216)

The purpose of this state regulation is to implement a state permit program, applicable to the discharge of waste materials from industrial operations into ground and surface waters of the state. However, this regulation excludes point service discharge of pollutants into navigable waters of the state, which is regulated by the "National Pollutant Discharge Elimination System Permit Program" (WAC 173-220). This regulation also excludes the injection of fluid through wells, which is regulated by "Underground Injection Control Program" (WAC 173-218).

3.4.3 Underground Injection Control Program (WAC 173-218)

The purpose of this regulation is to set forth the procedures and practices applicable to the injection of fluid through wells. The disposal of waste fluids from industrial sources into wells will not be authorized by this regulation. All known, available, and reasonable methods to prevent and control the discharge of fluids and waste fluids into the water of the state will be regulated.

3.4.4 National Pollutants Discharge Elimination System Permit Program (WAC 173-220)

The purpose of this regulation is to establish a state permit program, applicable to discharge of pollutants and other wastes and materials to the surface waters of the state. WAC 173-225 establishes the state certification program for implementation of the *Federal Water Pollution Control Act of 1972*.

3.4.5 Federal Water Pollution Control Act - Establishment of Implementation Procedures of Application for Certification (WAC 173-225)

The *Federal Water Pollution Control Act of 1972* provides that applicants for a license or permit from the Federal Government relating to any activity that may result in any discharge into the navigable waters shall obtain a certification from the state in which the discharge originates. The purpose of this regulation is to establish procedures for public notice and public hearings in relation to processing of applications for certification.

3.4.6 Submission of Plans and Reports for Construction of Wastewater Facilities (WAC 173-240)

Prior to the construction or modification of wastewater facilities, engineering reports and plans and specifications for the project shall be submitted to and approved by the state.

3.4.7 Dangerous Waste Regulations (WAC 173-303)

Any release of a dangerous or hazardous substance (as designated by the Washington [State] Administration Code) to the environment, except permitted releases, must be reported. Waste streams that have the potential to contain dangerous waste constituents must be monitored accordingly.

3.4.8 General Regulations for Air Pollution Sources (WAC 173-400)

It is the policy of the Washington State Department of Ecology to provide the systematic control of air pollution from air contamination sources and for the proper development of the State's natural resources.

3.4.9 Air Operating Permit Program (WAC 173-401)

The provisions in this regulation establish the element of a comprehensive Washington State air operating permit program consistent with the requirements of the *Federal Clean Air Act of 1977*. All sources (hazardous and radionuclides pollutants) subject to this regulation shall have a permit to operate that assures compliance by the service with all applicable requirements.

3.4.10 Controls for New Sources of Toxic Air Pollutants (WAC 173-460)

This regulation establishes the systematic control of new services that emit toxic air pollutants (in order to prevent air pollution), emission reduction (to the extent reasonably possible), and maintenance of such levels of air quality as will protect human health and safety. Toxic air pollutants include carcinogens and noncarcinogens listed in WAC 173-460-150 and 173-460-160.

3.4.11 Ambient Air Quality Standards and Emission Limits For Radionuclides (WAC 173-480)

Although the standard for Washington State establishes a 25-mrem/year EDE for public exposure to radionuclide emissions, facilities must comply with the most restrictive of federal, state, or local law. Therefore, the exposure limit that must be complied with is 10 mrem/year; however, compliance is calculated at the point of maximum annual air concentration in an unrestricted area where any member of the public may be located (fence boundary).

3.4.12 Radiation Protection - Air Emissions (WAC 246-247)

This regulation specifies new source review, notification, registration, and permitting requirements associated with any source of radioactive air emissions in Washington State, including those on the Hanford Site. One requirement listed in WAC 246-247 is the semiannual (twice yearly) reporting of emissions from each registered stack or vent onsite. By agreement with Washington State Department of Health, only annual reporting is required.

3.5 LOCAL REGULATIONS

3.5.1 Benton County Air Pollution Control Authority (80-7)

The local air pollution control authority has jurisdiction over all air emissions except radionuclide emissions in Benton County areas, including the Hanford Site. Currently, there are no local standards more restrictive than the previously mentioned state and federal limits; therefore state and federal standards apply.

3.6 PERMITS

3.6.1 Authorization to Discharge Under NPDES for Stormwater Discharges Associated with Construction Activities (WAR-10-000F)(EPA 1992a)

Permittees who discharge stormwater associated with industrial activity from construction activities must be included in the stormwater pollution prevention plan. If there is evidence indicating potential or realized impacts on water quality due to any stormwater discharge associated with industrial activity covered by this permit, an individual permit may be required or the permit may be modified to include different limitations and/or requirements.

3.6.2 Authorization to Discharge Under NPDES for Stormwater Discharge for Industrial Activities (WAR-00-000F)(EPA 1992b)

The sitewide stormwater discharge permit for industrial activities, which is issued through the EPA general stormwater discharge permitting program, requires that point source discharges to the Columbia River be permitted. Diversion of stormwater discharges to groundwater from existing discharges to surface water shall not be authorized by this permit if such diversion causes a violation or the potential for violation of groundwater standards (WAC 173-200). Discharges below the surface of the ground are also regulated by the Underground Injection Control Program (WAC 173-218).

3.6.3 NPDES Permit (WA-000374-3)

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the *Federal Water Pollution Control Act of 1972* and is grounds for enforcement action. The permittee shall give notice to EPA, as soon as possible, of any planned physical alterations or additions to the permitted facility. The permittee shall also give advance notice of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.

3.6.4 Radioactive Airborne Emissions (FF-01)

The collective emissions from all registered sources from all areas on the Site shall meet the emission requirements of WAC 173-400-040. The department shall be notified of any source location changes. Operations shall be consistent with 40 CFR 61, the *Washington Clean Air Act of 1967* (RCW 70.94), and WAC 246-247.

3.6.5 Notice of Construction for KE Basin

A notice of construction (NOC) for 105-KE Basin Fuel Encapsulation Activity was submitted to the Washington State Department of Health pursuant to WAC 246-247. The NOC presented the chemical and physical processes relating to the encapsulation activity, source term, expected annual emission, radionuclide control and monitoring equipment, and projected dose to the maximally exposed individual. According to DOE/RL-93-13, *Notice of Construction for 105 KE Encapsulation Activity*, the remitted effective dose equivalent to maximally exposed individual was 6.9 E-04 mrem/yr for all radionuclides projected annually.

This NOC has been amended by the Washington State Department of Health for other K Basin work not covered in this NOC.

3.7 AIR EMISSIONS

DOE Order 5400.5 (DOE 1990a) provides requirements for the monitoring of radioactive and nonradioactive airborne effluents from DOE facilities at the Hanford Site. This order states that DOE-controlled facilities must comply with "National Emission Standards for Hazardous Air Pollutants (NESHAP)(40 CFR 61).

Additional EPA requirements on hazardous substances are contained in the *Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA)*. This regulation provides information on reportable quantities of radioactive and nonradioactive hazardous substances. Unlisted hazardous substances designated by CERCLA are regulated in accordance with the EPA toxicity of the contaminant.

In Washington State, airborne effluents are regulated by the Washington State Department of Ecology through regulations in the WAC, Title 173, Chapters 173-400 through 173-480, as amended, pursuant to the *Washington Clean Air Act of 1967 (RCW 70.94, as amended)*. General regulations for air pollution sources are presented in WAC 173-400, including emission standards for sources emitting hazardous air pollutants found in WAC 173-400-075.

WAC 246-247, "Radiation Protection Air Emissions," specifies new source review, notification, registration, and permitting requirements associated with any source of radioactive air emissions in Washington State, including those on the Hanford Site. One requirement listed in WAC 246-247 is the biannual (twice yearly) reporting of emissions from each registered stack or vent on site. By agreement with the Washington State Department of Health, only annual reporting is required.

WAC 173-480, "Ambient Radionuclides," defines maximum allowable levels for radionuclides in the ambient air and defines required levels for control of emissions.

While both WAC 246-247 and 173-480 list outdated maximum EDE standards, each contains a caveat stating that a more stringent federal standards take precedence over the EDE standard specified by the WAC. Therefore, each effectively endorses the 10 mrem/year EDE standard of "National Emission Standards for Hazardous Air Pollutants (NESHAP)" (40 CFR 61), Subpart H.

Regulations, including DOE orders, state that DOE facilities must comply with the requirements set forth in the National Emission Standards for Hazardous Air Pollutants (NESHAP)(40 CFR 61). Other regulations (e.g., 40 CFR 52, "Approval and Promulgation of Implementation Plans"; and DOE Orders 5400.1 (DOE 1988a), 5400.5 (DOE 1990a), DOE/EH-0173T (DOE 1991b), and 5484.1 (DOE 1981) state that DOE facilities must comply with the applicable requirements set forth in the *Washington Clean Air Act of 1967*.

3.8 LIQUID EFFLUENTS

Requirements limiting the exposure of the public to radioactive materials from DOE-controlled activities through the drinking water pathway are presented in DOE Order 5400.5, Chapter II, Paragraph 1.d (DOE 1990a). The radiological criteria of the public community drinking water standards of 40 CFR Part 141, "National Interim Primary Drinking Water Regulations," are applicable to 183 KE Water Plant as the provider of potable water to K Area under the *Safe Drinking Water Act of 1974*. It is the policy of DOE to provide an equivalent level of protection for all persons consuming water from a drinking water supply operated by, or for, the DOE. These systems shall not cause any persons consuming the water to receive an EDE greater than 4 mrem/year, excluding naturally occurring radionuclides. In addition, DOE facility operators shall ensure that the liquid effluents from DOE activities shall not cause private or public drinking water systems downstream of the facility discharge to exceed the drinking water radiological limits of 40 CFR Part 141.

Depending on where a liquid effluent (wastewater) is discharged, certain regulations apply. These regulations are implemented through issuance of permits by federal, state, and/or local agencies. It is the responsibility of the facility, through the Richland Operations Office (RL), to apply for the permit appropriate to the effluent being discharged. Before applying for any permits, the applicant must know the source of wastewater discharges and where the wastewater is being discharged to.

Each type of discharge permit identified will typically contain discharge limitations and monitoring requirements. However, the limitations and monitoring requirements will vary depending on the source and type of wastewater being discharged. For instance, discharges to a publicly owned treatment works will be subject to pretreatment standards based on the production process that generated the wastewater for those processes categorized by the EPA. Categorical processes are identified in 40 CFR 401-471. Specific limitations, monitoring, and reporting requirements have been promulgated for each categorical process. In addition to EPA's requirements, state and local wastewater treatment agencies may impose additional

limitations, monitoring, and reporting requirements. Discharges to a navigable waterway also will be subject to certain standards based on the industrial process that generated the wastewater; certain additional limitations are typically imposed in the NPDES permit. In all cases, the specific pollutants to be monitored and the frequency of monitoring and reporting will be based on the applicable regulations and the language of the permit.

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4.0 IDENTIFICATION AND CHARACTERIZATION OF EFFLUENT STREAMS

Both liquid and gaseous effluent streams exist at the K Area. Radionuclides are discharged to the air from: (1) 105 KE Spent Fuel Storage Basin; (2) 105 KW Spent Fuel Storage Basin; and (3) the Engineering and Environmental Demonstration Laboratory 1706 KE complex. Radionuclides are discharged to the Columbia River from one discharge point located at the 1908 Outfall, also known as NPDES Outfall 004. The radionuclides emitted from the effluent release points via the air pathway and the liquid effluent pathway are ^3H , ^{60}Co , ^{90}Sr , ^{134}Cs , ^{137}Cs , ^{238}Pu , ^{239}Pu , ^{40}Pu , ^{241}Pu , ^{241}Am , ^{155}Eu , ^{106}Ru , ^{125}Sb , and ^{154}Eu .

4.1 IDENTIFICATION AND CHARACTERIZATION OF CONTAMINANTS TO EACH EFFLUENT STREAM

This section describes contaminants that actually or potentially contribute to the K Area effluent streams during routine or upset operating conditions. General information for all streams is provided in Table 4-1 for liquids and Table 4-2 for gaseous streams.

4.1.1 Routine Operating Conditions

Radioactivity is released from the roof vents over the KE and KW Storage Basins without use of environmental control equipment. The isotopes that may be released include ^{60}Co , ^{90}Sr , ^{134}Cs , ^{238}Pu , ^{239}Pu , ^{240}Pu , ^{241}Pu , ^{241}Am , ^{155}Eu , ^{106}Ru , ^{125}Sb , and ^{154}Eu . Radioactivity is also released from the roof vents of the 1706 KE complex. The 1706 KE complex has the following discharge points: (1) 1706 KE (main floor, 0-ft level); (2) 1706 KE (basement, minus 13-ft level); (3) 1706 KE (sub-basement, minus 27-ft level); (4) 1706 KER (main floor, 0-ft level); (5) 1706 KER (minus 27-ft level); (6) 1706 KER tunnel exhaust (minus 27-ft level); and (7) 1706 KEL laboratory space, (0-ft level). The isotopes that may be released include ^{90}Sr , ^{106}Ru , ^{125}Sb , ^{134}Cs , ^{155}Eu , ^{238}Pu , ^{239}Pu , and ^{240}Pu . Radionuclides are also released by the 1908 KE outfall. The isotopes that are released include ^{60}Co , ^{106}Ru , ^{134}Cs , and ^{137}Cs . Details of releases from specific 1993 release points are shown in Table 4-3.

4.1.2 Upset Operating Conditions

The unplanned-upset potential effluent was developed by using the highest recorded radionuclide concentrations in 105 Spent Fuel Storage Basin water. These highest recorded radionuclide concentrations are: (1) ^{137}Cs -41E+6 picocuries (pCi)/L, (2) ^{90}Sr -90E+6 pCi/L, (3) $^{239,240}\text{Pu}$ -0.0678E+6 pCi/L, and (4) ^3H -6E+6 pCi/L. The upset conditions that these radionuclide concentrations were applied to are: (1) 105 Spent Nuclear Fuel Basin leakage at the construction joint between the reactor and basin potentially effecting the soil column and

groundwater; and (2) a pipe break in the 105 building causing an overflow of the fuel storage basin water, potentially effecting the soil column, air, and river. Most likely the off-normal event would be less severe than either of the two events listed above, because the consequences of either event do not take operator response actions into consideration.

4.1.2.1 105 Spent Nuclear Fuel Basin Construction Joint Leakage. There are no deliberate radioactive liquid discharges from the basin. Beneath each basin is an asphalt membrane that was installed during the original construction. The membrane was intended to collect any basin leakage and divert it to a tile drainage field. The diversion line has been intercepted and connected to a sump. Any leakage collected would be pumped from the sump back into the basin. The basin leak collection membrane does not extend to the construction joint in the discharge chute and thus will not collect leaks from the discharge chute.

Basin leaks that have been detected have been attributed to leaks in the discharge chute area. A leak identified in 1983 was confirmed to be from the discharge chute. Following the repair of the discharge chute, no further leakage was suspected until 1993, when a leak occurred. During the 1993 leak, no water accumulated in the sump connected to the collection membrane. Therefore, it is speculated, although not confirmed, that the 1993 leak, which stopped following an increase in the basin water temperature, was in the discharge chute.

Periodic basin drawdown tests and basin water level trending are used to provide evidence of basin leaks. Additional checks for leakage are provided by seven groundwater monitoring wells located around each basin. Quarterly sampling from these wells is used to trend and evaluate changes in groundwater quality as an indicator of a potential basin leak.

Due to past leaks in the basin, an inventory of ^{137}Cs , ^{90}Sr , $^{239,240}\text{Pu}$ and ^3H , the primary radionuclides of concern, has accumulated in soil column beneath the basin. Because only the highly mobile tritium (tritiated water) has been detected in groundwater monitoring wells immediately down-gradient from the basin, it is assumed that breakthrough of ^{90}Sr , ^{137}Cs , and $^{239,240}\text{Pu}$ to groundwater has probably not occurred. Increased seepage due to a large leak, however, may result in transport of some of the soil column inventory to groundwater. The most likely point of exposure to the public would be along the river bank where groundwater containing tritium and other contamination emerges in "springs."

To resolve potential environmental impacts from basin leakage following an earthquake, isolation barriers were installed to separate the discharge chute from the rest of the basin. These barriers provide a seismic boundary that would prevent loss of water from the main basin in the event an earthquake opens the construction joint in the discharge chute. The barriers are sealed against the concrete on the basin side and held in place by brackets positioned and tightened from the discharge chute side. This would reduce loss of basin water to the soil column. The concentration used in Table 4-4 for basin water concentration pCi/L was the maximum concentration recorded in historical sampling/analysis records. The

leak rate used to determine the upset release was 4,542 L/h (1,200 gal/h) which is within the facility's authorization basis leak rate of 5,678 L/h (1,500 gal/h).

4.1.2.2 105 Spent Nuclear Fuel Basin Overflow Due to Pipe Break. Filtered water is supplied to the 105 Spent Nuclear Fuel Basins backup cooling for the air chillers, basin makeup water, and fire fighting through an 8-in. supply line. The distribution lines inside the facility are also 8-in. A break in one of these lines would result in the release of water into the fuel storage facility which, if not terminated in time, would completely fill the basin and then overflow through any floor level openings to the areas surrounding the storage facility.

A complete break of the 8-in. supply line with a flowthrough of 7,570 L/min (2,000 gal/min) would fill the basin to overflowing in three hours, resulting in a basin overflow of approximately 2,293,950 L (606,000 gal). Of this quantity, approximately 378,540 L (100,000 gal) would flow to the river through the drains to the outfall, approximately 302,832 L (80,000 gal) would soak into the soil as a pond formed, and the pond would contain approximately 1,665,576 L (440,000 gal) at its maximum state. The pond's maximum area would be approximately 2.19 hectares (5.4 acres) or an area of approximately 148 m x 148 m (485 ft x 485 ft) (WHC 1991d). The concentration used in Table 4-5 for the basin water concentration pCi/L was the maximum concentration recorded in historical sampling/analysis records. The total curies released directly to the river would be: 5.18E+1; released to ground, 4.15E+1; and released to the air by evaporation of all water, 2.27E+02.

Assumptions (WHC 1991d) made for this potential upset condition are:

- Complete break of pipe, with flowthrough of 7,570 L/min (2,000 gal/min)
- Basin high-level alarm occurs, and operators respond to alarm. However, because of consequences and damage from the seismic event, chlorine spill, or other unforeseen factors, the flow through the break is not shut off for eight hours.
- All basin overflow is assumed to be water displaced from the basin.
- 15% of the basin overflow leaks under the door into the administration area, from where it drains to the basement and through drains to the 1908 Outfall to the river.
- The remainder of the overflow drains through the various openings in the walls and under doors to the outside area east, north, and west of the storage facility, forming a shallow pond with an average depth of 8 cm (3 in.).
- 15% of the water that drains to the outside area soaks into the soil as a pond is forming.

Table 4-1. K Area Liquid Effluent Streams.

Discharge designation	Facilities served	Liquid waste description	Hazardous chemical content	Radioactive material content	Comments
1908 KE Outfall	105 KE 105 KW 183 KE 1706 KE	Backup cooling Backup cooling Backwash/leakage Process drains	None	⁶⁰ Co, ¹⁰⁶ Ru, ¹³⁴ Cs, ¹³⁷ Cs (From contaminated discharge pipe)	Low concentration of radionuclides released
Tile field	1717 K 1709 K 1722 K 1718 K 1711 K 1719 K	Kitchen and rest room sanitary waste	None	None	No hazardous potential
Tile field	105 KE 1706 KE	Kitchen and rest room sanitary waste	None	None	No hazardous potential
Tile field	105 KW	Kitchen and rest room sanitary waste	None	None	No hazardous potential
Tile field	183 KE	Kitchen and rest room sanitary waste	None	None	No hazardous potential
Tile field	Trailer by 183 KE	Kitchen and rest room sanitary waste	None	None	No hazardous potential
Tile field	1721K 1720K	Kitchen and rest room sanitary waste	None	None	No hazardous potential

Table 4-2. K Area Gaseous Effluent Streams.

Discharge designation	Facilities served	Gaseous effluent description	Hazardous chemical content	Radioactive material content	Comments
Building exhaust fans (4)	105 KE Basin and Highbay	Building exhaust	None	⁶⁰ Co, ⁹⁰ Sr, ¹³⁴ Cs, ²³⁸ Pu, ²³⁹ Pu, ²⁴⁰ Pu, ²⁴¹ Pu, ²⁴¹ Am, ¹⁵⁵ Eu, ¹⁰⁶ Ru, ¹²⁵ Sb, ¹⁵⁴ Eu	Samples analyzed weekly/monthly
Building exhaust fans (4)	105 KW Basin and Highbay	Building exhaust	None	⁶⁰ Co, ⁹⁰ Sr, ¹³⁴ Cs, ²³⁸ Pu, ²³⁹ Pu, ²⁴⁰ Pu, ²⁴¹ Pu, ²⁴¹ Am, ¹⁵⁵ Eu, ¹⁰⁶ Ru, ¹²⁵ Sb, ¹⁵⁴ Eu	Samples analyzed weekly/monthly
Laboratory exhaust hoods (10) and canopy (1)	1706 KE Main Floor 0-ft level	Laboratory exhaust	Hexane (wash equipment)	⁹⁰ Sr, ¹⁰⁶ Ru, ¹²⁵ Sb, ¹³⁴ Cs, ¹⁵⁵ Eu, ²³⁸ Pu, ^{239,240} Pu	Samples analyzed monthly, 12 bank HEPA, 340 m ³ /min (12,000 ft ³ /min) for all exhaust. Operational 24 hr/day
Ventilates 4-m (13-ft) level	1706 KE Basement 4-m (13-ft) level	Ventilates basement	No	No	Not operational since 1989 with no HEPA. Internal contamination in pipes that traverse basement not sampled.
Tunnel exhaust	1706 KE Sub-basement 8-m (27-ft) level	Radon control	No	Radon control	Not sampled, no HEPA filter. 28 m ³ /min (1,000 ft ³ /min) 24 hr/day
Main floor	1706 KER Main floor 0-ft level	None	No	No	No exhaust from this level. Radioactive mat'l stored in drums.
Laboratory exhaust hoods (3)	1706 KER 8-m (27-ft) level	Laboratory exhaust	Ammonia gas to deacid fuel	⁹⁰ Sr, ¹²⁵ Sb, ¹³⁴ Cs, ¹³⁷ Cs, ¹⁵⁴ Eu, ²³⁸ Pu, ^{239,240} Pu, ²⁴¹ Am	Samples analyzed monthly, two stage HEPA, 71 m ³ /min (2,500 ft ³ /min) for all three lab exhausts. Operational 24 hr/day
Tunnel exhaust	1706 KER 8-m (27-ft) level	Radon control	No	Radon control	No sampling. Two stage HEPA, 58 m ³ /min (2,000 ft ³ /min). Not operational in 1994
Laboratory exhaust, canopy and room	1706 KEL Laboratory exhaust	Laboratory exhaust	Hexane	Potential	Operational at this time. No sampling. Site sampling tool decon. Nine bank HEPA, 255 m ³ /min (9,000 ft ³ /min). No Rad source at this time.

HEPA = High-efficiency particulate air [filter]

Table 4-3. Normal Operation Radioactive Emissions for 1993 from K Area.

Release point	Radionuclide	Release quantity (Ci)
1908 KE Outfall (liquid)	⁶⁰ Co	2.7E-04
	¹⁰⁶ Ru	1.5E-03
	¹³⁴ Cs	4.7E-05
	¹³⁷ Cs	4.0E-04
105 KE (air emission)	⁶⁰ Co	2.2E-06
	⁹⁰ Sr	5.0E-05
	¹⁰⁶ Ru	7.6E-06
	¹²⁵ Sb	7.6E-07
	¹³⁷ Cs	1.4E-04
	¹⁵⁴ Eu	3.9E-06
	¹⁵⁵ Eu	1.1E-06
	²³⁸ Pu	9.9E-07
	²³⁹ Pu	7.7E-06
	²⁴¹ Am	5.2E-06
	105 KW (air emission)	⁹⁰ Sr
¹⁰⁶ Ru		1.6E-06
¹²⁵ Sb		1.2E-06
¹³⁷ Cs		2.1E-05
¹⁵⁴ Eu		1.9E-06
²³⁸ Pu		7.5E-09
^{239, 240} Pu		5.3E-08
²⁴¹ Am		4.0E-08
1706 KE Main Floor (0-ft level) air emission	⁹⁰ Sr	2.4E-08
	¹⁰⁶ Ru	1.3E-06
	¹²⁵ Sb	2.6E-07
	¹³⁴ Cs	7.8E-08
	¹⁵⁵ Eu	9.1E-08
	²³⁸ Pu	6.1E-10
	^{239/240} Pu	7.4E-09
1706 KE Basement (air emission)	Not operational	
1706 KE Sub-basement 8-m (27-ft) level (air emission)	Not sampled	
1706 KER Main floor 0-ft level (air emission)	No exhaust	

Table 4-3. Normal Operation Radioactive Emissions for 1993 from K Area.

Release point	Radionuclide	Release quantity (Ci)
1706 KER 8-m (27-ft) level (air emission)	⁹⁰ Sr	3.3E-08
	¹²⁵ Sb	5.0E-08
	¹³⁴ Cs	4.9E-09
	¹³⁷ Cs	3.4E-08
	¹⁵⁴ Eu	4.7E-08
	²³⁸ Pu	3.0E-10
	^{239/240} Pu	1.1E-09
	²⁴¹ Am	6.6E-10
1706 KER 8-m (27-ft) level (air emission)	Not sampled	
1706 KEL (air emission)	Not sampled and no rad source	

Table 4-4. Upset Operating Conditions for 105 Spent Nuclear Fuel Basin Construction Join Leakage (Earthquake Release).

Radionuclide	Basin water concentration pCi/L	105 KE & 105 KW discharge chute release 442,800 L (117,000 gal) Ci	Leak 4,542 L/h (1,200 gal/hr) for 4 months, both basins 2.62E+7 L 6.91E+6 gal Ci
¹³⁷ Cs	41E+6	1.8E+1	1.07E+3
⁹⁰ Sr	90E+6	3.98E+1	2.35E+3
^{239/240} Pu	.0678E+6	3.0E-2	1.77E+0
³ H	6.E+6	2.66E+0	1.57E+2
Total curie		6.06E+1	3.58E+3

Note: A leak rate of 5,678 L/h (1,500 gal/h) is within the facility authorization basis. A design basis seismic event is a low probability event (10⁻⁴) not expected to occur in the remaining facility lifetime. A leak rate of 4,542 L/h (1,200 gal/h) was used to determine the upset release.

- Calculated Ci was multiplied by a conversion factor for gallons to liters by 3.7854 and for pCi to Ci by 1.0E-12.

Table 4-5. Upset Operating Conditions for 105 Spent Nuclear Fuel Basin Overflow Due to Pipe Break.

Radionuclide	Basin water concentration pCi/L	River discharge 378,540 L (100,000 gal) Ci	Soak into ground 302,832 L (80,000 gal) Ci	Lake formed 1,665,576 L (440,000 gal) Ci
¹³⁷ Cs	41E+6	1.55E+1	1.24E+1	6.83E+1
⁹⁰ Sr	90E+6	3.41E+1	2.73E+1	1.49E+2
^{239/240} Pu	.0678E+6	2.57E-2	2.05E-2	1.13E-1
³ H	6E+6	2.27E+0	1.82E+0	9.99E+0
Total curie		5.18E+1	4.15E+1	2.27E+02

Note:

Calculated Ci was multiplied by a conversion factor for gallons to liters by 3.7854 and for pCi to Ci by 1.0E-12.

5.0 EFFLUENT POINT OF DISCHARGE DESCRIPTION

Of the 16 effluent discharge points in the 100 K Area, only 8 effluent discharge points have the potential for containing radiological pollutants. These include one liquid release point and 7 air release points. The following release point descriptions include the precise location and identification of all contributing streams (actual and potential), instrumentation and flow rates.

5.1 AIRBORNE DISCHARGE POINTS

As noted in Section 2-1, the 100 K Area is comprised of various facilities. Three of these facilities contain systems or materials that could be contaminated and contribute radioactivity to the airborne effluent streams. These air release points in the 105 KE Basin, 105 KW Basin, and 1706 KE Engineering and Environmental Demonstration Laboratory Facility Complex consist of exhaust vents and are described below.

5.1.1 105 KW Basin Exhaust Vents

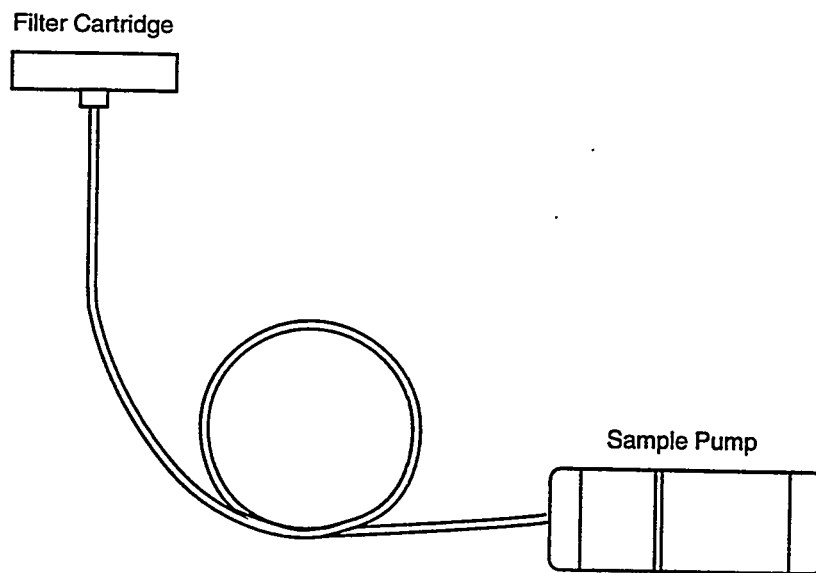
The 105 KE and 105 KW Basin structures are in most respects identical in design and vent characteristics. Two exhaust vents are located on the roof of the building above the fuel storage basin, and two vents are located above the transfer area. The vents in the basin and transfer area exhaust at a maximum flow total of 1,104 m³/min (39,000 ft³/min). The exhausts vent air directly to the atmosphere without treatment (high-efficiency particulate air [HEPA] filter).

The sampling system consists of three samplers inside the 105 KW Fuel Basin. Of the three samplers, one is located in the high bay area and two are located in the low bay area. All three samplers are similar, consisting of a 1/4-hp Gast integral vacuum that provides 0.3 m³/min (1 ft³/min) at a minimum of 33 cm (13 in.). The collection probes for the samplers pull air through a particulate filter that collects radionuclides. The filters are changed weekly and a monthly composite is made to conduct radioisotopic analyses to characterize the radionuclides present in the air entering the exhaust vents. A schematic of the sampling system is shown in Figure 5-1.

5.1.2 105 KE Basin Exhaust Vents (Closed by December 1995)

The 105 KE Basin exhaust vents are located on the roof of the building directly above the fuel storage basin and transfer area, approximately 4.5 m (15 ft) and 11.5 m (38 ft) aboveground, respectively. The vents in the basin and transfer area exhaust at a maximum flow total of 1,529 m³/min (54,000 ft³/min).

Figure 5-1. 105 KE/KW Monitoring Schematic.



29505047.2

The exhausts vent air directly to the atmosphere without treatment (HEPA filters). The sampling system consists of four samplers inside the 105 KE Fuel Basin. Two samplers are located in the high bay area and two are located in the low bay area. Each sampler includes a 1/4-hp Gast integral vacuum pump that provides 0.3 m³/min (1 ft³/min) at a minimum of 33 cm (13 in.). The collection probes for the samplers are positioned below the exhaust vents. Each of the samplers pulls air through a particulate filter that collects radionuclides. The filters are changed weekly, and a monthly composite is made to approximate the radionuclides present in the air entering the exhaust vent. A schematic of the sampling system is shown in Figure 5-1.

5.1.3 1706 KE Complex Exhaust Vents (Projected Closure by December 1995)

The 1706 KE Complex contains five operating exhaust ventilation systems: (1) the 1706 KE Laboratory exhaust; (2) the 1706 KE Tunnel exhaust; (3) the 1706 KER Laboratory exhaust; (4) 1706 KER Tunnel exhaust (not operational); and (5) the 1706 KEL Laboratory exhaust.

5.1.3.1 The 1706 KE Laboratory Exhaust System is located on the west end roof of the 1706 Building. This system contains a bank of 12 HEPA filters and releases air at a rate of 340 m³/min (12,000 ft³/min). The release point is located approximately 7.6 m (25 ft) aboveground. The primary function of this exhaust is to ventilate hoods within the 1706 Building. Some of these hoods contain one additional stage of HEPA filtration. The HEPA filters are dioctyl phthalate (DOP) tested yearly and the hood flows are checked monthly. The exhaust air is sampled at the discharge with a 3-micron filter at a rate of 0.01 m³/min (0.5 ft³/min). These samples are changed and analyzed on a monthly basis. Schematics of the sampling and exhaust systems are shown in Figures 5-2 and 5-3.

5.1.3.2 The 1706 KE Tunnel exhaust is an unfiltered 28-m³/min (1,000-ft³/min) system. This system is located east of the 1706 KE Building at ground level. The discharge point is approximately 1.5 m (5 ft) aboveground. The primary function is radon control of the 8-m (27-ft) level in the 1706 KE Building.

5.1.3.3 The 1706 KER Laboratory exhaust system is located south of the 1706 KER Building at ground level. This system contains a bank of two HEPA filters and releases air at a rate of 57 m³/min (2,500 ft³/min). The release point is located approximately 3.7 m (12 ft) aboveground. The primary function of this system is to ventilate hoods located in the 8-m (27-ft) level of the 1706 KER Building. The HEPA filters are DOP tested yearly and the hood flows are checked monthly. The exhaust air is sampled at the discharge with a 3-micron filter at a rate of 0.01 m³/min (0.5 ft³/min). These samples are changed and analyzed on a monthly basis. Schematics of the sampling and exhaust systems are shown in Figures 5-4 and 5-5.

5.1.3.4 The 1706 KER Tunnel exhaust is filtered exhaust with a two-stage HEPA. The air releases at a rate of 56.6 m³/min (2,000 ft³/min). The primary function is for radon control of the 8-m (27-ft) level in the 1706 KER. Not operational at this time.

Figure 5-2. 1706-KE Exhaust Schematic.

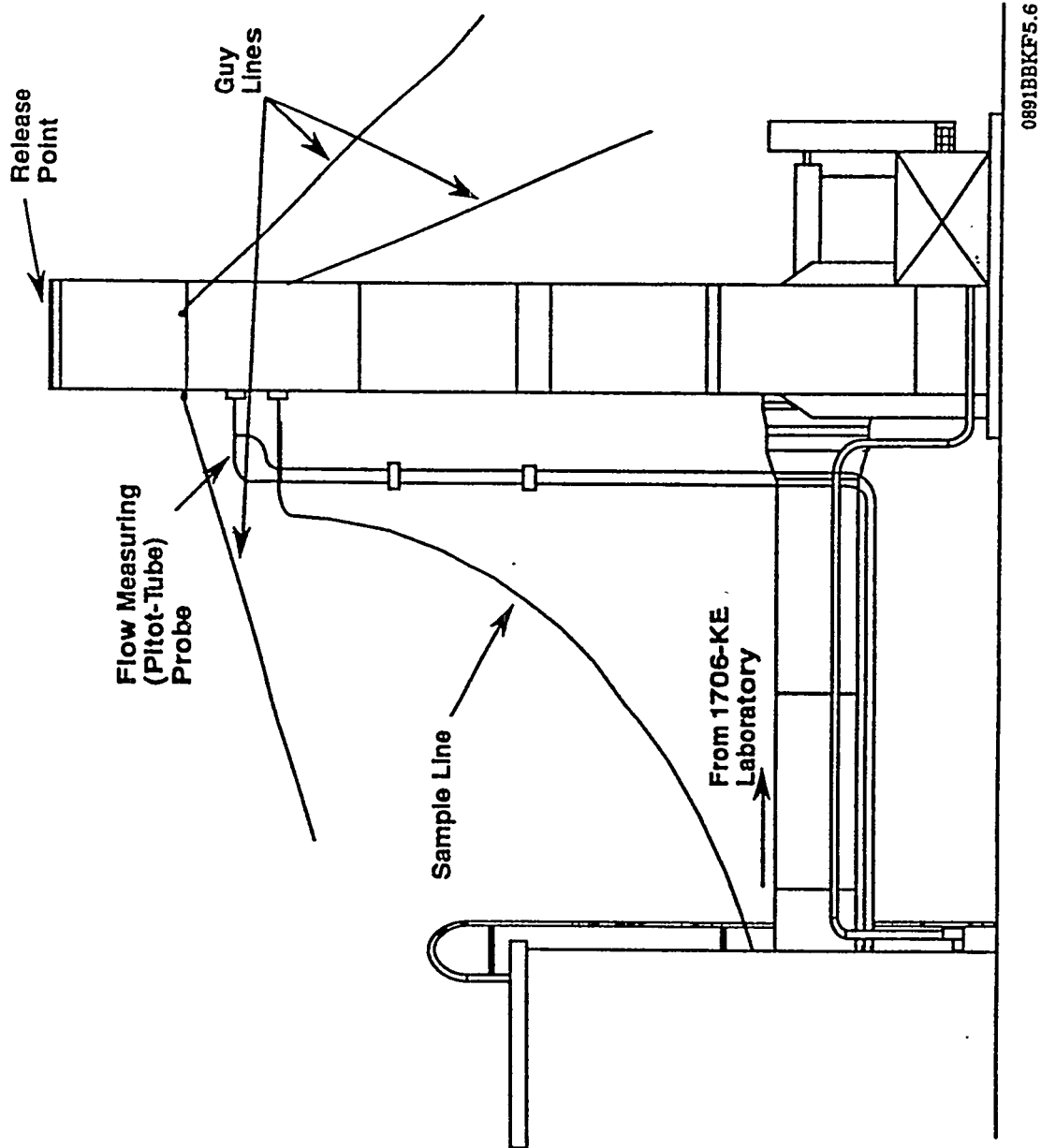


Figure 5-3. 1706-KE Sampling System Schematic.

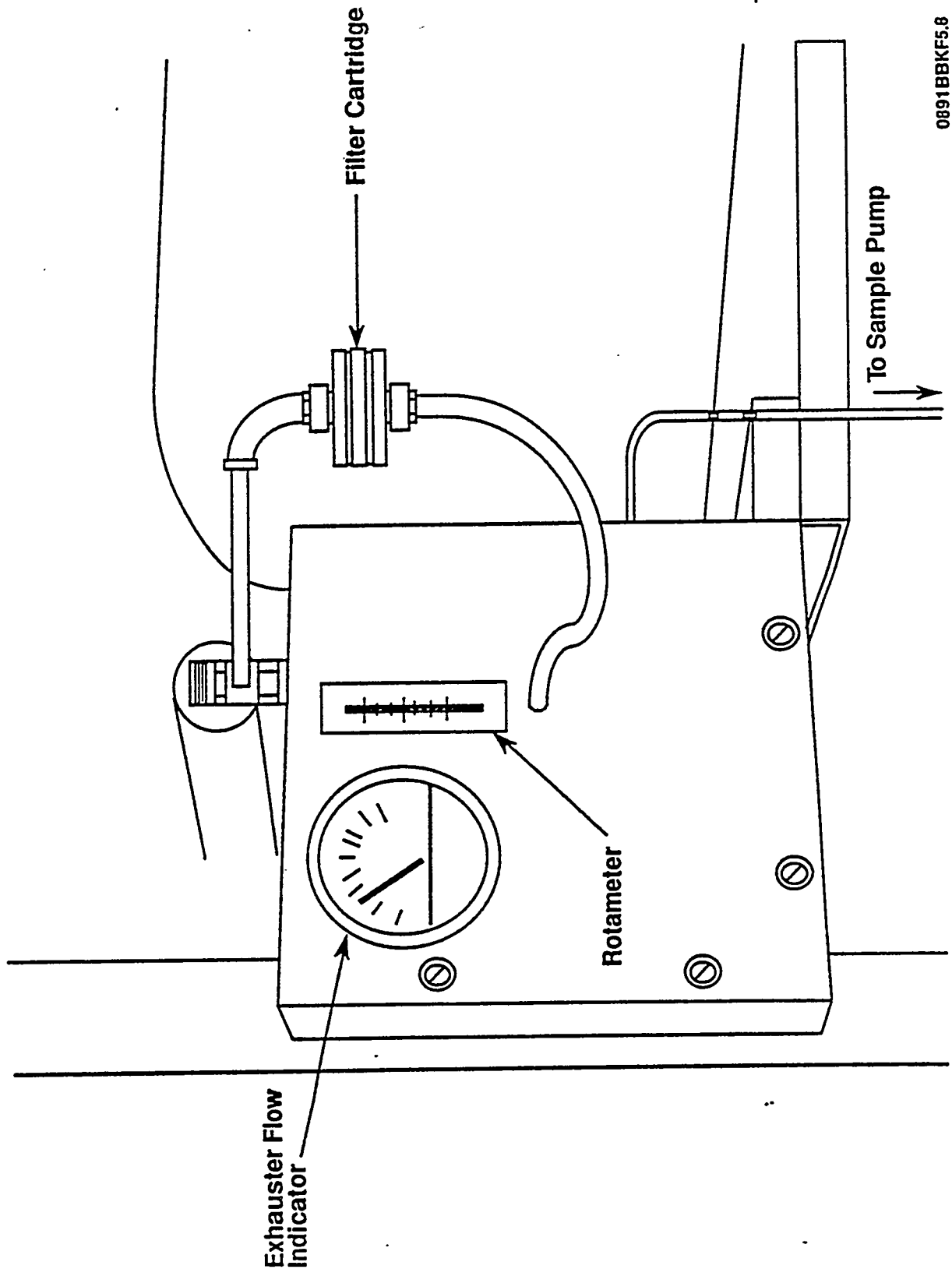


Figure 5-4. 1706-KER Exhaust System Schematic.

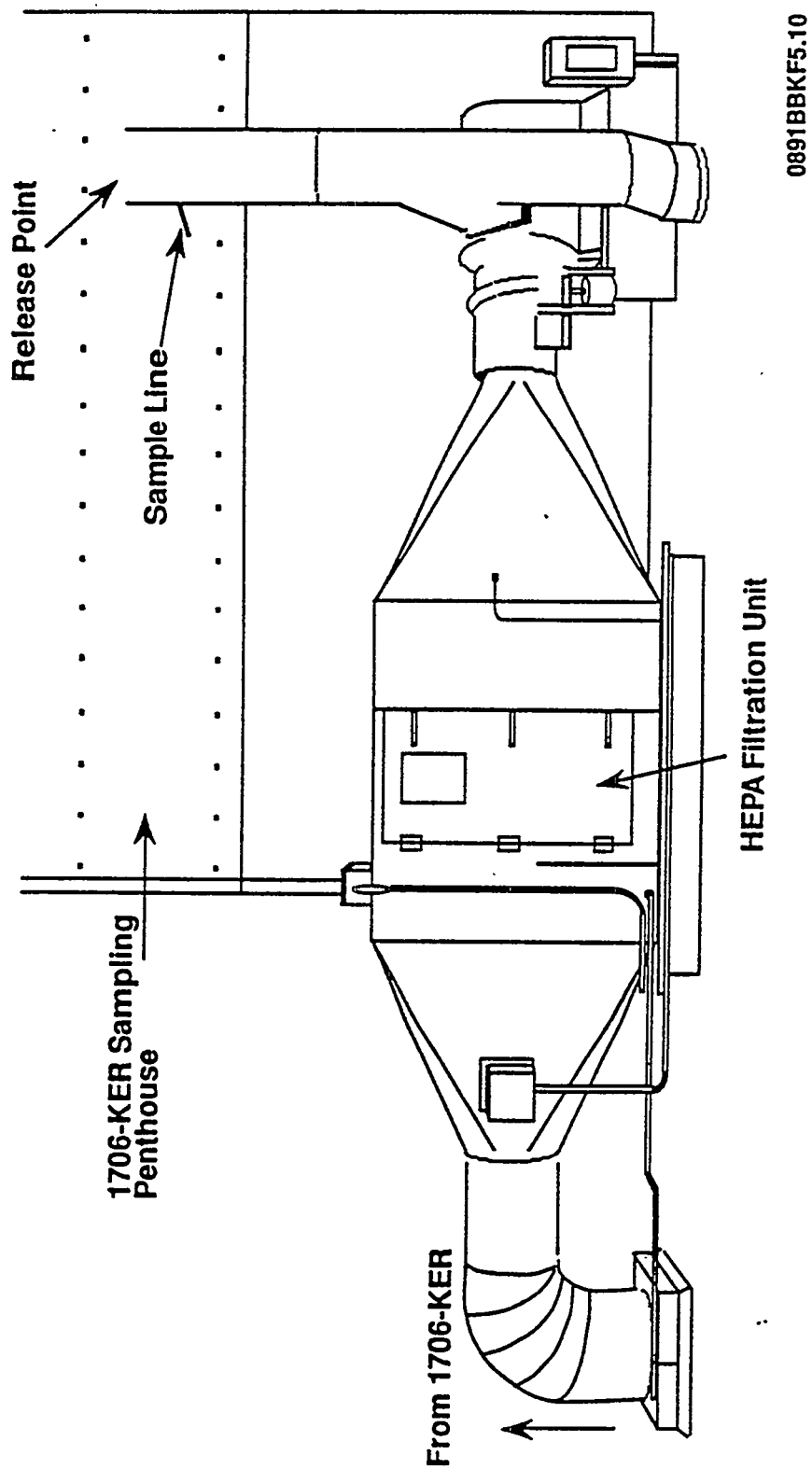
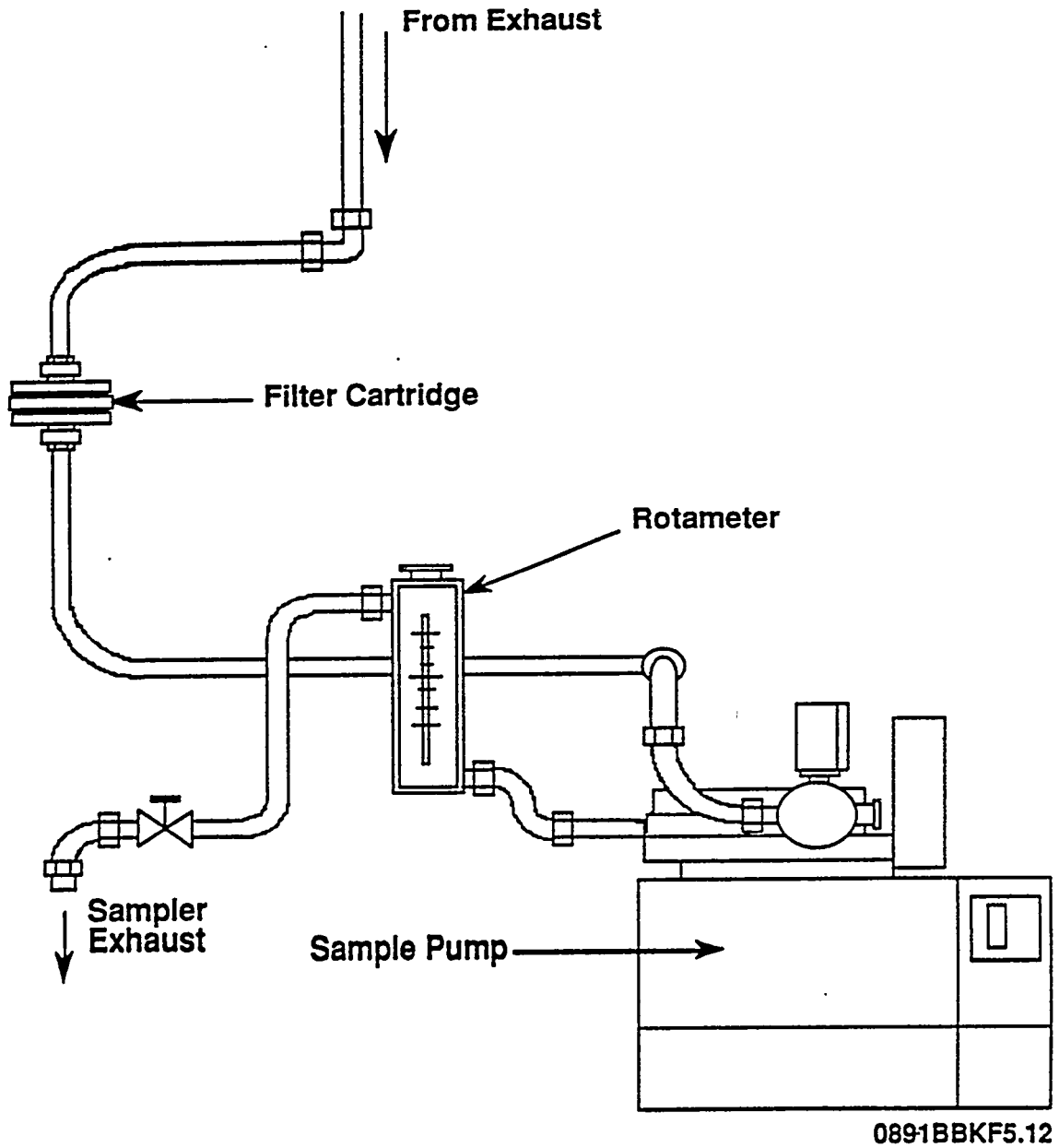


Figure 5-5. 1706-KER Sampling System Schematic.



5.1.3.5 The 1706 KEL Laboratory exhaust plenum is located on the east end roof of the 1706 KEL Building. This system contains a bank of nine HEPA filters and releases air at a rate of 255 m³/min (9,000 ft³/min). The release point is located approximately 6 m (20 ft) above ground. The primary function of this exhaust is to ventilate a canopy hood, equipment, and rooms in the 1706 KEL Building. The equipment exhaust loop in the pilot plant laboratory contains one additional stage of HEPA filtration. The HEPA filters are DOP tested yearly and the canopy hood flow is checked monthly. At present there is no rad source term.

5.2 LIQUID DISCHARGE POINTS

There are two liquid effluent discharges from the 100 K Area. Both discharges are permitted NPDES discharges. They are permitted under NPDES Permit No. WA-000374-3 as Outfalls 003 and 004 (EPA 1981). A more detailed description of the release points is included in the following sections.

5.2.1 181-KE Outfall (NPDES Outfall 003)

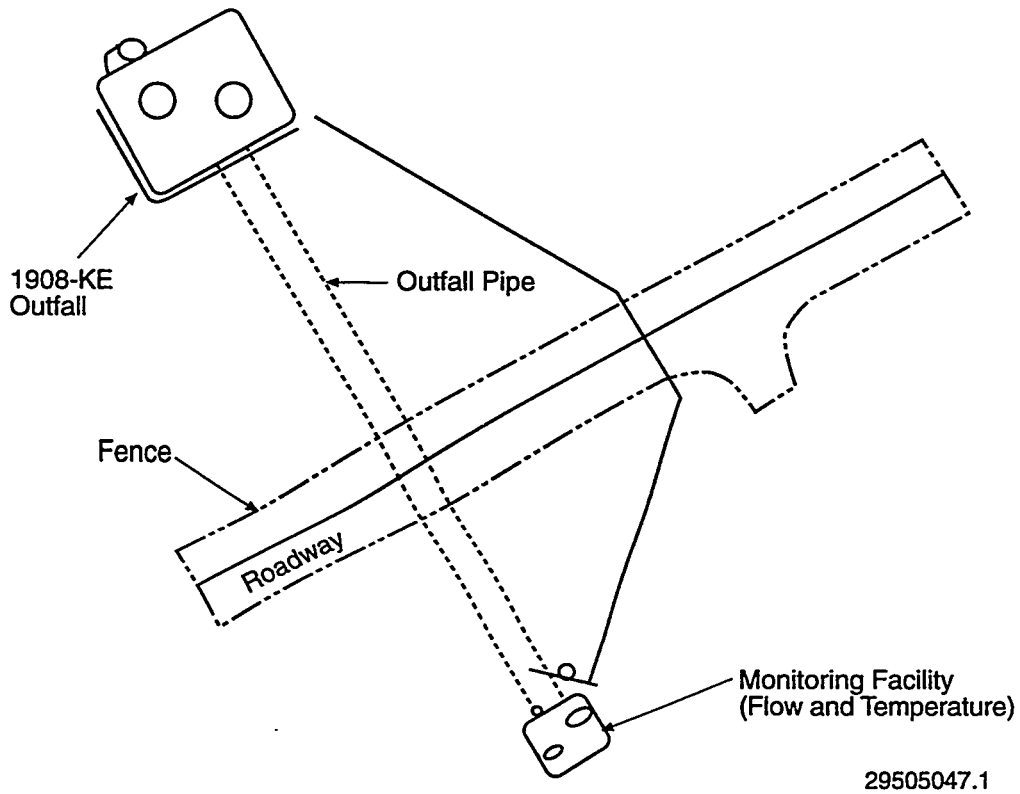
Outfall 003, the discharge for the travelling water screen and backwash water, operated intermittently. This water contains only constituents removed from the river water being taken into the intakes of the 181-KE Building. The travelling screens remove debris from the river water brought into the 181 KE Building intakes. This outfall is a 30-cm (12-in.)-diameter pipe that discharges at an average rate of 18,927 L/day (5,000 gal/day) when operational. This pipe comes from the 181 KE Pumphouse, enters the ground, and bends to the north before discharging beneath the surface of the Columbia River approximately 175 m (575 ft) towards the center of the river. When operational, this outfall is grab sampled to ensure NPDES permit compliance. At present, this backwash is collected and trucked to one of the 183 KW sedimentation basins for evaporation, and there is no discharge.

5.2.2 1908 KE Outfall (NPDES Outfall 004)

The primary liquid effluent discharge point at the K Area is the 1908 KE Outfall. This discharge is permitted as NPDES Outfall 004. The 004 Outfall is used to discharge filter backwash effluent following settling of suspended solids in one of the deactivated basins. The 004 Outfall also discharges periodic releases of raw water from the 183 KE Basin being used for fish rearing activities, standby cooling water for the 105 KE and 105 KW spent fuel basin water-cooled chillers, and effluent from the 1706 KE Complex. All of these streams are non-radioactive. When the reactor was operational, this outfall was used to discharge once-through reactor cooling water to the Columbia River. Consequently, the steel pipelines used to collect and route effluent stream to the river became contaminated with low-level radionuclides.

This outfall is a pair of 213-cm (84-in.)-diameter pipes that extend 412 m (1,350 ft) from the 1908 KE Building and discharge beneath the surface of the Columbia River near the center of the channel. The outfall, which is covered in rip-rap, is continuously monitored for flow. The samples for this outfall are drawn from the outfall pipe before the effluent reaches the 1908 KE Building. The samples are grab sampled. This outfall discharges liquids to the Columbia River at a rate of approximately $2.48E+08$ gal/year (1994). A schematic of the sampling system is shown in Figure 5-6. Only one of the outfall discharge pipes is operational.

Figure 5-6. 1908-KE Monitoring Schematic.



6.0 EFFLUENT MONITORING/SAMPLING SYSTEM DESIGN CRITERIA

The 100 K Area Facility effluents are routinely sampled to obtain the data necessary for determining regulatory compliance. Both airborne and liquid effluent streams with the potential for containing contaminants are sampled for radioactivity, pollutants, and other hazardous material.

6.1 AIRBORNE EMISSION SAMPLING SYSTEM DESIGN

Currently, the same type of system is used for monitoring/sampling the airborne emissions from both the 105 KE and 105 KE Basin exhausts. The 1706 KE exhaust and the 1706 KER exhausts have slightly different sampler configurations. The 1706 KE Tunnel exhaust, 1706 KEL Laboratory exhaust plume, and 1706 KER Tunnel exhaust are not sampled.

The system for determining radiological contaminants in the airborne emissions is a fixed airborne effluent sampling system. This system consists of a vacuum pump, which draws a sample of the air discharged through a 47-mm particulate sample cartridge. The samplers on the 105 KE/KW use a 1/4-hp Gast internal vacuum pump, and the samplers at 1706 KE and 1706 KER use a 1/4-hp dia-vac vacuum pump. All seven sample cartridges used in 105 KE/KW Basins and 1706 KE contain 47-mm glass fiber filters for trapping particulates.

The 1706 KER and 1706 KE sampling systems incorporate rotameters to provide direct readout of sampler air flow. In addition, the 1706 KE exhaust system has instrumentation indicating exhaust flow data.

The particulate samples are collected and analyzed from the sample locations as follows.

- 105 KE Basin exhaust: weekly
- 105 KW Basin exhaust: weekly
- 1706 KE Laboratory exhaust: collected monthly, analyzed quarterly
- 1706 KER Laboratory exhaust: collected monthly, analyzed quarterly.

6.2 LIQUID EFFLUENT SAMPLING SYSTEM DESIGN

Two liquid effluent sampling systems that are used at the 100 K Area are for obtaining discharge data during operation. NPDES Outfall 003 is an intermittent discharge from the 181 KE intake structure travelling water screen backwash (not operational at this time). Grab samples are taken during discharge. The 1908 KE Outfall, or NPDES Outfall 004, is sampled by a grab sample collected monthly. The sampling system on Outfall 004 consists of a V-notch weir structure for measuring flow on a continuous basis. Temperature is measured weekly by a grab sample but is read out continuously in the monitoring facility.

6.3 OFF NORMAL RELEASES (UPSET CONDITIONS)

This revision to the FEMP included two off normal releases that have the potential to damage the environment. These off normal events are:

1. Pipe break in the 105 KE or KW building, causing an overflow of the fuel storage basin water, and a possible release of radioactivity to the environment.
2. Fuel storage basin in 105 KE or KW would leak at the construction joint that connects the basin with the reactor building.

The 105 KE and KW facilities have up-gradient and down-gradient monitoring wells that are sampled quarterly for radiological contamination. This information is trended to determine any effects that K Basin operations have on the post-contamination plumes. Also, monthly draw-down tests are conducted at each basin to determine water loss. Basin water level is monitored to determine whether a leak or overflow of the basin is occurring.

7.0 CHARACTERIZATION OF CURRENT EFFLUENT MONITORING SYSTEM

7.1 INSTRUMENT DESCRIPTION

7.1.1 Air Sampling Equipment

The air-sampling equipment at both the KE and KW Basins and at 1706 KER and 1706 KE includes the following:

- Sample tube leads from the sample cartridge to the sample pump.
- A sample filter cartridge, containing a 47-mm glass fiber filter, used to collect particulate.
- A rotameter installed on the 1706 KE and 1706 KER for measuring: (1) flow rate through the sampling system at 1706 KE and 1706 KER; and (2) ventilation flow.
- A vacuum pump for pulling air through the sampling system.

7.1.2 Water Sampling Equipment

Outfalls 003 and 004 have a grab sample taken when the outfall is in operation. This is required by NPDES permit compliance determination.

7.2 INSTRUMENT SPECIFICATIONS

This section contains a description of the effluent monitoring instrumentation for K Area release points.

7.2.1 Air Sampling/Monitoring Equipment

7.2.1.1 Flow Monitoring Equipment. The 105 KE/KW Basin system uses a vacuum pump with a predetermined flow, which is equal to the amount of air that has passed through the filter. The flow for each exhaust is measured annually. With this data and the air analysis, the amount of radionuclide releases can be calculated.

7.2.1.2 Sample Collection Equipment. Each sampler has a filter cartridge to collect particulate radionuclides released from the exhaust.

7.2.1.3 Calibration Requirements. Current procedures require annual instrument calibration. Instrumentation calibration is performed in accordance with Westinghouse Hanford Company procedures. Laboratory instruments are calibrated in accordance with the laboratory requirements.

7.2.2 Liquid Sampling/Monitoring Equipment

7.2.2.1 Flow Monitoring Equipment. Outfall 004 is equipped with a weir that has been calibrated to measure the flow from the release point.

7.2.2.2 Sample Collection Equipment. Sampling is done by a grab sample, which provides a representative sample from the outfall.

7.2.2.3 Calibration Requirements. There are no calibration requirements for the present system using the weir. When automatic continuous-flow monitors are installed, calibrations are performed in accordance with Westinghouse Hanford Company procedures and ANSI/American Society of Mechanical Engineers standards. Laboratories that analyze samples will have their own instrumentation calibration procedures.

7.3 ALTERNATE MONITORING AND ASSESSMENT METHODS

7.3.1 Alternate Air Monitoring and Assessment Method

All the airborne effluent sampling systems at the 100 K Area use similar equipment. The systems consist of a particulate filter, sample lines, and a vacuum pump. In the event of a vacuum pump failure, the preferred corrective action is to replace the failed pump with either the same or the equivalent equipment. Should a sampling system failure occur in the sample transport line, the alternative is to take portable grab-air samples until the line can be replaced. If grab samples cannot be taken, the fans will be turned off until the sampling is online.

7.3.2 Alternate Liquid Effluent Monitoring and Assessment Methods

The liquid effluent sampling system consists of a grab sample for Outfalls 004 and 003. Flow of liquid effluent discharge is monitored by a flow weir. The grab sample of the effluent discharge stream is taken prior to discharge. The grab samples are random 3.8-L (1-gal) samples taken at the discharge point. There is no need for an alternate measurement system at the present time. When an automated sampling system is installed, the present system will be removed.

8.0 HISTORICAL MONITORING/SAMPLING DATA FOR EFFLUENT STREAMS

8.1 NORMAL CONDITIONS

The 100 KE/KW Reactor Facilities were constructed in the early to mid 1950's and operated until 1971. The facilities were deactivated following shutdown. The 105 KE/KW Fuel Storage Basins were modified for the interim storage of N Reactor irradiated fuel. Actual storage of the N Reactor irradiated fuel began in 1975 and continues today. The last shipment of N Reactor irradiated fuel to the basins occurred in 1989.

From 1975 through the early 1980's, normal 100 K Basin operations included receiving irradiated fuel from N Reactor, shipping irradiated fuel to PUREX for processing, and periodically segregating selected fuel elements. Modifications to the 100 K Basins continue to make the basins more environmentally acceptable.

The Engineering and Environmental Demonstration Laboratory (1706 KE Complex) houses the KE, KEL, and KER facilities. The KE, KEL, and KER have been used to support N Reactor startup, K Reactor shutdown, and N Reactor standby. Currently, 1706 KEL has an RCRA demonstration plant for treating 200 Area water. KE, KEL, and KER have the potential to be used in development work.

8.1.1 Effluent Releases

Since the 100 K Area status has changed from operating reactors to storing irradiated fuel, pre-1971 effluent monitoring results and techniques are considered to be non-germane for the 100 K Area Fuel Storage Basins FEMP. The majority of the work after 1975 concerned irradiated fuel storage and manipulation and transfer of the fuel. The basins vent airborne effluent directly to the atmosphere.

Radiological and chemical effluents from the 100 K Area facilities were reviewed to determine the potential for releasing hazardous waste. Consequently, it was concluded that only the radiological effluent releases and NPDES-permitted effluents merit consideration.

The 100 K Area has a total of 11 monitored effluent discharge points, 9 airborne effluent discharge points, and 2 liquid effluent discharge points. The airborne discharge points are the 105 KE Basin, 105 KW Basin exhaust vents, and 1706 KE Complex. The 105 KE/KW Basin monitored exhaust discharge points are approximately 4.5 m to 9 m (15 to 30 ft) aboveground. These release points are unfiltered.

The 1706 KE and KER monitored discharged points are 7.6 m and 3 m (25 ft and 10 ft) above ground, respectively. The KE and KER exhaust through HEPA filters prior to being released to the environment.

The liquid effluent discharge points for the 100 K Area are NPDES-permitted locations (EPA 1981). The 1908 KE outfall is identified as NPDES Outfall 004, and the 181 KE filter screen backwash discharge is identified as NPDES Outfall 003. Radioactive airborne and liquid effluent discharge data are included in Tables 8-1 through 8-5 for calendar year (CY) 1993. No radioactive effluent has been measured at NPDES Outfall 003.

8.2 UPSET CONDITIONS

The normal conditions for the releases during CY 1993 are shown in Tables 8-6 and 8-7. The unplanned upset potential for (1) 105 Spent Nuclear Fuel basin leakage of the construction joint and (2) a pipe break in the 105 KE Basin causing an overflow is shown in Table 8-8 using the highest recorded radionuclide concentrations for ¹³⁷Cs, ⁹⁰Sr, ^{239,240}Pu and ³H in basin water. Most likely the off-normal event would be less severe than either of the two events listed above, because the consequences of either event do not take operator response actions into consideration.

Table 8-1. 105-KE Airborne Effluent Release.¹

Isotope	Ci (1993)	Sample point	Average concentration (μCi/mL)
⁶⁰ Co	2.2E-06	Exhaust	3.0E-15
⁹⁰ Sr	5.0E-05	Exhaust	6.8E-14
¹⁰⁶ Ru	7.6E-06	Exhaust	1.0E-14
¹²⁵ Sb	7.6E-07	Exhaust	1.0E-15
¹³⁷ Cs	1.4E-04	Exhaust	1.9E-13
¹⁵⁴ Eu	3.9E-06	Exhaust	5.3E-15
¹⁵⁵ Eu	1.1E-06	Exhaust	1.5E-15
²³⁸ Pu	9.9E-07	Exhaust	1.3E-15
²³⁹ Pu	7.7E-06	Exhaust	1.0E-14
²⁴¹ Am	5.2E-08	Exhaust	7.0E-15

¹WHC 1994a

Table 8-2. 105 KW Airborne Effluent Release.¹

Isotope	CI (1993)	Sample point	Average concentration ($\mu\text{Ci/mL}$)
⁹⁰ Sr	1.7E-06	Exhaust	2.3E-15
¹⁰⁶ Ru	1.6E-06	Exhaust	2.2E-15
¹³⁷ Cs	2.1E-05	Exhaust	2.9E-14
¹⁵⁴ Eu	1.9E-06	Exhaust	2.6E-15
²³⁸ Pu	7.5E-09	Exhaust	1.0E-17
^{239/240} Pu	5.3E-08	Exhaust	7.2E-17
²⁴¹ Am	4.0E-08	Exhaust	5.4E-17

Note:

¹WHC 1994a

Table 8-3. 1706 KE Airborne Effluent Releases.¹

Isotope	CI (1993)	Sample point	Average concentration ($\mu\text{Ci/mL}$)
⁹⁰ Sr	2.4E-08	Exhaust	1.3E-16
¹⁰⁶ Ru	1.3E-06	Exhaust	7.3E-15
¹²⁵ Sb	2.6E-07	Exhaust	1.5E-15
¹³⁴ Cs	7.8E-08	Exhaust	4.4E-16
¹⁵⁵ Eu	9.1E-08	Exhaust	5.1E-16
²³⁸ Pu	6.1E-10	Exhaust	3.4E-18
^{239/240} Pu	7.4E-09	Exhaust	4.1E-17

Note:

¹WHC 1994a

Table 8-4. 1706 KER Airborne Effluent Releases.¹

Isotope	Ci (1993)	Sample point	Average concentration (μCi/mL)
⁹⁰ Sr	3.3E-08	Exhaust	8.9E-16
¹²⁵ Sb	5.0E-08	Exhaust	1.4E-15
¹³⁴ Cs	4.9E-09	Exhaust	1.3E-16
¹³⁷ Cs	3.4E-08	Exhaust	9.3E-16
¹⁵⁴ Eu	4.7E-08	Exhaust	1.3E-15
²³⁸ Pu	3.0E-10	Exhaust	8.2E-18
^{239/240} Pu	1.1E-09	Exhaust	3.0E-17
²⁴¹ Am	6.6E-10	Exhaust	1.8E-17

Note:

¹WHC 1994a

Table 8-5. 1908-K Outfall Liquid Effluent.¹

Isotope	Ci (1993)	Sample point	Average concentration (μCi/mL)
⁶⁰ Co	2.4E-04	004	3.0E-10
¹⁰⁶ Ru	1.5E-08	004	1.7E-09
¹³⁴ Cs	4.7E-05	004	5.2E-11
¹³⁷ Cs	4.0E-04	004	4.4E-10

Note:

¹WHC 1994a

Table 8-6. K Area Normal Operation Dose Assessment for Airborne Emissions - 1993.

Release point	Release (Ci)	Effective dose equivalent (mrem) ¹
105-KE	2.2E-04	2.2E-04
105-KW	2.8E-05	2.5E-06
1706-KE	1.8E-06	1.5E-07
1706-KER	1.7E-07	3.6E-08

Note:

¹WHC-EP-0498, *Unit Dose Calculation Methods and Summary of Facility Effluent Monitoring Plan Determinations* (WHC 1991b)

Table 8-7. K Area Normal Operational Dose Assessment for Liquid Effluents - 1993.

Release point	Release (Ci)	Effective dose equivalent (mrem) ¹
1908-KE (Outfall 004)	2.2E-03	1.5E-04

Note:

¹WHC-EP-0498, *Unit Dose Calculation Methods and Summary of Facility Effluent Monitoring Plan Determinations* (WHC 1991b)

Table 8-8. K Area Upset Dose Assessment for Airborne Emissions.

Release point	Release ² (Ci)	Effective dose equivalent (mrem) ¹
K basin overflow (all evaporators)	2.27E+02	13.47

Note:

¹WHC-EP-0498, *Unit Dose Calculation Methods and Summary of Facility Effluent Monitoring Plan Determinations* (WHC 1991b)

²Most likely the off-normal would be less severe than the release, because the consequences of either event do not take operator response actions into consideration.

Table 8-9. K Area Upset Dose Assessment for Liquid Effluents.

Release point	Release ⁴ (Ci)	Effective dose equivalent (mrem) ¹
K Basin overflow outfall	5.18E+1	5.2E+0
K Basin overflow ground	4.15E+1	²
Basin leak discharge chute	6.06E+1	³
Basin leak 4,542 L/min (1,200 gal/min) for four months	3.58+3	³

Notes:

¹WHC-EP-0498, *Unit Dose Calculation Methods and Summary of Facility Effluent Monitoring Plan Determinations* (WHC 1991b)

²Release would remain in the soil column. If it reaches the water table, travel time to the river would reduce the effect of the spill. Annual sampling of seeps along the river bank would detect any movement of the liquid release.

³Release would be contained before the four months is over. If the release reaches the water table, travel time to the river would reduce the effect of the spill. Annual sampling of seeps along the river bank would detect any movement of the liquid release. The results of the 1975-1980 leak in the 105 KE Basin, and the measured effects over time near the 100 K shoreline, are bases for this assessment.

⁴Most likely the off-normal would be less severe than the release, because the consequences of either event do not take operator response actions into consideration.

9.0 SAMPLE ANALYSIS

The effluent monitoring and analysis plan was developed specifically for 100 K Area to monitor the 105 KE/KW Fuel Storage Basins and the Engineering and Environmental Demonstration Laboratory (1706 KE Complex).

9.1 PURPOSE

The 100 K Area effluent monitoring and analysis program provides representative samples and analyses of the facilities' effluents to provide data for record and reporting purposes. The documentation and record keeping will enable the facility to demonstrate that it meets applicable DOE orders and federal, state, and local agency regulations.

9.2 BACKGROUND

The 100 Area has been operating an effluent monitoring program since the 100 K Reactors began operation. When the reactors were deactivated, this monitoring program was no longer necessary. When the storage basins began to be used for storing N Reactor-irradiated fuel, sampling was again established.

9.3 SAMPLING SCHEDULE, FREQUENCY, AND STRATEGY

9.3.1 Air Sampling Schedule, Frequency, and Strategy

The 100 K Area airborne emissions are sampled at effluent release points (see Table 9-1). The selection of air monitoring equipment, method, and frequency is based on the calculated maximum offsite effective dose equivalent (EDE) as recommended in the *Environmental Regulatory Guide for Effluent Monitoring and Surveillance* (DOE 1991b) and the estimated dose from the actual airborne effluents released by the facility in 1993. Selection of the equipment is based on the effluent regulatory guide and past effluent sampling performed routinely for insignificant doses approaching background. Selection of effluent monitoring equipment, method, and frequency is based on the following criteria:

- Effluent monitoring method/max annual offsite dose
 - Continuous online/offline monitor: to ≥ 0.1 mrem/year
 - Continuous sampling: if < 0.1 to ≥ 0.01 mrem/year
 - Periodic confirmatory measurement: if < 0.01 mrem/year.

Table 9-1. Air Sampling and Analytical Requirements.

Location	Reason for sampling	Sampling frequency	Sampling method	Sample analysis requirements
105-KE Basin exhaust	Radioactivity	Weekly	0.03 m ³ /min (1.2 ft ³ /min) air pump with 47-mm particulate filter	Gross alpha and beta scan (0.05-2.0 MeV) ⁹⁰ Sr, ²³⁸ Pu, ²⁴⁰ Pu
105-KW Basin exhaust	Radioactivity	Weekly	0.03 m ³ /min (1.2 ft ³ /min) air pump with 47-mm particulate filter	Gross Alpha and beta scan (0.05-2.0 MeV) ⁹⁰ Sr, ²³⁸ Pu, ²⁴⁰ Pu
1706 KE	Radioactive	Monthly	0.03 m ³ /min (1.2 ft ³ /min) air pump with 47-mm particulate filter	Gross alpha and beta scan (0.05-2.0 MeV) ⁹⁰ Sr, ²³⁸ Pu, ²⁴⁰ Pu
1706 KER	Radioactive	Monthly	0.03 m ³ /min (1.2 ft ³ /min) air pump with 47-mm particulate filter	Gross alpha and beta scan (0.05-2.0 MeV) ⁹⁰ Sr, ²³⁸ Pu, ²⁴⁰ Pu

9.3.2 Water Sample, Schedule, and Frequency

Water sampling is to be performed at the liquid effluent discharges to the Columbia River. The sampling locations, flow monitoring, sampling frequency, sample size, sampling method, and analytical requirements are given in Table 9-2.

9.3.3 Groundwater Monitoring

Groundwater monitoring at the 105 KE and KW basins has been conducted under several programs. These programs include monitoring during the period when the reactors were operating, to the present period of limited operations involving fuel storage and environmental restoration activities.

The groundwater monitoring wells are located both up-gradient and down-gradient of the fuel storage basins (Figure 9-1).

Table 9-2. Liquid Effluent Sampling and Analytical Requirements.

Location	Reason for sampling	Flow monitoring	Frequency of sampling		Analysis/measurement			
			Radioactivity	NPDES	Radioactivity	NPDES	Sample size/type	Sampling method
1908-KE (Outfall 004)	Radioactivity NPDES OSR	Continuous flow monitoring	Monthly	Weekly	^{239,240} Pu, ³ H, gamma scan	Temperature, free available chlorine, pH, total suspended solids	1 L	Grab
181-KE (Outfall 003)	NPDES			Monthly		Total suspended solids ¹	1 L	Grab

Notes:

¹Not operational at this time.

NPDES = National Pollutant Discharge Elimination System

OSR = Operational Safety Requirement

9.4 SAMPLE ANALYSIS, DETECTION, AND ACCURACY

9.4.1 Air Samples

Air samples are collected at four effluent release points identified in Table 9-1. All the air samples collected are particulate samples from continuous air samples. The air samples are analyzed for radionuclides according to the list of analyses shown in Table 9-3. Because no short-lived isotopes are present, the analytical scheme for air samples is primarily concerned with identifying the long-lived activation and fission isotopes and determining the concentration of the specific radionuclide being emitted. The analyses listed in Table 9-3 are based on the radionuclides present in the fuel in the KE and KW Basins and potentially in minor amounts in 1706 KE and KER.

The minimum detectable concentrations (MDCs) for the specific radiochemical analyses are shown in Table 9-3. The MDCs for the air samples are very low because of the large sample size of 800 to 1,500 m³. An MDC of this magnitude will readily detect radionuclides at or near background levels for specific radionuclides.

The accuracy for the analyses is 25%. The accuracy and the precision of the various analytical methods are verified by a daily check source, sample blanks, and spiked samples.

Table 9-3. Radiochemical Analytical Methods and Limits for Airborne Samples.

Radiochemical	Sample type	Sample size	Analytical methods	Minimum detectable concentration	Accuracy (+/-)
Gross alpha	Air particulate	800 m ³	9310 ¹ LA-508-101 ²	0.003 pCi/m ³	25 %
Gross beta	Air particulate	800 m ³	9310 ¹ LA-508-101 ²	0.001 pCi/m ³	25 %
Tritium	Air (moisture)	50 mL	LA-218-111 ²	50 pCi/m ³	25 %
Gamma scan (0.05-2.0 MeV) ⁴⁰ K, ⁵⁴ Mn, ⁵⁸ Co, ⁶⁰ Co, ⁵⁹ Fe, ⁶⁵ Zn, ⁹⁵ ZrNb, ⁹⁹ Mo, ¹³⁴ Cs, ¹³⁷ Cs, ¹⁵² Eu, ¹⁵⁴ Eu, ¹⁵⁵ Eu	Air particulate	1,500 m ³	LA-548-121 ²	0.01 pCi/m ³	25 %
⁹⁰ Sr	Air particulate	1,500 m ³	ESM-697/687 ³	0.001 pCi/m ³	25 %
^{238,239,240} Pu	Air particulate	1,500 m ³	ESM-D578 ³	0.000025 pCi/m ³	25 %
⁸⁵ Kr	TBD	TBD	TBD	TBD	25 %

Notes:

¹These procedures are SW-846 procedures (EPA 1986).

²These procedures are 222-S procedures or from offsite contractors.

³These procedures are EPA radionuclide analytical procedures (EPA 1984).

9.4.2 Water Samples

Water samples are taken from the liquid effluent monitoring points shown in Table 9-2 to fulfill the DOE and EPA requirements for monitoring for radioactivity and specified pollutants, respectively. Table 9-2 shows: (1) location; (2) reason for sampling; (3) flow monitoring; (4) frequency of sampling; (5) analysis to be performed; (6) sample size; and (7) sampling method. The samples are then analyzed for the radionuclides as shown in Table 9-4.

Table 9-4. Radiochemical Analytical Methods and Limits for Liquid Effluents.

Radiochemical	Sample type	Sample size	Analytical methods	Minimum detectable concentration	Accuracy (+/-)
Gross alpha	Water	4 L	9310 ¹ LA-508-101 ²	4 pCi/m ³	25 %
Gross beta	Water	4 L	9310 ¹ LA-508-101 ²	4 pCi/m ³	25 %
Tritium	Water	1 L	LA-218-111 ²	50 pCi/m ³	25 %
Gamma scan (0.05-2.0 MeV)	Water	4 L	LA-548-121 ²	8 pCi/m ³	25 %
⁹⁰ Sr	Water	4 L	ESM-697/687 ³	0.06 pCi/m ³	25 %
²³⁸ Pu	Water	4 L	ESM-D578 ³	0.01 pCi/m ³	25 %
^{239,240} Pu	Water	4 L	ESM-578 ³	0.01 pCi/m ³	TBD

Notes:

¹These procedures are SW-846 procedures (EPA 1986).

²These procedures are 222-S procedures or from offsite contractors.

³These procedures are EPA radionuclide analytical procedures (EPA 1984).

The minimum detection limits for the radionuclide for the liquid effluent samples are given in Table 9-4. The table shows the analysis of the radionuclide, sample type, sample size, analytical method, MDC, and accuracy of the method. The analytical methods used in this environmental monitoring plan are from EPA SW-846 (EPA 1986), Westinghouse Hanford Company's 222-S Laboratory procedures, or contract laboratory procedures authorized by the OSM. The accuracy of the analytical methods is determined as part of the overall calibration procedure, and is checked on a daily basis by using calibration check sources, sample blanks, spiked samples, and split samples, which are part of the overall laboratory Quality Control (QC) program.

9.4.3 Groundwater Samples

Sampling and analysis under the groundwater program is conducted by the Hanford Technical Services organization within Westinghouse Hanford Company. Offsite analytical vendors are used for analyses that cannot be performed onsite. Field and laboratory protocols are consistent with *Resource Conservation and Recovery Act of 1976 (RCRA)* requirements. The data from groundwater monitoring are stored in the Hanford Environmental Information System and the Geosciences Data Analysis Booklet. Results are reported in annual operational monitoring programs and in separate reports for specific projects. Radiological and chemical releases are monitored.

9.5 SAMPLE SHIPPING AND SAMPLE CHAIN OF CUSTODY

9.5.1 Sample Shipping

The various types of effluent samples from 100 K Area are to be packaged and shipped from 100 K to other laboratories under the following packaging and shipping procedures.

- *Managing, Packaging and Shipping Waste Samples*, Procedure Number KB-OA and WH-DI-E002 (from WHC 1990a).
- *Hazardous and Radiological Waste Control Manual*, WHC-NR-M-12 (WHC 1990a).

The above procedures ensure that waste samples are packaged and shipped to either Hanford Site laboratories or offsite laboratories that meet the packaging and shipping requirements of DOE, Nuclear Regulatory Commission (NRC), Department of Transportation, and Washington State.

9.5.2 Sample Custody

Effluent samples from the 100 K Area are transported to the laboratory under an administrative chain-of-custody procedure entitled Environmental Sample Chain of Custody KB-OA and WH-OI-E003 contained in the *Hazardous and Radiological Waste Control Manual*, WHC-NR-M-12 (WHC 1990a).

The purpose of the procedure is to create an accurate written record that can be used to trace the possession and handling of a waste sample in the process of being characterized. This procedure is consistent with the State of Washington requirements in "Dangerous Waste Regulations," WAC 173-303.

9.6 EFFLUENT MONITORING PROCEDURES

The facility effluent monitoring program is conducted by using approved procedures. Effluent monitoring sampling procedures used for ongoing activities are shown in Table 9-5.

Table 9-5. K Area Effluent Sampling Procedures.

Monitoring procedure	Responsible group	Procedure number
Environmental sample chain of custody	Operations Analysis and Waste Handling	KB-OA and WH-DI-E003 (WHC 1990a)
Packaging and shipment of environmental samples	Operations Analysis and Waste Handling	KB-OA and WH-DI-E002 (WHC 1990a)
Collection of NPDES and liquid effluent samples	Operations Analysis and Waste Handling	KB-OA and WH-DI-E002 (WHC 1990a)
Air sampling	Health Physics	K-W-001 (WHC 1994g)
Quarterly flow checks	Health Physics	K-Q-008 (WHC 1994h)
Effluent monitoring procedures	Effluent Emissions Monitoring	WHC-IP-1066 (WHC 1994f)
Effluent data verification, validation, recordkeeping, and dose calculations	Effluent Emissions Monitoring	WHC-IP-1066 (WHC 1994f)
Laboratory analysis and calibrations	222-S Laboratory/Contract Laboratory	Analyte dependent
Groundwater monitoring: chain-of-custody, packaging, and shipment	Hanford Technical Services	Procedures used are to support Hanford Site wide groundwater monitoring programs.

9.7 U.S. DEPARTMENT OF ENERGY ANALYTICAL AND LABORATORY GUIDELINES

The analytical and laboratory procedures for the FEMP activities are identified in Section 8.0 of the QAPP, *Quality Assurance Project Plan for Facility Effluent Monitoring Plans* (WHC 1994c). General requirements for laboratory procedures, data analyses, and statistical treatment are addressed in the QAPP. Detailed descriptions of these requirements are given in each FEMP.

The following elements identified in Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance, DOE/EH-0173T (DOE 1991b) are addressed in Table 9-6.

Table 9-6. Data Analyses and Statistical Treatment.

Element	Documentation
Summary of data and statistical treatment requirements	WHC-SD-CP-QAPP-003, Rev. 1 (WHC 1994d)
Variability of effluent and environmental data	WHC-EP-0527-3, <i>Environmental Releases for Calendar Year 1993</i> (WHC 1994a)
Summarization of data and testing for outliers	Statistical identification of control standards are performed by the Laboratory Measurement Control System database program during the annual review of data for setting control limits. Outliers are evaluated.
Treatment of significant figures	WHC-SD-CP-QAPP-003, Rev. 1 (WHC 1994d)
Parent-decay product relationships	Parent-decay product relationships are not accounted for in laboratory operating procedures.
Comparisons to regulatory or administrative control standards and control data	The 222-S/Contract Laboratory participates in the EPA Intra Comparison Program
Quality assurance	WHC-SD-CP-QAPP-003, Rev. 1 (WHC 1994d)

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10.0 NOTIFICATION AND REPORTING REQUIREMENTS

Notification and reporting requirements are imposed by federal and state law as well as by DOE orders and permits. Because DOE and EPA documents are periodically updated, the current requirements should be obtained from the latest CFR and DOE order. This section is to serve as a guideline for general notification and reporting requirements and as a reference to the sources where specific information may be found for federal, state, and DOE requirements.

10.1 OCCURRENCE CATEGORIZATION, NOTIFICATION, AND REPORTING

Notifications and reporting of specific events related to environmental releases and/or events involving effluents and/or hazardous materials shall be made in accordance with DOE Orders 5400.1 (DOE 1988) and 5000.3A (DOE 1990b). Implementing the orders is accomplished via WHC-CM-1-3, *Management Requirements and Procedures Manual*. Specific implementation, where required, is included in the appropriate facility's "Occurrence Categorization, Notification, and Reporting" procedure. Implementing environmental limits and requirements is found in WHC-CM-7-5, *Environmental Compliance*.

Each employee shall identify events and conditions and shall promptly notify management of such occurrences.

- a. Call 911 if immediate help such as fire, ambulance, or patrol is required.
- b. Call 373-3800 (the Patrol Operations Center) if assistance other than fire, ambulance, or patrol is required.
- c. After requesting necessary outside assistance, the employee shall notify his or her supervisor, who shall notify the facility manager, the building emergency director, and the Occurrence Notification Center (376-2900).

Operations personnel shall take appropriate immediate action to stabilize or return the facility/operation to a safe condition. Actions taken in response to nonroutine releases, as evidenced by high sample results from liquid and gaseous effluent sampling, are documented in WHC-CM-7-5, *Environmental Compliance*.

The oversight organizations shall notify their DOE Field Office, Richland, counterparts of the event after receiving notifications from, and discussing the event with, the facility manager.

Occurrences (environmental) shall be categorized as soon as practical using the specific criteria listed in Section 10.2 for radioactive and hazardous materials release. These categorizations should be made within 2 hours of identification. Occurrences shall be categorized by their seriousness; if categorization is not clear, the occurrence shall be categorized initially at the higher level being considered. The occurrence categorization shall then be either evaluated, maintained, or lowered as information becomes available.

10.2 OCCURRENCE CATEGORIZATION

The following criteria for categorization of occurrences are established in WHC-CM-1-5, *Standard Operating Practices*, section 7.1, "Reporting Occurrences and Processing Operations Information," which implements the requirements contained in DOE Order 5000.3A (DOE 1990b).

10.2.1 Radioactive Releases

10.2.1.1 Emergency.

- Any release of radionuclide material to controlled or uncontrolled areas in concentration which, if averaged over 24-hour period, would exceed 5 times the respective reportable quantities specified for such materials in 40 CFR 302 Note: This event must also meet the criteria for classified emergency in accordance with WHC-CM-4-43, *Emergency Management Procedures*, section 1.1, "100 K Area - Recognizing and Classifying Emergencies," and/or facility-specific emergency action levels.

10.2.1.2 Unusual Occurrence.

- Release of a radionuclide material that exceeds a federally permitted release by the amount of a CERCLA reportable quantity or, where no federally permitted release exists, the release exceeds the reportable quantity.
- Release of radionuclide material that violates environmental requirements in federal permits, federal regulations, or DOE standards.
- Release below emergency levels which requires immediate (less than 4 hours) reporting to federal regulatory authorities or triggers specific action levels for an outside agency.

10.2.1.3 Off-Normal.

- Any release of radionuclide material to controlled or uncontrolled areas that is not part of a normal monitored release and exceeds 50% of a CERCLA reportable quantity specified for such material in accordance with 40 CFR 302.
- Any controlled release of radionuclide material that occurs as a monitored part of normal operations that exceeds what historical data and/or analysis show is expected as a result of normal operations.
- Any monitored facility or site boundary where exposure of concentrations exceed what historical data and/or analysis show is expected as a result of normal operations.
- Any detection of a radionuclide in a sanitary or storm sewer, waste or process stream, or any holding points where such a material is not expected.
- Any controlled, uncontrolled, or accidental release that is not classified as an unusual occurrence but that will be reported in writing to state/local agencies in a format other than routine monthly or quarterly reports. Note: This does not include routine offsite distribution of notification reports.

10.2.2 Release of Hazardous Substances/Regulated Pollutants/Oil

10.2.2.1 Emergency.

- Any actual or potential release of material to the environment that results in, or could result in, significant off-site consequences (e.g., need to relocate people, major wildlife kills, major wetland degradation, major aquifer contamination, need to secure downstream water supply intakes, etc.). Note: This event must also meet the criteria for classified emergency in accordance with WHC-CM-4-43, *Emergency Management Procedures*, section 1.1, "100 K Area - Recognizing and Classifying Emergencies," and/or facility-specific emergency action levels.
- Any release of hazardous substances or regulated pollutants in concentrations which exceed 5 times the respective reportable quantities specified for such materials in 40 CFR 302. Note: This event must also meet the criteria for classified emergency in accordance with WHC-CM-4-43, *Emergency Management Procedures*, section 1.1, "100 K Area - Recognizing and Classifying Emergencies," and/or facility-specific emergency action levels.

10.2.2.2 Unusual Occurrence.

- Release of a hazardous substance or regulated pollutant that exceeds a CERCLA reportable quantity in accordance with 40 CFR 302 or exceeds a federally permitted release by a reportable quantity.
- Release of a hazardous substance, regulated pollutant, or oil that violates environmental requirements in federal permits, federal regulations, or DOE standards.
- Release below emergency levels that requires immediate (less than 4 hours) reporting to federal regulatory agencies or triggers specific levels for an outside federal agency.
- Any release of 100 gal or more of oil.

10.2.2.3 Off-Normal.

- Release of a hazardous substance or regulated pollutant to controlled or uncontrolled areas that is not part of a normal, monitored release and exceeds 50% of a CERCLA-reportable quantity as specified for such material in accordance with 40 CFR 302.
- Any release of oil less than unusual occurrence levels but greater than 10 gal.
- Any detection of a toxic or hazardous substance in a sanitary or storm sewer, waste or process stream, or any holding points where such a material is not expected.
- Any controlled, uncontrolled, or accidental release not classified as an unusual occurrence, but which will be reported in writing to state/local agencies in a format other than routine monthly or quarterly reports. Note: This does not include routine offsite distribution of notification reports.
- Any controlled release of hazardous/regulated material that occurs as a monitored part of normal operations which exceeds what historical data and/or analysis shows is expected as a result of normal operations.
- Any general environmental monitoring where concentration increases to a level which exceeds what historical data and/or analysis shows is expected as a result of normal operations.

10.2.3 Discovery of Hazardous Material Contamination Due to DOE Operations

10.2.3.1 Emergency.

- Discovery of contamination that results or could result in significant consequences (i.e. exceeding safe exposure limits to workers or public). Note: This event must also meet the criteria for classified emergency in accordance with WHC-CM-4-43, *Emergency Management Procedures*, section 1.1, "100 K Area - Recognizing and Classifying Emergencies," and/or facility-specific emergency action levels.
- Discovery of onsite or offsite hazardous material contamination in concentrations that exceed 5 times the respective reportable quantities specified for such materials in 40 CFR 302. Note: This event must also meet the criteria for classified emergency in accordance with WHC-CM-4-43, *Emergency Management Procedures*, section 1.1, "100 K Area - Recognizing and Classifying Emergencies," and/or facility-specific emergency action levels.

10.2.3.2 Unusual Occurrence.

- Discovery of on-site or off-site contamination due to DOE operations which does not represent an immediate threat to the public, that exceeds a reportable quantity for such materials in accordance with 40 CFR 302.
- Any discovery of groundwater contamination that is not part of an existing plume previously identified either in an annual report or in any CERCLA/RCRA activity or report.

10.2.3.3 Off-Normal.

- Discovery of onsite contamination attributable to DOE operations that exceeds 50% of a reportable quantity for such material in accordance with 40 CFR 302.

10.2.4 Agreement/Compliance Activities

10.2.4.1 Unusual Occurrence.

- Any agreement, compliance, remediation, or permit-mandated activity for which formal notification has been received from the relevant regulatory agency that a site plan is not satisfactory, or that a site is considered to be in noncompliance with schedules or requirements. Note: Formal notification must be received by Westinghouse Hanford Company in writing.

- Any occurrence under any agreement or compliance area that requires notification of an outside regulatory agency within 4 hours or less, or triggers an outside regulatory agency action level, or otherwise indicates specific interest/concern from such agencies. Note: This does not include notifications made for radionuclide/hazardous material releases that are less than 50% of the reportable quantity as specified in 40 CFR 302.

10.2.4.2 Off-Normal.

- Any occurrence under any agreement or compliance area that will be reported in writing to outside agencies in a format other than routine monthly or quarterly reports. Note: This does not include routine offsite distribution of notification reports.

10.2.5 Ecological Resources

10.2.5.1 Unusual Occurrence.

- Any occurrence causing significant impact to any ecological resource for which the DOE is a trustee (i.e. destruction of a critical habitat, damage to an historical/archeological site, or damage to wetlands).

10.3 FEDERAL REQUIREMENTS

10.3.1 Resource Conservation and Recovery Act of 1976

The RCRA requires biennial reports to be submitted to the regional administrator of EPA. 40 CFR 262, Subpart D sets forth the reporting requirements for generators of hazardous waste that ship waste offsite, or store, treat, or dispose of hazardous waste onsite.

Owners or operators of treatment, storage, and disposal facilities must comply with the reporting requirements contained in 40 CFR 264, Subpart E and 40 CFR 265, Subpart E.

10.3.2 Comprehensive Environmental Response, Compensation and Liability Act of 1980

The 40 CFR 302 contains reportable quantities and notification requirements for releases of hazardous substances as designated by CERCLA and the *Safe Drinking Water Act of 1974*.

10.3.3 National Emission Standards for Hazardous Air Pollutants

Compliance and reporting requirements for DOE facilities emitting radionuclides other than Radon are contained in 40 CFR 61, Subpart H (EPA 1989). The NESHAP requires that an annual report be submitted to EPA headquarters and the appropriate regional office.

10.4 STATE REQUIREMENTS

10.4.1 Generator Reporting

Generator reporting requirements are found in WAC 173-303-220. The State requires that annual reports covering the preceding year be submitted by March 1 to the Washington State Department of Ecology.

10.4.2 Facility Reporting

Owners or operators of treatment, storage and disposal facilities are also required to prepare and submit annual reports. These must be submitted by March 1 and cover facility activities for the previous year. The specific content requirements are specified in WAC 173-303-390.

Effluents produced by Spent Nuclear Fuels while in transition to shutdown do not contain hazardous or dangerous wastes; therefore, Spent Nuclear Fuels operations are not subject to RCRA or WAC 173 reporting requirements. Westinghouse Hanford Company would only have to comply with the above federal and state reporting requirements in the event that the facility operations were to change, and discharges (either liquid or gaseous) from the Spent Nuclear Fuels facility contained a hazardous or dangerous components.

10.5 U.S. DEPARTMENT OF ENERGY REQUIREMENTS

10.5.1 DOE Order 5400.1, Chapter II, "General Environmental Protection Program - Notification and Reports"

Consistent with the notification requirements contained in DOE Orders 5484.1 (DOE 1981), 5000.3A (DOE 1990b) and the DOE 5500 series, field organizations shall notify the Emergency Operations Center of the significant nonroutine releases of any pollutant or hazardous substance.

All DOE facilities that conduct significant environmental protection programs shall prepare an annual site environmental report. Annual summary reports on environmental occurrences shall be included in the annual site environmental report. Suggested content and format for the annual site environmental report are contained in DOE Order 5400.1 (DOE 1988).

DOE Order 5400.1 (DOE 1991) also requires that a radioactive effluent and onsite discharge data report, covering the previous calendar year be submitted to the Waste Information Systems Branch, EG&G Idaho, in Idaho Falls, Idaho 83415, by April 1. Unplanned releases of radioactive material in effluents, whether onsite or offsite, shall also be reported. The content and forms to be used for these reports are contained in DOE Order 5400.1, Chapter II (DOE 1988).

10.5.2 DOE Order 5484.1, *Environmental Protection, Safety and Health Protection Information Reporting Requirements*

Annual radiation exposure reports for the preceding calendar year are required to be submitted to the System Safety Development Center by March 31. Content and form requirements are in Chapter IV of this order.

DOE Order 5484.1 (DOE 1981) also requires radiation exposures of individuals that exceed the specified limits in one calendar quarter to be reported in the form of a memorandum to the Operational and Environmental Safety Division. Radiation exposure limits are listed in Chapter II of this order.

Events that occur in the facility and adversely affect operations, personnel safety, or DOE requirements should receive a thorough investigation and an investigation report should be prepared. DOE Order 5484.1 sets forth occurrences requiring investigation, as well as the investigation requirements as determined by the severity of the occurrence, investigation report format, and content outlines.

Contractors shall, at a minimum, make oral notification to the appropriate RL program division or office, to the Public Affairs Office, and to Safety and Quality Assurance (SQA) or the SQA duty officer as soon as it is apparent that an incident may meet the criteria of a Type A or Type B occurrence. A listing of occurrences requiring a Type A or Type B investigation is contained in Chapter I of DOE Order 5484.1 (DOE 1981).

Contractors are required to verbally notify responsible SQA environmental protection officials within 24 hours of becoming aware of any of the following occurrences:

- Violation of applicable federal, state, or local pollution control standards and requirements

- Any noncompliance with the terms and/or conditions of an existing National Pollutant Discharge Elimination System (NPDES) permit, or any other environmental-protection-based permit or formal agreement with an applicable regulatory body
- Any gaseous or liquid radiological effluent releases that exceed DOE requirements and/or contractor-specific radiological release concentration guides.

Following verbal notifications, written reports must be submitted according to procedures in DOE Order 5000.3A (DOE 1990b).

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11.0 INTERFACE WITH THE OPERATIONAL ENVIRONMENTAL MONITORING PROGRAM

11.1 DESCRIPTION

The sitewide Environmental Monitoring Plan (EMP), as described in the FEMP Management Plan (WHC 1991c), consists of two distinct but related components: environmental surveillance conducted by Pacific Northwest Laboratory, and effluent monitoring conducted by Westinghouse Hanford Company. The responsibilities for these two portions of the EMP are delineated in a Memorandum of Understanding (MOU 1989). Environmental surveillance, conducted by Pacific Northwest Laboratory, consists of surveillance of all environmental parameters to demonstrate compliance with regulations. Effluent monitoring includes both in-line and facility effluent monitoring as well as near-field (near-facility) operational environmental monitoring. Projected EDEs, reported in this FEMP, are the products of in-line effluent monitoring. Near-field monitoring is required by WHC-CM-7-5, *Environmental Compliance Manual*, Section 5.4, "Environmental Monitoring."

11.2 PURPOSE

The purpose of the Operational Environmental Monitoring Program (OEMP) is to provide facility-specific environmental monitoring to protect the environment adjacent to facilities under the responsibility of Westinghouse Hanford Company and ensure compliance with Westinghouse Hanford Company requirements and local, state, and federal environmental regulations. The objectives of the OEMP are to evaluate the following:

- Compliance with DOE, EPA, Washington State Department of Ecology, Washington State Department of Health, and internal Westinghouse Hanford Company environmental radiation protection requirements and guides
- Performance of radioactive waste confinement systems
- Trends of radioactive materials in the environment at and adjacent to nuclear facilities and waste disposal sites.

Specifically, the OEMP is developed to:

- Monitor all inactive, existing, and new low-level waste disposal sites to assess both radiological and nonradiological hazards (DOE Order 5820.2A [DOE 1990d])

- Determine the effectiveness of effluent treatment and controls in reducing effluents and emissions (DOE/EH-0173T, Page 1-1, Par. 1 [DOE 1991b]) (DOE/EV/1830-T5 [DOE 1991a])
- Detect and quantify unplanned releases (DOE/EH-0173T, Page 1-1, Par. 2 [DOE 1991a]) (40 CFR 302) (WAC 173-303-145) (DOE 5000.3A [DOE 1990b]) (DOE 5484.1 [DOE 1981])
- Monitor fugitive emissions and diffuse sources from contaminated areas for compliance with NESHAP (40 CFR 61), (DOE/EH-0173T, Pg. 3-4, 3.3.2 [DOE 1991b]), Toxic Air Emissions Inventory (40 CFR 265, Subparts AA and B13), State Operating Permit Program (40 CFR 70), and Source Registration (WAC 246-247).
- Monitor all surplus facilities prior to decontaminating or decommissioning (DOE Order 5820.2A [DOE 1990d]).
- Monitor new and existing sites, processes, and facilities for potential impacts and releases (DOE Order 5484.1 [DOE 1981] and DOE/EH-0173T [DOE 1991b]).
- Monitor and assess radioactive contamination and potential exposure to employees and the public (DOE Orders 5400.1 [DOE 1988] and 5400.5 [DOE 1990a]).

The purpose and justification for the OEMP is contained in WHC-CM-7-5, *Environmental Compliance*. The primary justification for the OEMP includes the following:

- The OEMP provides a level of assurance to Westinghouse Hanford Company that the effluent and contamination controls for the various facilities and waste sites are effective.
- The OEMP monitors a diversity of operations, activities, and programs managed by several different Westinghouse Hanford Company organizations. Accordingly, the program direction and integration function performed by Environmental Engineering Studies are needed to assure program consistency, technical quality, and cost effectiveness.
- A secondary aspect of the OEMP is additional assurance beyond that provided by the Occupational Health and Safety Program that it is safe to work onsite and that visitors can safely tour the site.

11.3 BASIS

Near-field environmental surveillance is conducted to: (1) monitor employee protection; (2) monitor environmental protection; and (3) ensure compliance with local, state, and federal regulations. Compliance with parts of the following DOE orders, 40 CFRs, and WACs is addressed through this activity.

- DOE Order 5000.3A (DOE 1990b), *Occurrence Reporting and Processing of Operational Information*
- DOE Order 5400.1 (DOE 1988), *General Environmental Protection Program*
- DOE Order 5400.5 (DOE 1990a), *Radiation Protection of the Public and the Environment*
- DOE Order 5484.1 (DOE 1981), *Protection, Safety, and Health Protection Information Reporting System*
- DOE Order 5820.2A (DOE 1990d), *Radioactive Waste Management*
- DOE/EH-0173T (DOE 1991b), *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*
- DOE/EV/1830-T5 (DOE 1991a), *A Guide to Reducing Radiation Exposure to As Low As Reasonably Achievable (ALARA)*
- 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants"
- 40 CFR 70, "State Operating Permit Programs"
- 40 CFR 265, Subpart AA and B13, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities"
- 40 CFR 302, "Designation, Reportable Quantities, and Notification"
- WAC 173-303-145, "Dangerous Waste Regulations (Spills and Discharges)"
- WAC 246-247, "Radiation Protection--Air Emissions."

11.4 MEDIA SAMPLED AND ANALYSES PERFORMED

Procedure protocols for sampling, analysis, data handling, and reporting are in place. Media include ambient air, surface water, groundwater, external radiation dose, soil, sediment, vegetation, and animals at or near active and inactive facilities and/or waste sites. Parameters monitored include the following, as needed: pH, water temperature, radionuclides, radiation exposure, and hazardous constituents. Animals that are not contaminated, as determined by a field instrument survey, are released to a non-hazardous environment.

11.5 LOCATIONS

Samples are collected from known or suspected effluent pathways (e.g., downwind of potential releases, liquid streams, or proximal to release points). To avoid duplication, Westinghouse Hanford Company relies on existing sample locations where Pacific Northwest Laboratory has previously established sample sites.

Surveys to detect surface radiological contamination, scheduled in WHC-SP-0098-5 (WHC 1993), are conducted near and on liquid waste disposal sites (e.g., cribs, trenches, drains, retention basin perimeters, pond perimeters, and ditch banks), solid waste disposal sites (e.g., burial grounds and trenches), unplanned release sites, tank farm perimeters, stabilized waste disposal sites, roads, and firebreaks in the Operations Areas.

11.6 PROGRAM REVIEW

The near-field (operational environmental) monitoring program will be reviewed at least annually to determine that the appropriate effluents are being monitored and that the monitor locations are in position to best determine potential releases.

11.7 SAMPLER DESIGN

Sampler design (e.g., air monitors) will be reviewed at least biannually to determine equipment efficiency and compliance with current EPA and industry (e.g., ANSI and American Society for Testing and Materials) standards.

11.8 COMMUNICATION

The operations and engineering contractor and the research and development contractor will compare and communicate to each other the results of their respective monitoring programs at least quarterly and as soon as possible under upset conditions.

11.9 REPORTS

Results of the near-field environmental monitoring program are published in WHC-EP-0527-3, *Environmental Releases for Calendar Year 1993* (WHC 1994a), and WHC-EP-0573-1, *Environmental Surveillance Annual Report Calendar Year 1993* (WHC 1994b). The radionuclide values in these reports are expressed in curies, or portions thereof, for each radionuclide per unit weight of sample (e.g., pCi per gram) or in field instrument values (e.g., counts per minute). Values are reported in this manner, rather than EDE, which is calculated as the summation of the products of the dose equivalent received by specified tissues of the body and a tissue-specific weighting factor.

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12.0 QUALITY ASSURANCE

12.1 PURPOSE

This Quality Assurance Plan describes the quality assurance requirements associated with implementing FEMPs. The plan identifies the FEMP activities and assigns the appropriate quality assurance requirements defined by the Westinghouse Hanford Company *Quality Assurance Manual* (WHC-CM-4-2). This quality assurance (QA) Plan shall be consistent with the requirements in 10 CFR 830.120, "Quality Assurance Requirements." In addition, QA requirements in 40 CFR 60, Appendix A, "Reference Methodologies" shall be considered when performing monitoring calculations and establishing monitoring systems.

12.2 OBJECTIVE

The objective of this plan is to provide a documented QA plan describing QA requirements for facilities implementing the FEMPs.

12.3 REQUIREMENTS

A Quality Assurance Project Plan (WHC 1994c) has been developed to implement the overall QA program requirements defined by WHC-CM-4-2. The QAPjP applies specifically to the field activities, laboratory analyses, and continuous monitoring performed for all FEMPs conducted by Westinghouse Hanford Company. Plans and procedures referenced in the QAPjP are available for regulatory review upon request by the direction of the Westinghouse Hanford Company Effluent Monitoring Manager. A QAPjP (WHC-EP-0536-2) (WHC 1995) for radioactive airborne emission monitoring was prepared to address the QA elements of 40 CFR 61 and was submitted to the EPA.

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13.0 INTERNAL AND EXTERNAL PLAN REVIEW

The *General Environmental Protection Program*, DOE Order 5400.1, Chapter IV.4 (DOE 1988), requires that the FEMP be reviewed annually and updated every three years. The FEMP should be reviewed and updated as necessary after each major change or modification in the facility processes, facility structure, ventilation and liquid collection systems, monitoring equipment, waste treatment, or a significant change to the Safety Analysis Reports. In addition, EPA regulations require that records on the results of radioactive airborne emissions monitoring be maintained onsite for five years. Operations management shall maintain records of measurements of stack particulates or other nonradioactive hazardous pollutant emissions for three years. Facility operators will have to determine on a semiannual basis that no changes in operations that would require additional measurements have occurred.

Westinghouse Hanford Company Effluent Monitoring (EM) prepares an annual effluent discharges report for each area on the Hanford Site to cover both airborne and liquid release pathways. Although the report is based on the calendar year, the emission limits apply to any period of 12 consecutive months. In addition, a report on the air emissions and compliance to the *Federal Clean Air Act of 1977* is prepared by EM and submitted to EPA as well as DOE.

Facility management is to obtain the EM function's approval for all changes to the FEMPs, including those generated in the annual review and update. In addition, the FEMP shall be reviewed by others if determined by EM.

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14.0 COMPLIANCE ASSESSMENT

This section provides a detailed comparison of the effluent monitoring system described in Section 7.0 with the applicable regulations presented in Section 3.0. Based on the information presented previously, there are no K Basin complex effluent streams out of compliance with the requirement to provide monitoring. Furthermore, all radioactive and nonradioactive hazardous materials that are potentially released through these streams are currently being monitored if required. This section also verifies compliance and applicability of federal, state, and local effluent regulations and DOE orders for the K Area monitoring. Where a potential environmental monitoring problem exists, an evaluation of the existing condition is presented. Remedial actions or mitigation measures should also be reviewed for action if there is a release to the environment.

14.1 105 KE AND 105 KW BASINS

The sample probes for the basin area exhaust consist of a single probe near the four exhausts above the basins. Because the basin exhausts are a minor stack, only confirmatory sampling analysis is required. Confirmatory sampling will be done by continuous sampling when the exhaust fans are in operation. The sampler line is plastic tubing, which is connected to a vacuum pump. Although this meets the requirements, upgrades to the system are needed. The upgrades are to: (1) secure sampling lines; (2) install a rotameter at the vacuum pump; (3) use flow meter (totalizer) to determine volume of flow through the vacuum pump; and (4) connect vacuum pump and exhaust fan to the same on/off switch.

14.2 1706 KE MAIN FLOOR (0-FOOT LEVEL)

The sample probe for the 1706 KE is appropriate for the size of the stack and is located generally in accordance with the standard. Because this stack has been designated as a minor release point, only confirmatory sampling is required. Confirmatory sampling will be done by continuous sampling when the exhaust fan is in operation. The prescribed sampling frequency and duration are appropriate. The 1706 KE complex should be closed by December 1995, and this sample point will be removed from this FEMP in future revisions.

14.3 1706 KE BASEMENT (4-METER [13-FOOT] LEVEL)

This ventilation system has not been operated since 1989 and there are no plans to operate this system in the future. If the system were to be vented, a confirmatory sampling program would need to be established to sample minor stacks. The 1706 KE complex should be closed by December 1995 and this sample point will be removed from the FEMP in future revisions.

14.4 1706 KE SUB-BASEMENT (8-METER [27-FOOT] LEVEL)

This ventilation system is used to control radon. A confirmatory sampling program must be established if this system continues to operate. The 1706 KE complex should be closed by December 1995 and this sample point will be removed from this FEMP in future revisions.

14.5 1706 KER MAIN FLOOR (0-FOOT LEVEL)

There is no exhaust from this area. Radioactive material is stored in drums in this area.

14.6 1706 KER (8-METER [27-FOOT] LEVEL)

The sampling probe location and configuration for the facility meet the general criteria of the standard. Because this stack has been designated as a minor release point, only confirmatory sampling is required. Confirmatory sampling will be done by continuous sampling when the exhaust fan is in operation. The 1706 KE complex should be closed by December 1995, and this sample point will be removed from this FEMP in future revisions.

14.7 1706 KER (27-FOOT LEVEL) TUNNEL EXHAUST

This ventilation system was used to control radon, and is not in operation as of 1994. A confirmatory sampling program would have to be established if this system were to operate. The 1706 KE complex should be closed by December 1995, and this sample point will be removed from this FEMP in future revisions.

14.8 1706 KEL

This system is operating at this time and confirmed to be a minor stack. There is no rad source in this area. The 1706 KE complex should be closed by December 1995, and this sample point will be removed from this FEMP in future revisions.

14.9 1908 KE OUTFALL (004)

At present, this system uses a grab sample and an automatic system to measure flow and temperature to meet the NPDES requirements. A new automatic system has been designed to replace this system.

14.10 181 KE OUTFALL (003)

This system is not operational because of silting. When the system was operational, only a grab sample was required.

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15.0 SUMMARY AND CONCLUSIONS

This FEMP assess the magnitude of routine and potential liquid and airborne effluent releases from the K Area to determine the compliance of effluent monitoring systems and sampling programs with applicable federal, state, and local regulations. Based on the data reviewed, air emissions at the K Area are designated as minor stacks and only require confirmation sampling. A method to do the confirmation sample must be developed to ensure that the dose remains below <0.1 mrem/yr per 40 CFR 61, Subpart H. No definitive requirements are listed in 40 CFR 61, Subpart H for performing periodic confirmatory measurements. K Area has established continuous sampling as their method of confirmatory measurement.

The NPDES outfalls meet the requirements. A new automated system is to replace the present system.

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16.0 REFERENCES

- 10 CFR 830.120, 1995, "Quality Assurance Requirements," *Code of Federal Regulations*, as amended.
- 40 CFR 52, 1989, "Approval and Promulgation of Implementation Plans," *Code of Federal Regulations*, as amended.
- 40 CFR 60, 1990, "Standards of Performance for New Stationary Sources," *Code of Federal Regulations*, as amended.
- 40 CFR 61, 1989, "National Emission Standards for Hazardous Air Pollutants (NESHAP)," *Code of Federal Regulations*, as amended.
- 40 CFR 70, 1992, "State Operating Permit Program," *Code of Federal Regulations*, as amended.
- 40 CFR 122, 1983, "EPA Administered Permit Programs: The National Pollutant Discharge Elimination System," *Code of Federal Regulations*, as amended.
- 40 CFR 141, 1989, "National Primary Drinking Water Regulations," *Code of Federal Regulations*, as amended.
- 40 CFR 191, 1985, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," *Code of Federal Regulations*, as amended.
- 40 CFR 261, 1989, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations*, as amended.
- 40 CFR 262, 1988, "Standards Applicable to Generators of Hazardous Waste," *Code of Federal Regulations*, as amended.
- 40 CFR 264, 1989, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations*, as amended.
- 40 CFR 265, 1989, "Interim Status for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations*, as amended.
- 40 CFR 302, 1991, "EPA Designation, Reportable Quantities, and Notification Requirements for Hazardous Substances Under CERCLA," *Code of Federal Regulations*, as amended.

40 CFR 355, 1987, "Superfund Amendments and Reauthorization Act of 1986 (SARA):
Emergency Planning and Notification, *Code of Federal Regulations*, as amended.

40 CFR 401-471, 1990, "Effluent Guidelines Standards," *Code of Federal Regulations*, as
amended.

ANSI, 1969, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*, ANSI
N13.1, American National Standards Institute, New York, New York.

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

Benton-Franklin/Walla Walla Counties Air Pollution Control Authority, General
Regulation 80-7/Proposed Regulation, Kennewick, Washington.

Comprehensive Environmental Response, Compensation and Liability Act of 1980,
42 USC 9601 et seq.

DOE, 1981, *Environmental Protection, Safety, and Health Protection Information Reporting
Requirements*, DOE Order 5484.1, U.S. Department of Energy, Washington, D.C.

DOE, 1988, *General Environmental Protection Program*, DOE Order 5400.1,
U.S. Department of Energy, Washington, D.C.

DOE, 1990a, *Environmental Protection, Safety, and Health Protection Standards*, DOE
Order 5400.5, U.S. Department of Energy, Washington, D.C.

DOE, 1990b, *Occurrence Reporting and Processing of Operations Information*, DOE Order
5000.3A, U.S. Department of Energy, Washington, D.C.

DOE, 1990c, *Radiation Protection of the Public and the Environment*, DOE Order 5400.5,
U.S. Department of Energy, Washington, D.C.

DOE, 1990d, *Radioactive Waste Management*, DOE Order 5820.2A, U.S. Department of
Energy, Washington, D.C.

DOE, 1991a, *A Guide to Reducing Radiation Exposure to As Low As Reasonably Achievable
(ALARA)*, DOE/EV/1830-T5, U.S. Department of Energy, Washington, D.C.

DOE, 1991b, *Environmental Regulatory Guide for Radiological Effluent Monitoring and
Environmental Surveillance*, DOE/EH-0173T, U.S. Department of Energy,
Washington, D.C.

DOE/RL, 1993, *Notice of Construction for 105-KE Encapsulation Activity*, DOE/RL-93-13, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL, 1994, *Environmental Monitoring Plan*, DOE/RL-91-50, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOH, 1993a, *Air 93-908*, Washington State Department of Health, Olympia, Washington.

DOH, 1993b, *Air 93-923*, Washington State Department of Health, Olympia, Washington.

DOH, 1993c, *Permit for Radioactive Airborne Emission Sources*, FF-01, Washington State Department of Health, Olympia, Washington.

EPA, 1981, *Authorization to Discharge Under the National Pollutants Discharge Elimination System*, NPDES, Permit WA-000374-3, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1984, *Eastern Environmental Radiation Facility, Radiochemistry Procedures Manual*, EPA-520/5-84-006, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1986, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1992a, *Authorization to Discharge Under NPDES for Stormwater Discharges Associated with Construction Activities*, WAR-10-000F, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1992b, *Authorization to Discharge Under NPDES for Stormwater Discharges for Industrial Activities*, WAR-00-000F, U.S. Environmental Protection Agency, Washington, D.C.

Federal Clean Air Act of 1977, 42 USC 7401 et seq.

Federal Water Pollution Control Act of 1972, 33 USC 1251 et seq.

MOU, 1989, "Memorandum of Understanding," Pacific Northwest Laboratory and Westinghouse Hanford Company, July 1989, Richland, Washington.

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

Resource Conservation and Recovery Act of 1976, 42 USC 6901 et seq.

Rokkan, D. J., 1990, *Model for Estimating Offsite Dose for Design Basin Event Involving 100-K Area Basins*, Westinghouse Hanford Company, Richland, Washington.

Safe Drinking Water Act of 1974, 42 USC 300f et seq.

Superfund Amendment and Reauthorization Act of 1986, 42 USC 11001 et seq.

WAC 173-200, 1990, "Water Quality Standards for Ground Waters of the State of Washington, *Washington Administration Code*, as amended.

WAC 173-216, 1994, "State Waste Discharge Permit Program," *Washington Administrative Code*, as amended.

WAC 173-218, 1984, "Underground Injection Control Program," *Washington Administrative Code*, as amended.

WAC 173-220, 1988, "National Pollutant Discharge Elimination System Permit Program," *Washington Administrative Code*, as amended.

WAC 173-225, 1993, "Federal Water Pollution Control - Establishment of Implementation Procedures of Application for Certification," *Washington Administrative Code*, as amended.

WAC 173-240, 1990, "Submission of Plans, and Reports for Construction of Waste Water Facilities," *Washington Administrative Code*, as amended.

WAC 173-303, 1991, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

WAC 173-400, 1991, "General Regulations for Air Pollution Sources," *Washington Administrative Code*, as amended.

WAC 173-401, 1994, "Air Operating Permit Program," *Washington Administrative Code*, as amended.

WAC 173-460, 1991, "Controls for New Sources of Toxic air Pollutants," *Washington Administrative Code*, as amended.

WAC 173-480, 1991, "Washington State Ambient Air Quality Standards and Emission Limits for Radionuclides," *Washington Administrative Code*, as amended.

WAC 173-480, 1990, "Ambient Air Quality Standards and Emission Limits for Radionuclides," *Washington Administrative Code*, as amended.

WAC 246-247, 1994, "Radiation Protection--Air Emissions," *Washington Administrative Code*, as amended.

Washington Clean Air Act of 1967, RCW 70.94, as amended.

WHC, 1990a, *Hazardous and Radiological Waste Control Manual*, WHC-NR-M-12, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990b, *Level III Probabilistic Risk Assessment for W Reactor*, WHC-MR-0045, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991a, *Facility Effluent Monitoring Plan Determination for the 100 Area Facilities*, WHC-EP-0439, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991b, *Unit Dose Calculation Methods and Summary of Facility Effluent Monitoring Plan Determination*, WHC-EP-0498, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991c, *Management Plan for Facility Effluent Monitoring Plan Activities*, WHC-EP-0441, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991d, *An Assessment of Potential Radiological Doses from Overflow of a 100 K Fuel Storage Basin*, WHC-SD-NR-TA-011, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992, *A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans* WHC-EP-0438-1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993, *Routine Operational Environmental Monitoring Schedule - CY 1994*, WHC-SP-0098-5, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994a, *Environmental Releases for Calendar Year 1993*, WHC-EP-0527-3, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994b, *Environmental Surveillance Annual Report Calendar Year 1993*, WHC-EP-0573-1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994c, *Quality Assurance Project Plan for Facility Effluent Monitoring Plans*, WHC-EP-0446-02, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994d, *Quality Assurance Project Plan for Chemical Analysis of Highly Radioactive Mixed Waste Samples in Support of Environmental Activities on the Hanford Site*, WHC-SD-CP-QAPP-003, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994e, *Quality Assurance Project Plan for Radioactive Airborne Emissions Data Compilation and Reporting*, WHC-EP-0528-1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994f, *Effluent Monitoring Procedures*, WHC-IP-1066, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994g, *Health Physics Task for Air Sampling*, HPT 1, K-W-001, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994h, *Health Physics Task for Quarterly Flow Checks*, HPT 2, K-Q-008, Westinghouse Hanford Company, Richland, Washington.

WHC, 1995, *Quality Assurance Program Plan for Radionuclide Airborne Monitoring*, WHC-EP-0536-2, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-1-5, *Standard Operating Practices*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-2, *Quality Assurance Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-43, *Emergency Management Procedures*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-7-4, *Operational Environmental Monitoring*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-7-5, *Environmental Compliance Manual*, Westinghouse Hanford Company, Richland, Washington.

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