
# Office of Inspector General
# Audit Report

**RESOURCE CONSERVATION AND RECOVERY ACT**

# Report on the Tank Waste Remediation System (TWRS) Program for the Hanford Federal Facility

**Report No. WAD 99-000421-2000-P-00012**

**March 30, 2000**

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| **Inspector General Division Conducting the Audit** | **Western Audit Division Seattle Branch Office** |
| **Region Covered** | **Region 10** |
| **Program Office Involved** | **Office of Waste and Chemicals Management** |

March 30, 2000

MEMORANDUM

SUBJECT: Tank Waste Remediation System Program for the Hanford Federal Facility
Audit Report No. WAD 99-000421-2000-P-00012

FROM: Truman R. Beeler
Divisional Inspector General for Audits
Western Audit Division

TO: Chuck Clarke
Regional Administrator
EPA Region 10

Attached is our final report titled *Tank Waste Remediation System (TWRS) Program for the Hanford Federal Facility*. The objective of the audit was to determine if the State of Washington's Department of Ecology and EPA Region 10's oversight of the TWRS Program is sufficient to ensure compliance with the Resource Conservation and Recovery Act (RCRA) and provides adequate protection to human health and the environment.

We concluded that the Department of Ecology and Region 10 need to improve their oversight and enforcement of RCRA requirements that apply to Hanford's TWRS Program. We believe that improvements are necessary to prevent threats to public health and the environment.

This audit report contains findings that describe problems the Office of Inspector General has identified and corrective actions the OIG recommends. This audit report represents the opinion of the OIG and the findings contained in this audit report do not necessarily represent the final EPA position. Final determinations on matters in this audit report will be made by EPA managers in accordance with established EPA audit resolution procedures. Accordingly, the findings described in this audit report are not binding upon EPA in any enforcement proceeding brought by EPA or the Department of Justice.

ACTION REQUIRED

In accordance with EPA Order 2750, you, as the Action Official, are required to provide our office with a written response to the audit report within 90 days of the report date. The response should address all recommendations. For corrective actions planned but not completed by the response date, reference to specific milestone dates will assist us in deciding whether to close

this report. We have no objection to the release of this report to the public.

We appreciate the cooperation from your staff as well as the staff of the Washington Department of Ecology during this audit. Should you or your staff have any questions about this report, please call me at (415) 744-2445, or Mike Owen of our Seattle Office at (206) 553-2542.

Attachment

Distribution: Appendix C

# EXECUTIVE SUMMARY

## INTRODUCTION

The Resource Conservation and Recovery Act (RCRA), Subtitle C establishes a program for managing hazardous waste from generation to disposal. The State of Washington's Hazardous Waste Program was initially authorized by EPA in 1986 and was revised to include regulation of radioactive mixed wastes in 1987. This authorization places primary responsibility for implementation and enforcement of RCRA on the State's Department of Ecology (Ecology).

In May 1989, Ecology, Region 10 (the Region), and the United States Department of Energy (DOE) signed the Hanford Federal Facility Agreement and Consent Order (FFACO). The FFACO requires DOE to: (i) bring its Hanford Federal Facility into compliance with RCRA and the State's Hazardous Waste Management Act; and (ii) establish a framework and schedule for implementing response actions in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act. Under the agreement, Hanford's single shell tanks (SSTs) and double shell tanks (DSTs) containing hazardous and highly radioactive waste were designated as RCRA units. DOE established the Tank Waste Remediation System (TWRS) Program for Hanford to ensure that the tank waste is stored, treated, and immobilized in a safe, environmentally sound, and cost-effective manner.

## OBJECTIVE

The objective of the audit was to determine if Ecology's and the Region's oversight of DOE's TWRS Program is sufficient to ensure compliance with RCRA and provides adequate protection to human health and the environment.

## RESULTS IN BRIEF

Ecology and the Region need to improve their oversight and enforcement of RCRA requirements that apply to Hanford's TWRS Program. Significant improvement is needed because: (i) progress with the TWRS Program has not been sufficient to ensure compliance with RCRA and to provide adequate protection to human health and the environment; (ii) sufficient oversight has not been provided for some safety issues involving the SSTs and DSTs; (iii) inspection coverage for the SSTs and DSTs has not met RCRA and Performance Partnership Agreement

(PPA) requirements; and (iv) leak detection systems for some SSTs and leak investigation procedures for the tanks do not provide adequate protection to the environment.

**Major Delays Threaten The Environment**

Progress with Hanford's TWRS Program has not been sufficient to ensure compliance with RCRA and to provide adequate protection to human health and the environment. Although the Hanford FFACO established major milestones for stabilizing SSTs, treating waste from SSTs and DSTs, and closing the SSTs, Ecology has been unsuccessful in obtaining DOE's compliance with the milestones. Specifically, milestones for: (i) interim stabilization of the SSTs have been consistently missed and completion of interim stabilization will be delayed by 9 years; (ii) start of treatment of tank wastes will be delayed at least 4 years and the completion of treatment may be delayed up to 19 years; (iii) initiation of waste retrieval from SST C-106, a "Watch List" tank, was not met and waste retrieval was delayed for over a year; and (iv) retrieval of waste from, and the closure of all SSTs may be delayed at least 15 years and 9 years, respectively. In addition, DOE's evaluation of DST storage capacity requirements was deficient and did not meet milestone requirements.

At least 1 million gallons of highly toxic and radioactive waste from 67 of Hanford's 149 SSTs has already leaked, and some of the waste has reached the groundwater. There are about 35 million gallons of high level radioactive waste remaining in the 149 SSTs and about 19 million gallons of waste stored in 28 DSTs. Continued delays in interim stabilization and delays in treatment and retrieval of the tank wastes could result in the use of both the SSTs and DSTs significantly beyond the schedule established by the FFACO. These delays could significantly increase the risks of releases into the environment.

We attribute the conditions to three principal causes. First, DOE has not demonstrated the ability or sufficient commitment to manage the TWRS Program to meet FFACO milestones and to provide adequate protection to human health and the environment. Second, DOE has not sufficiently funded all TWRS Program activities. Third, Ecology and the Region have not developed and implemented an effective oversight and enforcement strategy.

**Oversight Of Tank Safety Issues Need Attention**

DOE has responsibility for compliance with State and Federal hazardous waste regulatory requirements. However, Ecology has not provided sufficient oversight of some safety issues involving SSTs and DSTs. Specifically, Ecology: (i) has not ensured that DOE satisfactorily met a September 1998 FFACO milestone for the resolution of a flammable gas safety question for SSTs and DSTs; and (ii) was not timely in providing oversight on DOE's resolution of serious waste level growth and gas retention safety issues involving DST SY-101.

Unresolved flammable gas safety issues have caused significant delays in stabilizing the SSTs, and may cause additional delays in the TWRS Program and increased risks to human health and

the environment. In addition, DST SY-101 may eventually lose double containment unless the safety issues for the tank are adequately and timely resolved, and plans to transfer the waste to another tank may create similar safety problems in the receiving tank. A loss of double containment increases the risk of a release of hazardous and radioactive wastes into the soil and groundwater.

Ecology was not able to effectively oversee and evaluate DOE's resolution of safety issues mainly because it has not placed sufficient emphasis on filling a safety position supporting the TWRS Program. This position became vacant during August 1998 and was not filled at the time of our audit in September 1999.

**Ecology Is Not Conducting Enough Tank Inspections**

Although DOE is responsible for compliance with State and Federal hazardous waste regulations, Ecology, as the lead regulator, did not conduct a sufficient number of tank inspections to assess DOE compliance with RCRA.

Specifically, Ecology inspected only 22 percent of the tanks over a period of approximately 7 years even though RCRA, as amended by the Federal Facility Compliance Act, required thorough annual inspections of Federal facilities. In addition, inspection coverage for the tanks did not meet inspection commitments specified in PPA workplans for the State's fiscals 1998 and 1999. Ecology had not increased the number of inspections although 7 of the 8 inspections conducted during the 7-year period ended February 1999 identified serious compliance issues.

These conditions occurred because: (i) Ecology was not placing a sufficiently high priority on conducting tank inspections; and (ii) the Region was not monitoring PPA inspection commitments for Hanford**.**

**Leak Detection And Investigation Procedures Do Not Provide Adequate Protection To The Environment**

Effective leak detection systems have not been installed by DOE for all Hanford tanks. In addition, DOE has not always conducted adequate, timely, or documented investigations of suspected tank leaks. Specifically, we determined: (i) original leak detection systems installed in 58 of the 149 SSTs were no longer effective; (ii) an investigation had not been conducted into a possible ongoing leak from one SST that leaked in the past; (iii) investigations were not completed timely for suspected leaks from two SSTs that leaked in the past; and (iv) investigation results of a suspected leak from one SST were not documented.

These conditions occurred mainly because Ecology has not placed sufficient emphasis on ensuring that DOE has implemented an effective leak detection and investigation program. Specifically, Ecology has not: (i) required DOE to establish a leak detection program for all SSTs

that meets State and Federal regulatory requirements; and (ii) has not provided sufficient oversight and enforcement over DOE's leak assessment activities.

As noted in Chapter 2, at least 1 million gallons of highly toxic and radioactive waste has leaked from 67 of Hanford's 149 SSTs, some of which has already reached the groundwater. Without effective leak detection systems and an effective leak investigation process, there is no assurance that tank leaks will be identified and remediated timely. Minimizing the extent of leaks and an effective leak investigation process for the SSTs are critical to preventing additional groundwater contamination.

## RECOMMENDATIONS

Principal recommendations to the Regional Administrator are to:

1. Negotiate with Ecology to address oversight and enforcement responsibilities regarding DOE compliance with FFACO and RCRA requirements as part of the fiscal 2000/2001 PPA process.

2. Consult with EPA National Program Managers to determine what actions can be taken at the EPA Headquarters level to achieve a higher priority, including receiving funding, on cleanup of the Hanford tanks.

3. Report the weaknesses in the Hanford TWRS Program as a management control deficiency in the annual Federal Managers Financial Integrity Act assurance letter to the EPA Administrator.

4. Negotiate fiscal 2000/2001 PPA commitments with Ecology as necessary to oversee TWRS Program safety issues.

5. Establish annual EPA and Ecology inspection commitments through the fiscal 2000/2001 PPA process in accordance with the Compliance Assurance Agreement Between the Washington Department of Ecology and the United States Environmental Protection Agency for the Hazardous Waste Program (1997), including a mid-year and end-of-year review of commitment.

6. Assist Ecology in preparing a strategy for addressing DOE actions for SSTs not currently in compliance with interim status leak detection requirements.

7. Negotiate with Ecology appropriate inspection and enforcement responses to suspected tank leaks under interim status requirements and document theses commitments through the fiscal 2000/2001 PPA process.

# REGION 10 AND STATE DEPARTMENT OF ECOLOGY COMMENTS AND OIG EVALUATION

A draft report was provided to the Region and Ecology on January 21, 2000. The Region and Ecology submitted a joint response on February 22, 2000 and a revised implementation schedule for the report recommendations on March 10, 2000. The response is included as APPENDIX B to this report. As reflected in the following excerpts from the response, the Region and Ecology concurred with the report facts and recommendations.

> After review of the report and each of the recommendations, we concur in full with both the facts as presented in each finding, and with the associated recommendations. EPA and Ecology fully support the findings identified in the audit report, particularly the lack of progress on the part of Department of Energy (DOE) in addressing the significant threats posed by Hanford tank wastes. We intend to move forward in a timely manner with each of the recommendations, and believe our current activities, described below, demonstrate our resolve to address delays in the TWRS program...
>
> As documented in the audit report, Ecology and EPA have engaged in negotiations with the Department of Energy (DOE) to establish milestones in the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) relating to tank waste retrieval, construction and operation of a tank waste treatment system, and compliance concerns related with the RCRA Land Disposal Restriction (LDR) program. Despite extensive efforts on the part of both agencies, these negotiations concluded on January 31, 2000 with no agreement reached. DOE's eleventh-hour proposals for both tank waste treatment milestones and LDR dispute resolution served only to reinforce EPA's and Ecology's belief that DOE remains unwilling to commit to necessary work and be accountable for progress toward enforceable milestones. As a result, Ecology asked EPA to join in development and issuance of a final dispute determination to resolve these issues. EPA responded in a February 3, 2000 letter to Ecology strongly endorsing Ecology's position, and stating in no uncertain terms EPA's concern with DOE failures to complete work, fulfill milestone commitments, and demonstrate accountability for progress with Hanford environmental cleanup. We believe that these clear and decisive positions established by EPA and Ecology with respect to tank waste and LDR compliance are fully consistent with recommendations in the audit report, and reflect our commitment to implementing the audit recommendations.

We agree with the corrective actions which have been initiated or planned by the Region and Ecology. Their response to all of the report's recommendations reflect actions that should

improve oversight and enforcement of RCRA requirements that pertain to DOE's TWRS Program.

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**EXHIBITS**



**APPENDICES**

# ABBREVIATIONS

| | |
|---|---|
| AIP | Agreement in Principle |
| DOE | Department of Energy |
| Ecology | Washington Department of Ecology |
| EPA | Environmental Protection Agency |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act |
| CFR | Code of Federal Regulations |
| DST | Double Shell Tank |
| FFACO | Hanford Federal Facility Agreement and Consent Order |
| FMFIA | Federal Managers' Financial Integrity Act |
| GAO | General Accounting Office |
| HLW | High Level (Radioactive) Waste |
| HTI | Hanford Tanks Initiative |
| HWMA | Washington's Hazardous Waste Management Act |
| IAMIT | Interagency Management Integration Team |
| LAW | Low Activity (Radioactive) Waste |
| MOU | Memorandum of Understanding |
| OIG | Office of Inspector General |
| OSD | DOE Operating Specification Document |
| OWCM | EPA Region 10 Office of Waste and Chemicals Management |
| PCHB | Washington Pollution Control Hearing Board |
| PPA | Performance Partnership Agreement |
| RCRA | Resource Conservation and Recovery Act |
| SST | Single Shell Tank |
| TAP | Tank Advisory Panel |
| TSD | RCRA Treatment Storage and Disposal Unit |
| TWRS | Tank Waste Remediation System |
| USQ | Unreviewed Safety Question |
| WAC | Washington Administrative Code |

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# CHAPTER 1

## INTRODUCTION

### PURPOSE

The objective of the audit was to determine if the State of Washington's Department of Ecology (Ecology) and EPA Region 10's oversight of the Department of Energy's (DOE's) Tank Waste Remediation System (TWRS) Program is sufficient to ensure compliance with the Resource Conservation and Recovery Act (RCRA) and provides adequate protection to human health and the environment.

### BACKGROUND

#### The Site

The Hanford Site is in southeastern Washington State and occupies about 560 square miles. The Columbia River, one of the largest rivers in the United States, runs through more than 50 miles of the site. From 1943 to 1989 Hanford's principal mission was the

**Hanford's First ("B") Reactor, Completed 1944**
**(Source: Phil Weihrouch, EPA OIG)**

production of weapons-grade plutonium. To produce plutonium, uranium metal was irradiated in a plutonium production reactor. The irradiated uranium metal, also known as spent fuel, was cooled and treated in a chemical separations plant where plutonium was separated from uranium and many other radioactive by-products. Large amounts of spent fuel were generated to produce enough plutonium to make a nuclear weapon. The chemical separations process resulted in several hundred thousand metric tons of radioactive and hazardous waste. Hanford is said to be the world's largest environmental cleanup project.

## The Tank Farms

The most dangerous radioactive, hazardous, and mixed waste is stored in 177 large underground storage tanks in groups called tank farms. The waste includes more than 177 million curies (a unit quantity of radioactive nuclide) in approximately 54 million gallons of liquid, sludge, and saltcake (generally a semi-solid crusty material). These tanks contain about 60 percent of DOE's nationwide inventory of high level liquid wastes. High level waste is the most dangerous radioactive waste and requires radiation shielding, special handling techniques, and when disposed of, special measures to isolate it from humans and the environment. The radioisotopes cesium-137 and strontium-90 account for essentially all of the radioactivity in the tanks and will remain the primary individual contributors to the total radioactivity over the next 150 to 200 years.

In the 1940's through the early 1960's, 149 single-shell tanks (SSTs) with capacities of 55,000 to 1 million gallons were built to store high-level waste in a region near the center of the site referred to as the 200 Areas. During the 1950's, uranium was extracted from some of the tanks for reprocessing, an action that introduced new chemicals into the tanks. Also, chemicals were added to the tanks to settle radionuclides from the liquid to the bottom of the tanks. The low-activity liquid waste that resulted was sent to shallow subsurface drainfields where it percolated into the soil. This process resulted in higher concentrations of heat-generating cesium-137 and strontium-90 in the tanks, which threaten the integrity of the tanks. The SSTs had a design life of approximately 20 years. Leakage from these tanks to the underlying soil was suspected in 1956 and confirmed in 1961. Based on historical data, one additional tank begins to leak each year.

By the late 1980's, 67 tanks were known or suspected leakers, and an estimated 1 million gallons of high-level waste had been released to the soil beneath the 200 Areas. To address concerns with the design of the SSTs, 28 double-shell tanks (DSTs) with capacities from 1 million gallons to 1.16 million gallons were constructed between 1968 and 1986. Of the 54 million gallons of waste stored in the 177 tanks, approximately 19 million gallons (35 percent) is stored in the DSTs. Therefore, the majority of the waste is still stored in the deteriorating SSTs. In 1998 Ecology reported that "There are two types of tanks at Hanford, those that *have* leaked and those that *will* leak."

Some of the activities under DOE's TWRS Program include: (i) interim stabilization, a process of pumping liquid mixed waste from leaking SSTs to DSTs; (ii) waste treatment or vitrification, a process of converting the tank wastes into a solid form for permanent storage; (iii) waste retrieval; and (iv) tank closure. As of September 1999, interim stabilization and pilot work on waste retrieval were in process. Waste treatment, completion of waste retrieval, and tank closure were still in the planning phases and were yet to be completed.

## Threats to Human Health and the Environment

Hazardous waste in the tanks poses threats to human health and the environment because of the potential for release of high level radioactive waste through fire or explosion and through leaks into groundwater.

DOE reported that the accident with the most severe potential health impacts is hydrogen gas fire in a tank. At least 25 tanks are estimated to be generating hydrogen gas in sufficient quantities to cause a fire if ignited. If such a fire were to occur, DOE estimates that there is the potential for up to 22 latent cancer fatalities from direct radiation and inhalation of radioactive contaminants. The longer the waste remains in the tanks, the higher the probability that a hydrogen gas fire would occur. With respect to the risk of a tank explosion, while it appears considerably less than in the early 1990s, there is still some risk due to continuing tank safety issues.

Approximately 200 square miles of Hanford Site groundwater is contaminated from radioactive and hazardous waste. Groundwater occurs at a depth of 230 to over 300 feet below the ground surface. Past plutonium production and disposal practices resulted in extensive contamination in the soils. Some of the contamination


**Hanford Single Shell Tank Farm Under Construction Circa 1944 (Source: DOE Integrated Management Plan for the Hanford TWRS, January 1999)**

was caused from tank waste management practices as well as leaks from the tanks. Over time, the contaminants in the soils have been carried down to the groundwater and toward the Columbia River. DOE currently has no process to remove all contaminants from the groundwater before they reach the river.

Contaminants in the groundwater include arsenic, chromium, cyanide, carbon tetrachloride, cobalt-60, strontium-90, technetium-99, iodine-129, cesium-137, tritium, and plutonium-239 and -240. These materials have toxic, carcinogenic, mutagenic, or teratogenic effects on humans and other life forms. The migration of such materials presents a threat to the public health, welfare and the environment. The contaminants in the groundwater could reach the Columbia River in as little as 20 years and continue for the next 5,000 years. The Columbia River is heavily used for irrigation by agriculture interests in the area and is a major contributor to the economies of the cities of Kennewick, Pasco, and Richland, Washington. Approximately 450,000 people reside within a 50 miles radius of Hanford's 200 Areas and rely on the river for drinking water, employment, and/or recreation.

## Regulatory History

The State of Washington's Hazardous Waste Program was initially authorized by EPA in 1986 and was revised to include regulation of radioactive mixed wastes in 1987. This authorization gave the State authority to operate its Hazardous Waste Program in lieu of

the Federal RCRA Program. The authorization places primary implementation and enforcement responsibility of RCRA on the State. Washington's Hazardous Waste Program is executed through the State's Hazardous Waste Management Act (HWMA) and the implementing regulations, the Dangerous Waste Regulations.

In about 1984, Ecology staff began inquiring about RCRA compliance at Hanford's tank farms and other hazardous waste sites and operations. During the mid to late 1980's, Ecology and the Region performed RCRA/HWMA compliance inspections at Hanford, including the tank farms, noting many non-compliant areas. In 1988, spurred by the outstanding compliance problems at Hanford, Ecology, EPA, and DOE negotiated a combined Federal Facility Agreement under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and a Consent Order under RCRA/HWMA. The document, known as the Hanford Federal Facility Agreement and Consent Order (FFACO), required DOE to undertake cleanup actions at many existing waste sites, to obtain operating permits or undergo closure for RCRA Treatment, Storage, and Disposal units (TSDs), and other cleanup and compliance actions. The three parties signed the original FFACO in May 1989. Under the agreement, Hanford's SSTs and DSTs were designated as RCRA units.

In 1993 DOE sought to renegotiate the FFACO requirements for the tank systems, in order to incorporate new information and planning for them. DOE's new tank program, known as the TWRS Program was signed in a revised FFACO in January 1994 and was established to ensure that the tank waste is stored, treated, and immobilized in a safe, environmentally sound, and cost-effective manner.

The 1994 revision of the FFACO included a commitment from DOE to retrieve all of the waste from the SSTs and vitrify (stabilization within a molten glass matrix) tank waste from all SSTs and DSTs. The deadline for completing waste vitrification was 2028. The new amendment also required work to: (i) address tank safety issues; (ii) continue stabilizing the SSTs; (iii) construct new DST capacity; (iv) upgrade systems in tank farms; (v) continue characterizing the tank waste; and (vi) and close all SSTs.

In December 1995 the TWRS components of the FFACO were further modified to allow a "privatized" approach to a tank waste vitrification facility. This revision resulted in a revised schedule for the vitrification facilities, but no change to the other tank related work.

## Regulatory Role of Ecology and the Region

The FFACO defines the regulatory roles and responsibilities of Ecology and the Region for the Hanford Facility. The agreement designates Ecology as the lead regulatory agency for all RCRA units, including the SSTs and DSTs. As the lead regulatory agency, Ecology is required to provide regulatory oversight, including preparation of responses to documents submitted by DOE. The FFACO designates the Region as the non-lead regulatory agency for the SSTS and DSTs and specifies that the Region will not assign staff to provide any oversight or support of work at the RCRA units. However, the agreement does not eliminate the Region's responsibility for oversight of Ecology's exercise of its authorized RCRA authorities.

The Memorandum of Understanding (MOU) between Ecology and the Region concerning the Hanford FFACO specifies that Ecology is the single point of contact, regulator and decision maker for all activities subject to the State's Dangerous Waste Regulations. The MOU also states that the Region will not oversee activity subject to

**Hanford "N" Reactor Adjacent to the Columbia River (Source: Phil Weihrouch, EPA OIG)**

State rules, including rules that have not yet been authorized by the Region but which are substantially equivalent to RCRA. However, the MOU specifies that the Region may become involved in regulatory oversight when requested by Ecology or as otherwise appropriate as part of the Region's State program oversight responsibilities.

Ecology is the agency mandated by the Washington State Legislature to administer the State's federally approved RCRA Program. Ecology's Nuclear Waste Program is responsible for all dangerous/hazardous waste cleanup program activities at the Hanford Federal Facility. This responsibility includes oversight and enforcement of TWRS components of the FFACO. The Nuclear Waste Program has offices located in Olympia and Kennewick, Washington and currently has about 70 staff. Most of these staff are assigned to its Kennewick office.

The Region's Office of Waste and Chemicals Management (OWCM) administers the Federal RCRA Program within Region 10. At Ecology's request, the OWCM and the Region's Office of Regional Counsel provide technical, regulatory, and legal support for the TWRS Program.

## AUDIT SCOPE & METHODOLOGY

We performed this audit in accordance with the Government Auditing Standards (1994 Revision) issued by the Comptroller General of the United States as they apply to performance audits. Our review included tests of program records and other auditing procedures we considered necessary for the purposes of expressing an opinion based on our audit objectives. We also reviewed the Federal Manager's Financial Integrity Act reports for 1997 and 1998. The reports did not identify any material weaknesses, or vulnerabilities, relating to the issues discussed in this report. See APPENDIX A for scope and methodology details.

## PRIOR AUDIT COVERAGE

There have been no prior audits performed by the EPA Office of Inspector General (OIG) on Ecology's and the Region's oversight of the TWRS Program. However, GAO has performed a number of audits covering various aspects of DOE's management of the TWRS Program. The most recent reports entitled Nuclear Waste: Department of Energy's Hanford Tank Waste Project-Schedule, Cost, and Management Issues (GAO/RCED-99-13, October 1998)

and Nuclear Waste: Understanding of Waste Migration at Hanford is Inadequate for Key Decisions (GAO/RCED-98-80, March 1998) identified weaknesses in DOE's management of the program and are discussed in Chapter 2.

Recent audits conducted by the DOE Office of Inspector also have identified weaknesses in DOE's management of the Hanford tank farms. In 1995, the OIG issued a report entitled Audit of the Richland Operations Office Site Characterization Program (DOE/IG-0368, March 1995) that concluded: (i) the reduction of the completion period for core sampling of high level radioactive waste tanks from 6 to 3 years increased the characterization costs without a similar increase in benefits and (ii) renegotiation of the FFACO milestone that required 80 percent of low level waste sample analyses be performed within 25 miles of Hanford will add $46 million over the next 8 years to the cost of sample analyses.

The DOE OIG also issued a report in 1993 entitled DOE Management of High-Level Waste at the Hanford Site (DOE/IG-0325, April 1993) that concluded DOE managed the Hanford remediation program as a number of separate projects not fully integrated into one major acquisition system. Consequently, program costs were obscured, and DOE had not clearly defined systems requirements or developed overall cost and schedule baselines. They found a vast array of technical uncertainties, including tank safety and inadequate information about the makeup of the tank waste, that could significantly affect the program's cost and ultimate success. At the time of our fieldwork, the DOE OIG was conducting a follow up audit on the issues addressed in their 1993 report.

# CHAPTER 2

## MAJOR DELAYS THREATEN THE ENVIRONMENT

Progress with Hanford's TWRS Program has not been sufficient to ensure compliance with RCRA and to provide adequate protection to human health and the environment. Although the Hanford FFACO established major milestones for stabilizing SSTs, treating waste from SSTs and DSTs, and closing the SSTs, Ecology has been unsuccessful in obtaining DOE's compliance with the milestones. Specifically:

- Milestones for interim stabilization of the SSTs have been consistently missed and completion of interim stabilization will be delayed by 9 years.

- Milestones for the start of treatment of tank wastes will be delayed at least 4 years and the completion of treatment may be delayed up to 19 years.

- The milestone to initiate waste retrieval from SST C-106, a "Watch List" tank, was not met and waste retrieval was delayed for over a year.

- Milestones for the retrieval of waste from and the closure of all SSTs may be delayed at least 15 years and 9 years, respectively.

In addition, DOE's evaluation of DST storage capacity requirements was deficient and did not meet milestone requirements.

At least 1 million gallons of highly toxic and radioactive waste from 67 of Hanford's 149 SSTs has already leaked, and some of the waste has reached the groundwater. There are about 35 million gallons of high level radioactive waste remaining in the 149 SSTs and about 19 million gallons of waste stored in 28 DSTs. Continued delays in interim stabilization and delays in treatment and retrieval of the tank wastes could result in the use of both the

SSTs and DSTs significantly beyond the schedule established by the FFACO. Deficient DST storage capacity evaluations may cause additional delays in the retrieval and treatment of the tank waste. These delays could significantly increase the risks of releases into the environment.

We attribute the conditions to three principal causes. First, DOE has not demonstrated the ability or sufficient commitment to manage the TWRS Program to meet FFACO milestones and to provide adequate protection to human health and the environment. Second, DOE has not sufficiently funded all TWRS Program activities. Third, Ecology and the Region have not developed and implemented an effective oversight and enforcement strategy.

Exhibit 1 provides a timeline of actual and proposed revisions in the TWRS Program at the time of our audit.

## BACKGROUND

RCRA Subtitle C establishes a program for managing hazardous waste from generation to disposal. Section 3005 of RCRA requires facilities to obtain operating permits that establish the administrative and technical conditions under which hazardous wastes at the facilities must be managed. It also grants interim status to facilities until a permit is issued when specific qualifying criteria are met.

The Hanford Facility qualified for interim status, and the SSTs and DSTs are currently operating under interim status requirements. Washington Administrative Code (WAC) Chapter 173-303- *Dangerous Waste Regulations* and 40 CFR, Part 265- *Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities* provide regulations applicable to interim status tank systems used to store or treat hazardous waste. The WAC Chapter 173-303-400 and 40 CFR, Part 265, Subpart J include requirements for general operations, secondary containment systems, response to leaks and disposition of unfit tank systems, and closure and post closure care.[1]

[1] WAC Chapter 173-303-400 and 40 CFR, Part 265, Subpart J specify that a tank system becomes subject to closure and post closure requirements applicable to landfills in circumstances where all waste and contamination can not be removed from in and around the tank system. 40 CFR, Part 265, Subpart N establishes closure and post closure requirements for landfills.

The purpose of the FFACO is to: (i) bring the Hanford Facility into compliance with RCRA and the State's Hazardous Waste Management Act; and (ii) establish a framework and schedule for implementing response actions in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act. Because the SSTs and DSTs are not in compliance with State and Federal hazardous waste laws and regulations, the FFACO includes requirements and milestones for: (i) tank system integrity assessments; (ii) tank system upgrades; (iii) waste characterization of tank waste; (iv) resolution of tank safety issues; (v) interim stabilization; (vi) waste retrieval; (vii) waste processing facility construction and operations; (viii) waste storage and disposal; and (ix) tank closure.

The FFACO includes enforcement provisions for noncompliance with major requirements and milestones. Under the agreement, Ecology, as the lead regulator, is responsible for enforcement of FFACO milestones pertaining to regulation of the SSTs and DSTs. In the event DOE fails to comply with a term or condition of the FFACO, a stipulated penalty may be assessed in an amount up to $5,000 for the first week (or part thereof), and up to $10,000 for each additional week (or part thereof) of noncompliance. The FFACO also authorizes Ecology to seek other remedies or sanctions for noncompliance with the agreement, statutes, or regulations.

The FFACO also provides a dispute resolution process in the event DOE objects to Ecology's disapproval of a proposed modification, decision, or determination made under the agreement. The FFACO requires Ecology and DOE to make reasonable efforts to resolve disputes at the project manager level. However, the dispute may be elevated to the Interagency Management Integration Team (IAMIT)[2], if resolution at the project manager level cannot be achieved within 30 days. If the IAMIT is unable to resolve the dispute within 21 days, the Director of Ecology is required to make a final determination within 35 days of the date the dispute was elevated to the IAMIT. DOE may file an appeal with either the

[2] The IAMIT is composed of a DOE Executive Manager, Ecology's Program Manager for the Nuclear Waste Program, and the Region's Project Manager for the Hanford Project Office and is required by the FFACO. One of the roles of the IAMIT is to serve as a forum for resolution of disputes when agreement can not be reached through informal dispute resolution.

Washington Pollution Control Hearing Board[3] (PCHB) or the courts if DOE objects to the Director's final determination.

## INTERIM STABILIZATION MILESTONES WERE MISSED AND DELAYED BY 9 YEARS

Milestones for interim stabilization of the SSTs have been significantly delayed. In the initial FFACO, interim stabilization was to be completed by September 1995. However, as of August 1999, interim stabilization is not scheduled to be completed until September 2004.

The intent of interim stabilization is to provide an interim measure to reduce the impacts of leaks of liquid waste from the SSTs. Interim stabilization is the process of pumping liquid mixed waste from the SSTs to DSTs. An SST is interim stabilized and pumping may be discontinued when the tank contains less than 50,000 gallons of drainable liquid, less than 5,000 gallons of supernatant (free-standing) liquid, and the pump flow is 0.05 gallons per minute or less.

### A Delay of 5 Years

The FFACO originally required DOE to complete interim stabilization for all SSTs by September 1995, except tanks C-105 and C-106 which were to be interim stabilized by September 1996. During the period May 1989 through March 1997, milestones were modified 13 times. The most significant of these modifications was the sixth amendment, which was made in January 1994. This modification revised the major milestone for interim stabilization by extending the completion date 5 years from September 1995 to September 2000. Ecology and the Region approved the sixth amendment[4] in order to allow DOE additional time to resolve tank safety issues, including those associated with flammable gas.

Another significant modification to the FFACO was the twelfth amendment, which was made in September 1996. The modification extended near term interim milestones under the

[3] The PCHB was established under Washington Administrative Code to hear appeals of orders or decisions made by state environmental departments, including the Department of Ecology.

[4] The FFACO requires the approval of both Ecology and the Region for modifications of major milestones. The sixth amendment revised a major milestone. Therefore, both Ecology and the Region were required to approve the amendment.

major interim stabilization milestone. In addition, the amendment reduced the number of SSTs required to be interim stabilized by the near term interim milestones and increased the number of SSTs required to be interim stabilized by the later interim milestones. However, the modification did not extend the major milestone requiring completion of interim stabilization by September 2000.

Ecology approved the twelfth amendment[5] because DOE provided a recovery plan which included a schedule showing that interim stabilization would be completed by the September 2000 milestone. In its justification for the extension, DOE disclosed that the recovery plan included a schedule which addressed safety analysis requirements and additional preparation time needed for equipment and administrative controls for tanks containing flammable gas.

Subsequent to the thirteenth amendment, DOE requested two additional extensions of interim milestones. The first request was made in June 1997 and asked for an extension from September 30, 1997 to March 31, 1998 to start interim stabilization of six SSTs. The second request was made in December 1997 and asked for an extension from March 31, 1998 to a date "to be determined" to start interim stabilization of eight SSTs. DOE said unresolved flammable gas safety issues made the extensions necessary.

**DOE Stopped Pumping**

Unilaterally, DOE also placed an immediate moratorium on pumping of the SSTs in July 1997, and a 1-year moratorium on the tank interim stabilization program for fiscal 1998. DOE reported that the moratorium was necessary because funding was expected to be less than required to comply with all regulations and compliance commitments. DOE also said that it wanted the moratorium because the cost of interim stabilization per tank had been escalating and, as a result, it wanted to stop and refine an approach to reduce the cost prior to restarting the program. Consequently, DOE cut funding for interim stabilization from approximately $15 to $4 million for fiscal 1998.

**Milestones not Met**

Ecology denied both extension requests. In response, DOE invoked the FFACO dispute resolution process and appealed to the Director of Ecology. The Director denied both extensions citing

[5] The FFACO requires the approval of the lead regulatory agency for modifications of interim milestones. Ecology approved the twelfth amendment because it is the lead agency for regulation of the SSTs and DSTs.

that DOE did not have sufficient cause for the extensions. Although the extensions were denied, DOE subsequently failed to meet the milestones. No penalties were assessed by Ecology in response to DOE's failure to meet the September 1997 and March 1998 milestones.

DOE submitted another recovery plan for the interim stabilization program during April 1998 as a result of the Director of Ecology's decisions to deny the previous two extension requests. The recovery plan stated that DOE was unable to meet completion of interim stabilization by September 2000 and requested that the milestone be extended 4 years to September 2004. The recovery plan further stated that DOE could only meet the revised schedule if 29 "enabling assumptions" proved true.

**Intent to File Suit**

In response to DOE's April 1998 plan, Ecology notified DOE during June 1998 that it intended to file suit for DOE's failure to meet the September 1997 and March 1998 interim milestones. Ecology advised DOE:

> The history of the interim stabilization program at Hanford is one of delay, mismanagement, and above all failure to stop an ongoing threat to groundwater and the Columbia River. For years, the State has accommodated Energy's requests for more time to complete work. Despite thirteen amendments, many of them premised on the need to address safety issues, Energy has failed to take steps necessary to work safely in a flammable gas environment. In 1997, less than a year after the last significant extensions were made to interim stabilization milestones, Energy abruptly stopped pumping waste from tanks at Hanford. Apparently, Energy has decided that the way to work is do no work at all.

**Consent Decree Established to Enforce Revised Schedule**

Subsequent to Ecology's notice of intent to sue; DOE, Ecology, the U.S. Department of Justice, and the Washington Attorney General's Office entered into settlement negotiations which resulted in a consent decree for the Interim Stabilization Program. The consent decree in August 1999 removed the Interim Stabilization Program from the FFACO, and replaced it with a new agreement and schedule which is enforceable by Ecology through the U.S. District Court for the Eastern District of Washington. The consent decree also revised the date for completion of interim

stabilization an additional 4 years to September 2004. This extension, combined with previously agreed upon amendments, results in a 9-year delay in interim stabilization from the original September 1995 milestone.

In response to the settlement negotiations, DOE began pumping the first group of SSTs scheduled for interim stabilization under the consent decree between March and June 1999. As of the end of September 1999, pumping was progressing ahead of the latest schedule. In its response to our position papers, Ecology stated:

> Ecology would like EPA to note and be cognizant of the tremendous amount of Ecology technical staff time that went into the development of detail process definition systems analysis, and schedule scrubbing that is the basis of the new consent decree. Ecology technical staff worked along side, DOE, and contractor staff in this complete redefinition of the processes needed to interim stabilize a tank. It is this level of detail that gives Ecology confidence that the schedules are technically doable and more importantly that perhaps this time DOE has developed a well defined systems approach to interim stabilization that can be successful.

We acknowledge Ecology's efforts and accomplishment in establishing the new interim stabilization schedule under the consent decree and its confidence that the schedule is technically doable. However, safety issues and insufficient funding could cause further delays in interim stabilization. This is because the decree provides that unforseen safety concerns may constitute good cause for extending the interim stabilization schedule. If DOE is unable to resolve safety issues timely, safety issues may continue to cause delays in stabilizing the SSTs.

The consent decree also provides that DOE may raise unavailability of funds as a defense for failure to comply with the terms of the decree. Therefore, DOE's budget process could also cause delays. As specified in the decree, Ecology does not agree that lack of funding is a valid defense for further delays. However, Ecology decided not to seek judicial resolution of the issue until such time as DOE claims it is unable to perform because of insufficient funds.

## START AND COMPLETION OF WASTE TREATMENT WAS DELAYED

Waste treatment is a critical step in the process of getting hazardous waste out of leaking tanks. Yet, DOE will delay the start of waste treatment by at least 4 years[6] and may delay the completion of waste treatment up to 19 years. Furthermore, Ecology has not been successful in establishing revised, enforceable waste treatment milestones timely with DOE.

The purpose of waste treatment is to convert SST and DST wastes into a solid form for storage and disposal. DOE plans to first separate the wastes into low activity waste[7] (LAW) and high level waste[8] (HLW). The LAW and HLW will then be stabilized within a molten glass matrix, referred to as vitrification, that will be poured into stainless steel containers to harden. The vitrified HLW will be stored at Hanford until a national HLW repository is constructed. The vitrified LAW will be disposed at Hanford in near surface disposal facilities specially designed to meet requirements of the Nuclear Regulatory Commission, the State's Hazardous Waste Management Act, and RCRA.

### The Start of Waste Treatment Will be Delayed at Least 4 Years

The start of waste treatment will exceed the current FFACO milestones for waste treatment by at least 4 years. The FFACO requires DOE to acquire tank waste treatment capacity on an agreed-to primary path or, should DOE determine the primary path to be infeasible, an agreed-to alternative path. Under the primary path, FFACO milestone M-60-12 requires that two contractor-owned and operated Phase I LAW treatment facilities be operational by December 2002. If infeasible, however, then the alternative path's milestone M-61-02 requires that one Phase I LAW facility be operational by December 2003.

Under the primary path, DOE planned to purchase tank waste processing services at fixed-unit prices from contractor-owned and

[6] The 4 year delay is based on the current FFACO alternative path milestone requiring waste treatment to start in December 2003 and DOE's current plan to start waste treatment in December 2007. The original FFACO milestone for the start of waste treatment was December 1999. Therefore, the start of waste treatment will be delayed 8 years from the original milestone if waste treatment begins in 2007.

[7] LAW is high level waste that has been pre-treated to remove a portion of radioactive elements and when stabilized qualifies as incidental waste according to the Nuclear Regulatory Commission (NRC). The NRC allows disposal of LAW in storage appropriately constructed near surface facilities.

[8] HLW is a by-product of reprocessing spent nuclear fuel and is considered the most dangerous form of radioactive waste. HLW requires radiation shielding, special handling techniques, and when disposed of, special measures to isolate it from humans and the environment.

contractor-operated facilities at Hanford. Using this privatization approach, DOE sought to achieve greater accountability and risk sharing with the contractors than under traditional DOE cost-reimbursement contracts.

DOE initially planned to comply with the primary path's milestones through contracting for waste treatment services in two phases: Phase I and Phase II. Phase I was designed to treat and immobilize between 6 and 13 percent of Hanford's tank waste and serve as a demonstration of the elements that would be required for continuing the privatization approach with production-scale facilities during Phase II. During Phase II, DOE envisioned that the remaining tank waste would be processed.

The alternative path was intended as a fall back contracting and funding path. The path's milestones were to become enforceable only in the event that DOE was not maintaining adequate progress under the primary path and elected to pursue the alternative path. Therefore, the alternative path milestone was established to provide additional time to enable DOE to make necessary contracting and funding changes should the primary path become unfeasible.

Following the primary path, DOE awarded Phase I contracts to two contractors during September 1996. The contracts were structured in two parts, a 20-month Part A ending in mid-1998, and an optional Part B planned to last approximately 10 to 14 years. The purpose of the Part A was to evaluate the technical, operational, and immobilization services on a fixed-unit-price basis. If authorized to proceed to Part B, the contractors would then design, build, permit, operate, and deactivate privately financed, LAW and, optionally, HLW treatment plants.

Although the FFACO established milestones for DOE to start LAW waste treatment by either the end of 2002 or 2003, DOE awarded a contract modification in August 1998 which does not comply with either waste treatment milestone. Following completion of Part A by the two contractors, DOE only authorized one contractor to proceed to Part B. In the Part B contract, DOE did not authorize the contractor to proceed with construction and operation of the facilities as originally planned. Instead, the contract only authorized a 24-month design period, ending August 2000 (with the possibility of a 9 month extension), to refine the

design, technical approach, regulatory requirements, and financial and incentive structure of LAW and HLW waste treatment for Phase I.[9]

DOE plans to make a decision on whether to proceed with the contractor into construction and operation of Phase I in late August 2000 when the design phase will be at 30 percent and the contractor can propose fixed-unit prices for waste processing services. DOE estimates that if the contractor is granted an authorization to proceed with construction and operation of the facilities under Phase I, waste treatment will begin by December 2007 and continue through December 2018, a period of 11 years.

Assuming the contractor is authorized to proceed with construction, the August 1998 contract modification will result in a delay of Phase I waste treatment facilities being operational from December 2002 under the primary path (or December 2003 under the alternative path) to December 2007, a delay of at least 4 years. Further, the contract does not establish a commitment by DOE to construct and operate tank waste treatment facilities and DOE has not established an alternative plan for acquisition and operation of waste treatment facilities should the contractor not be authorized to proceed with the remainder of Phase I.

**Completion of Waste Treatment may be Delayed up to 19 Years**

DOE may significantly delay the completion of waste treatment. Primary path milestone M-60-00 requires completion of pretreatment and immobilization of LAW by December 2024 and alternative path milestone M-61-00 requires completion of pretreatment and immobilization of LAW by 2028. In addition, milestone M-51-00 requires completion of vitrification of HLW by December 2028.

DOE plans to build sufficient waste treatment capacity during Phase I to treat approximately 10 percent of the tank waste by volume by the end of 2018. Therefore, approximately 90 percent of the tank waste will be processed during Phase II of waste treatment which is scheduled to begin in 2010. Waste treatment analysis

[9] A major reason for DOE's change in contract scope for Part B was that both Part A contractors identified that DOE's waste treatment plan to build proof of concept facilities with a design life of 10 years was not feasible. Based on the need for a conservative, seismic-resistant design, and input from the financial communities, both contractors proposed more robust, capital-intensive facilities with a design life of 30 years or more. As a result, DOE determined that more time was needed to construct the facilities than originally planned and currently reflected in FFACO milestones.

presented by DOE to Ecology during March 1999 identifies that DOE will be required to significantly expand its treatment capacity during Phase II in order to complete waste treatment by the milestone of 2028.

However, DOE's waste treatment analysis indicates that the option it is considering for waste treatment capacity during Phase II may result in a delay of waste treatment completion for both LAW and HLW from 2028 to as late as 2047, or a delay of up to 19 years. DOE's analysis identifies 5 possible treatment capacity expansion options with waste treatment completion ranging from 2028 to 2047.

| Waste Treatment Capacity Options | | | | |
|---|---|---|---|---|
| **Option** | **Phase I Capacity** | **Phase II Expansion** | **Total Capacity** | **Treatment Completed** |
| Single Line | 10 MT* | 50 MT* | 60 MT* | 2047 |
| Minimum Deliverable | 30 MT | 30 MT | 60 MT | 2047 |
| Contract Reference | 30 MT | 30 or 90 MT | 60 or 120 MT | 2032 or 2047 |
| Double Capacity | 60 MT | 60 MT | 120 MT | 2032 |
| Maximum Capacity | 120 MT | N/A | 120 MT | 2028 |
| *Metric tons per day | | | | |

The waste treatment analysis identifies that DOE's preferred option for expanding treatment capacity is the Contract Reference Option. Under this option, waste treatment will not be completed until about 2047 if DOE decides to contract for waste treatment facilities with a total capacity of 30 metric tons per day during Phase I and 60 metric tons per day during Phase II.

In its response to our position papers, Ecology stated:

> DOE has repeatedly said that it can and will meet 2028 and there has been no agreement to delay the end of treatment of tank waste by Ecology. Actual Phase I treatment performance efficiencies coupled with Phase II facility expansion may allow DOE to meet the 2028 treatment completion requirement.

We agree that DOE should be able to meet the 2028 milestone if it obtains sufficient waste treatment capacity. However, DOE's waste treatment capacity analysis suggests that adequate capacity may not be acquired to treat all of the tank waste by 2028. Furthermore, the delay of the start of waste treatment by at least 4 years may make it more difficult for DOE to meet the FFACO milestone.

## Revised FFACO Milestones Have Not Been Established Timely

Although DOE has made it clear that it would not meet waste treatment milestones in the FFACO, Ecology has not been successful in establishing revised enforceable waste treatment milestones timely.

Recognizing the impact of the August 1998 contract modification on waste treatment milestones, in October 1998, Ecology requested that DOE enter into "Agreement in Principle, Hanford Federal Facility Agreement And Consent Order Tank Waste Remediation System (TWRS) Negotiations In conformance with TWRS Privatization Contract Number DE-RP06-96RL13308 August 1998" (AIP) to establish a negotiation framework for revision of FFACO milestones. In a draft AIP provided to DOE, Ecology stated:

> Signature of the contract will result in major impacts to Hanford Federal Facility Agreement and Consent Order (Agreement) requirements for tank waste processing facility design, construction, and operation, and will similarly impact many other aspects of the TWRS program. Approval to date of only Part B-1 has increased concern regarding further delay in processing plant acquisition. Prior to issuance of contract Part B-1, Agreement requirements represent the sole legal driver for compliance and cleanup of the tank farms.

Ecology requested that the AIP be finalized by early November 1998. Although meetings between senior executives from Ecology,

the Region, and DOE were held during February and April 1999 to resolve DOE's concerns with committing to an AIP, Ecology was unable to obtain a signed AIP from DOE until late May 1999. Therefore, the AIP was signed by DOE over 6 months late.

The AIP required the parties to revise specific milestones for Phase I waste treatment and establish milestones which provide a schedule to negotiate revised milestones for waste retrieval and Phase II waste treatment. The AIP also stated: "The Parties' negotiations must result in clear DOE accountability to move forward with pretreatment and vitrification of Hanford tank waste" and set a July 31, 1999 deadline for completion of the negotiations.

However, the July 1999 deadline specified by the AIP was not met. Ecology, the Region, and DOE signed "Agreement on Principal Regulatory Commitments Pertaining to Hanford Tank Waste Treatment Complex Construction and Operations" on November 15, 1999, or 3½ months after the deadline. Under this new agreement, DOE has committed to start operations for tank waste treatment by 2007 and to complete treatment of 10 percent of the tank waste by volume by 2018[10]. In addition, the three parties have agreed to establish milestones and target dates which provide a specific schedule for the parties to revisit and negotiate FFACO milestone modifications pertaining to Phase II waste treatment. Under the agreement, these commitments will be incorporated into the FFACO through an amendment.

The November 1999 agreement requires the 3 parties to complete negotiations on conversion of the regulatory commitments to FFACO change request format by the end of January 2000. Therefore, revised waste treatment milestones which are enforceable will not be established until after January 2000. If the negotiations are successfully competed by the deadline, it will have taken Ecology approximately 17 months (from the August 1998 contract modification) to reach agreement on revised FFACO milestones for Phase I waste treatment and a negotiation schedule for milestone modifications pertaining to Phase II.

[10] Ecology, the Region, and DOE have agreed that DOE will not seek an alternative path to meet the commitment dates.

## MILESTONE FOR INITIATION OF WASTE RETRIEVAL FOR SST C-106 WAS NOT MET

DOE did not meet FFACO milestone M-45-03A to initiate waste retrieval from SST C-106 timely, and waste retrieval was subsequently delayed for over a year.

SST C-106 is a 530,000 gallon tank built between 1943 and 1944. It is 55 years old, 2¾ times its design life of 20 years. In addition to normal deterioration, heat-generating radioisotopes threaten the tank's integrity. At one time, the tank stored 229,000 gallons of high-level radioactive waste, including 5 million curies of strontium-90. Decay of the strontium-90 generates high heat within the waste. Waste temperatures in the tank were observed in excess of 210 degrees (F). The excessive heat could have resulted in collapse of the tank dome and loss of containment of the tank's contents. The tank required 6,000 gallons of water a month to be added for cooling.

In 1990 Congress passed Public Law 101-510 which required DOE to identify Hanford tanks that "may have a serious potential for release of high level waste due to uncontrolled increases in temperature or pressure," and to develop action plans to respond to this risk. In response to the law, DOE placed tanks with high heat and high pressure conditions on a "Watch List." Tank C-106 was placed on the Watch List during 1991 as Hanford's only high heat tank. DOE considered the high-heat waste in Tank C-106 a priority 1 safety issue because:

(i) If the tank leaked and water cooling was stopped, an uncontrolled release of radioactive material could occur due to failure of the tank's dome, leading to on-site or off-site radiation exposure and a potential loss of human lives, and

(ii) If the tank leaked and water cooling was not stopped, maintaining cooling water levels would result in continual water contaminant loss to area soils and eventually the groundwater.

Completion of FFACO milestone M-45-03A represents a critical first step in determining how waste will be retrieved from the other SSTs as well as closure of the tanks. It required DOE to initiate retrieval of C-106 waste by October 31, 1997[11]. The milestone was

[11] The FFACO did not specify a completion date for the retrieval operations required under interim milestone M-45-03A.

created in order to: (i) resolve the high heat safety issues associated with the tank, and (ii) demonstrate SST retrieval technologies.

On May 6, 1997 DOE requested the due date for milestone M-45-03A be extended to September 1998. The extension was requested because DOE discovered an over-estimate in the ventilation capacity of the waste receiver tank. The over-estimate affected assumptions regarding the ability of the receiver tank to cool the waste, creating a "steam bump" safety issue for the receiver tank. A steam bump occurs when liquid comes in contact with superheated sludge and is converted to steam. The steam may result in over-pressurization of the tank and a release of contaminants to the air outside. DOE concluded it would not be possible to resolve the steam bump issue in time to meet the milestone.

Ecology disapproved DOE's request to extend the milestone. In response, DOE invoked the dispute resolution process outlined by the FFACO and appealed the decision to the Director of Ecology. The Director denied the appeal, stating DOE had been deficient in developing a sound safety analysis and in identifying and resolving safety issues within a reasonable time. The Director informed DOE that they would be in violation of the milestone on November 1, 1997, and that penalties may be assessed in accordance with the FFACO. However, the Director stated that penalties would not be assessed provided retrieval of waste was completed by December 31, 1999.

In November 1997, DOE appealed Ecology's decision to the Pollution Control Hearing Board (PCHB). The PCHB affirmed Ecology's determination in September 1998 denying extension of the milestone. Even though the appeal was denied and no extension was granted, DOE achieved in effect a 1-year delay by pursuing the appeal process. DOE initiated waste retrieval from C-106 in November 1998 instead of October 1997 as required by the milestone.

DOE subsequently completed waste retrieval from the tank earlier than the December 31, 1999 deadline established by Ecology's Director. The waste retrieval was successfully completed in October 1999.

## SST WASTE RETRIEVAL AND CLOSURE MAY BE DELAYED

DOE's current TWRS Operation and Utilization Plan[12] (OUP), dated May 1999, identifies that DOE may not meet the FFACO tank waste retrieval and closure milestones. In addition, funding reductions in retrieval technology development will most likely cause additional delays in retrieval and closure activities.

Milestone M-45-05 requires DOE to retrieve the waste from all 149 SSTs by the end of September 2018 and milestone M-45-00 requires the closure of all SSTs by the end of September 2024. Closure is to follow retrieval of as much tank waste as technically possible, with tank waste residues not to exceed the lesser of, the limit of waste retrieval technology capability or, 360 cubic feet in each of the 100 series tanks and 30 cubic feet in each of the 200 series tanks.

Target milestones M-45-03-T01 and M-45-04-T01 represent critical initial steps towards retrieving waste and closing the SSTs. Target milestone M-45-03-T01 requires completion of a SST retrieval demonstration for one tank by September 2003. Target milestone M-45-04-T01 requires the completion of construction and related testing of the initial SST retrieval systems for an entire tank farm, or an equivalent number of tanks, by November 2003.

### Retrieval and Closure Delays May be 15 and 9 Years, Respectively

DOE's TWRS OUP identifies that DOE may not complete retrieval operations until the end of September 2033, a delay of 15 years from the September 2018 due date specified by the FFACO.

According to the TWRS OUP, DOE's waste treatment contracting changes significantly impacted its waste retrieval plans. The TWRS OUP states:

> Privatization contract changes also had a great impact on SST retrieval plans.…There will not be space available to retrieve any tanks beyond the 241-C-106 demonstration until processing has started and has freed up space to allow further retrieval. In addition, the delays do not allow any of the SST retrieval interim target milestones to be

[12] The TWRS Operation and Utilization Plan provides an integrated and updated planning baseline for DOE's TWRS Program to use for revision of multi-year work plans, mission analysis reports, system specifications, and project plans in order to meet contract commitments for privatized waste treatment facilities.

met. The Tri-Party Agreement compliant Case 0 (achieve the SST Retrieval completion milestone of September 30, 2018) is not technically practical. Retrieval and processing rates are impractically high, the Phase 2 schedule has the same completion date as Phase I, and Tank space is not available.

The TWRS OUP identifies that approximately 100 million gallons of waste will be transferred from the SSTs during retrieval operations. However, the plan discloses that, under DOE's preferred schedule, only about 22 million gallons (or 22 percent) will be retrieved from the SSTs by the original milestone completion date of September 2018. DOE's preferred schedule for completion of retrieval may also result in the delay of the closure of the SSTs until after September 2033, a delay of at least 9 years from the September 2024 due date specified by the FFACO. If so, waste retrieval would not be completed until about 90 years after the first SSTs were built.

During the audit, Ecology was in the process of addressing DOE's plans to delay tank waste retrieval and closure through the negotiations outlined in the "Agreement on Principal Regulatory Commitments Pertaining to Hanford Tank Waste Treatment Complex Construction and Operations", dated November 15, 1999. Under the agreement, Ecology, the Region, and DOE will negotiate milestones and target dates which establish a specific schedule for further negotiation of FFACO milestone modifications pertaining to waste retrieval and tank closure. The agreement requires that the negotiations be completed no later than the end of January 2000.

**Retrieval Technology not Adequately Funded**

DOE has not adequately funded retrieval technology development. In April 1999 DOE suspended funding of the Hanford Tank Initiative (HTI) Project. DOE originally established the HTI Project to develop technologies for waste retrieval and to determine the amount of waste retrieval that is technically achievable. In a April 29, 1999 letter addressed to DOE's Manager of the Office of River Protection, Ecology notified DOE that the funding suspension was a short-sighted action and that the suspension will have negative impacts on future SST retrieval and closure activities. The suspension of funding will most likely result in DOE's inability to meet the FFACO's target milestones and may cause additional delays in retrieval of waste from the

SSTs beyond the 15-year delay identified by DOE's preferred schedule.

## ANNUAL DST OPERATIONAL WASTE VOLUME REPORT WAS DEFICIENT

DOE's DST Operational Waste Volume Report for 1998 was deficient and did not meet FFACO milestone requirements. The FFACO (milestone M-46-00E) requires DOE to submit an annual DST volume projection report identifying additional DST space requirements for tank waste remediation activities. The evaluation is essential to ensure that DOE has sufficient DST storage capacity to accommodate waste transferred from the SSTs during interim stabilization and retrieval operations until the waste is treated. The milestone also requires DOE to submit plans for acquisition of additional tanks if the projection identifies that additional space is needed. The report was due by September 1998.

Although DOE submitted the annual DST Operational Waste Volume Report on time, Ecology determined that the evaluation had serious shortcomings in the assumptions used for the projections. Ecology concluded that none of the scenarios used in the evaluation accurately reflected the actual site planning or requirements of the FFACO. In a deficiency letter addressed to DOE's Administrator for the Hanford FFACO, dated November 30, 1998, Ecology stated:

> A new analysis needs to be conducted and should reflect site planning, consent order requirements, retrieval of C-106 in late 1998/early 1999 and subsequent SST waste retrieval in compliance with the M-45 milestones, interim stabilization liquids of up to 7 million gallons complete in 2004, and treatment capacity available in 2006.
>
> Current projections show that available tank space is exceeded in 2004 to 2006 time frame. With no firm commitment to date from USDOE to obtain waste treatment capacity, even these projections may underestimate the need for new tank space. Given the 6-8 years required for new double shell tank capacity to become available, a decision must be made almost immediately to build new tank space in order for the Hanford site to fulfill its mission of waste retrieval and treatment.

The letter suggested that DOE recalculate the projection using the latest information from the various elements of the program and resubmit the projection by the end of January 1999. Ecology subsequently agreed to give DOE until April 1999 to resubmit the projection. However, DOE did not resubmit the projection to Ecology until late July 1999, or about 10 months after the projection was originally due. Therefore, Ecology was unable to timely determine whether DOE has an adequate plan for ensuring sufficient DST capacity is available to store waste transferred from the SSTs.

Because the revised projection was not submitted to Ecology until late July 1999, we did not evaluate it. However, Ecology informed us in late September 1999 that it had completed its review of the revised projection and determined that the projection was acceptable.

## DELAYS INCREASE RISKS TO THE ENVIRONMENT

There are about 35 million gallons of high level radioactive waste remaining in the SSTs and about 19 million gallons of waste stored in the DSTs. Continued delays in interim stabilization and planned delays in treatment and retrieval of the tank wastes will result in the use of both the SSTs and DSTs significantly beyond the scheduled date of 2028 for completion of waste treatment established by the FFACO. These delays may significantly increase the risks of releases into the environment. DOE's 1998 Report to Congress, Treatment and Immobilization of Hanford Radioactive Tank Waste, stated:

> The waste poses a serious safety concern to the public and to the environment. Since most of the single-shell tanks have exceeded their design life, that risk is growing. Sixty-seven of the single shell tanks are known to have leaked, and several additional tanks are being investigated for potential leaks. Nearly a million gallons of the tank waste has spilled into the soil of the vadose zone[13] below the tanks since the first leak occurred. Recent information has indicated that tank waste radionuclides have moved through the vadose zone and now have reached the groundwater that flows

[13] The vadose zone is the soil zone below the surface above the saturated groundwater area.

> under the Hanford Site and connects with the Columbia River. However, it is not possible to predict when the next tank will leak, and with the passage of time, even the newer, safer, double-shell tanks are approaching the end of their design lives. Removal of waste from the tanks, treatment, and immobilization as an inert waste form will constitute a lasting solution to the problem.

The SSTs were built in the 1940's through the 1960's and had a design life of approximately 20 years. At least 1 million gallons of highly toxic and radioactive waste has already leaked from 67 of the 149 SSTs. Some of the waste has reached the groundwater, and DOE currently has no method of removing all of the hazardous contaminates from the groundwater before it reaches the Columbia River. DOE reported that the potential for accident resulting in large releases of radioactive and chemical contaminants will increase as the tanks age. Releases of tank waste to soil and groundwater will be more difficult and expensive, if not impossible, to remediate. Therefore, the extended use of the SSTs may require subsurface barriers to prevent migration of contamination through the vadose zone to the groundwater. In addition, extensive use of surface barriers both in the near term, as interim corrective measures, and in the long term, as closure methods, may be required to prevent further contamination of the groundwater.

The DSTs will be near or will exceed their 50 year design lives by 2028, the current milestone for completion of waste treatment. DOE's preferred schedule for waste treatment is to extend completion of treatment to approximately 2047. By 2047, the average age of the DSTs will be 67 years. Extending the waste treatment schedule will require the use of the DSTs significantly beyond their design lives unless sufficient additional DST capacity is built. The use of the tanks beyond their design lives will increase the risk of releases into the environment from tank structural failures.

The 1 year delay in retrieval of waste from Tank C-106 increased the risk of an uncontrolled release of radioactive wastes into the environment from a catastrophic failure of the tank. In addition, an extension of the retrieval of waste from the SSTs from 2018 to 2033 will require the continued storage of waste in the failing SSTs. By 2033, some of the SSTs will have exceeded their design

lives by about 70 years. Insufficient funding of the HTI program may cause even further delays in retrieval of the wastes from the SSTs.

Deficient DST space evaluations may cause additional delays in the retrieval and treatment of the tank waste. DOE estimates that it will take 6 to 8 years to build new DSTs. Based on DOE's DST Operational Waste Volume Projection Report for 1998, DOE will need 1 additional DST for fiscal 2001 and up to 6 additional DSTs by 2012 in order to meet current waste retrieval and treatment milestones. As of September 1999, DOE did not have any contracts for construction of additional DSTs.

## REASONS FOR LACK OF PROGRAM PROGRESS AND COMPLIANCE

We attribute the conditions to three principal causes. First, DOE has demonstrated neither an ability nor sufficient commitment to manage the TWRS Program to meet FFACO milestones and to provide adequate protection to human health and the environment. Second, DOE has not sufficiently funded all TWRS Program activities. Third, Ecology and the Region have not developed and implemented an effective oversight and enforcement strategy.

### DOE Has Not Managed the TWRS Program Effectively

Recent reports by DOE and GAO on TWRS Program operations identified significant weaknesses in management of the Program. Specifically:

(i) DOE report entitled Review of the Federal Management of the Tank Waste Remediation System Project (January 1998). The report was based on the evaluation results of an independent nine-person review team of DOE employees and contractors chartered by the Secretary of DOE to investigate confidential allegations regarding management of the TWRS Program. The report included the following findings:

•Current TWRS management processes for addressing safety and technical issues lack sufficient rigor to consistently detect, manage, and resolve problems before they become major issues for the program. This lack of rigor is evident throughout several aspects of TWRS management processes.

•Processes for reviewing and resolving technical and safety comments are weak and have failed to address significant issues in several cases.

•Management problems in previous self-assessments persist.

(ii) A March 1996 DOE report entitled DOE-RL TWRS Organizational Effectiveness Study Report (March 1996). The report was based on evaluation results of a review team of senior DOE staff with Government and private industry experience who were external to the TWRS Program. It included the following findings:

•Organizational structure and responsibilities have not been consistently defined in a clear and timely manner to the DOE-TWRS staff.

•Project managers are not all fully trained, knowledgeable or skilled in project management practices.

•Decision making, problem resolution, action plan development, and implementation are not timely or of required quality.

•DOE-TWRS administrative procedures required to support efficient "Conduct of Operations" are not existent, not effectively utilized, or require further development.

•Effectiveness of the DOE-TWRS organization is adversely impacted by some poor management and administrative practices.

(iii) GAO's report entitled Nuclear Waste: Department of Energy's Hanford Tank Waste Project-Schedule, Cost, and Management Issues (GAO/RCED-99-13, October 1998). GAO pointed out that DOE has had a history of not fully implementing its management and oversight plans at its facilities. GAO also said that outstanding issues concerning technical staff, site support activities, and project administration may keep DOE from being fully prepared to oversee the Hanford Tank Waste Project.

(iv) GAO's report entitled Nuclear Waste: Understanding of Waste Migration at Hanford is Inadequate for Key Decisions (GAO/RCED-98-80, March 1998). GAO concluded that DOE has no strategy for investigating the contaminated soil beneath the tanks soil and above the groundwater. GAO found that DOE: (i) assigned low funding priority to most proposed studies of the contaminated soil, (ii) responded slowly to experts' recommendations for improving ongoing studies, (iii) did not integrate the information needs of the three organizational units responsible for cleanup activities, and (iv) does not know what information is needed for key cleanup decisions.

**Insufficient Emphasis on Meeting Milestones**

DOE has not placed sufficient emphasis on meeting key milestones pertaining to interim stabilization, waste treatment, waste retrieval, DST space requirements, and closure of the SSTs.

DOE's recent actions and current planning involving acquisition and operation of tank waste treatment facilities provide an example of DOE's lack of commitment to meeting important FFACO milestones. DOE made a unilateral decision to delay waste treatment even though it had committed to specific milestones under the FFACO. In addition to DOE's decision to not comply with current milestones, the Department was unwilling to commit to revised milestones for construction and operations of waste treatment facilities until mid November 1999. This commitment by DOE, "Agreement on Principal Regulatory Commitments Pertaining to Hanford Tank Waste Treatment Complex Construction and Operations", will not result in enforceable milestones until after negotiations on revised FFACO milestones are successfully completed in January 2000.

Prior to November 1999, DOE was unwilling to commit to revised waste treatment milestones because it was concerned that agreeing to milestones for start of waste treatment construction and operations would put it in a disadvantage when negotiating contract clauses for construction and operation of waste treatment facilities. In addition, DOE took the position that its schedules for construction of waste treatment facilities and their operations were only estimates and may change. As a result of DOE's position on waste treatment commitments, it took Ecology over 6 months to

finalize the AIP and 13[14] months to sign the "Agreement on Principal Regulatory Commitments Pertaining to Hanford Tank Waste Treatment Complex Construction and Operations."

**TWRS Program Has Not Been Sufficiently Funded**

DOE has not sufficiently funded all TWRS Program activities. For example, DOE did not adequately fund the interim stabilization operations during fiscal 1998 and it suspended funding for HTI. According to Ecology, DOE's inability to obtain a commitment by Congress to adequately fund the TWRS Program has contributed to delays in the Program. In its response to our position papers, Ecology stated:

> An additional "cause"... is the issue of capital cost and the historical lack of DOE ability to obtain commitment from Congress to fund this costly solution for the nation's largest environmental cleanup effort. Today much of this decision will be based on the financial and pricing package BNFL puts forward, the contractual scoring agreements needed from the Congressional Budget Office and finally funding commitments from Congress. The issue of tank waste treatment has historically always been and will always be controlled by funding commitment for this large capital project. All of this will either succeed or fail in the year 2000. If it fails, there will be 5 to 10 years delay in contracting and funding a new arrangement for waste treatment.

**Ecology and Regional Oversight and Enforcement Have Not Been Sufficient**

Ecology and the Region have not developed and implemented an effective oversight and enforcement strategy. Ecology as the lead regulatory agency, developed an oversight and enforcement strategy for the TWRS Program with primary elements of negotiation and partnering with DOE to achieve compliance with FFACO milestones and regulatory requirements. As a result, Ecology has historically focused on negotiation to address FFACO compliance issues rather than formal enforcement. While Ecology with the support of the Region has been successful in resolving many issues through its constant, ongoing negotiation efforts, additional enforcement actions were needed.

For example, Ecology's experience with interim stabilization of the SSTs showed that negotiation, by itself, was not successful in

[14] Thirteen months from Ecology's October 1998 request to DOE for an AIP.

achieving compliance with key FFACO milestones. Ecology's negotiations in response to DOE's inability to meet interim stabilization milestones resulted in continued extensions of the milestones. As a result of the lack of progress in interim stabilization, Ecology threatened a civil action. This threat of an enforcement action resulted in the entry of an enforceable consent decree in Federal Court that establishes a schedule for completion of interim stabilization of the SSTs by 2004.

Ecology's experience with DOE on addressing waste treatment delays has also shown that continued negotiation has not achieved timely resolution of significant compliance issues. As discussed earlier, it took Ecology 13 months to obtain a commitment from DOE to negotiate a FFACO change request to address planned and potential delays in waste treatment, waste retrieval, and closure of the SSTs.

The need for more effective regulation of the TWRS Program is reflected in a December 1998 letter from the Hanford Advisory Board[15] to senior DOE management and Ecology's Director. In the letter, the Hanford Advisory Board stated:

> The health, environmental, and economic consequences of a failure of the tank waste treatment and disposal program are extreme. The Board has been consistently correct in its warning of tank waste pitfalls. The current lack of leadership on the parts of DOE and Ecology in the implementation of this program is alarming. Without real leadership and action in the near-term, this program will fail. Management of this vital program through inaction is totally unacceptable.

## CONCLUSION

DOE has not demonstrated the ability or commitment to meet milestones for interim stabilization and is currently not working towards meeting several other key milestones. The waste stored in the SSTs and DSTs represents about 60 percent of the DOE's nationwide inventory of high level radioactive waste. The majority

[15] The Hanford Advisory Board is an independent, non-partisan, and broadly representative body consisting of a balanced mix of the diverse interests that are affected by Hanford cleanup issues. The primary mission of the Board is to provide informed recommendations and advice to DOE, Ecology, and the Region on major policy issues related to the cleanup of the Hanford site.

of this waste is currently stored in SSTs which are over 30 years past their design lives and many of them have had leaks. DOE estimates that it will cost about $30.5 billion to cleanup the 177 storage tanks at Hanford and Phase I of the cleanup alone will cost $11.3 billion. Additional delays in the TWRS Program increases the risk of releases into the environment from tank failures and threats to human health. Furthermore, additional delays and tank failures will increase the cost of the cleanup program.

DOE's history of poor performance, the significance of the environmental problems, the technical complexity of the solutions, and the cost of the cleanup program necessitate that both Ecology and the Region develop and implement an oversight and enforcement strategy that ensure compliance with FFACO milestones for the TWRS Program. In our view, the revised strategy should include increased use of formal enforcement actions, to include penalties, when FFACO milestones are not met by DOE in order to establish a deterrence to noncompliance.

In addition, Ecology, the Region, and appropriate EPA national program managers should work jointly with DOE to ensure the TWRS Program is sufficiently funded to meet FFACO milestones. If DOE does not receive sufficient funding for the TWRS Program from Congress, waste treatment and retrieval could be significantly delayed.

In response to our request for suggested recommendations, Ecology said that EPA should make the TWRS Program a national priority and establish Hanford tank farms and acquisition of treatment capacity as performance measures. Ecology also said that EPA should advise DOE on DOE's budget priorities and urge DOE to elevate Hanford tank waste treatment as a complex-wide priority. Furthermore, Ecology said that it needed additional support by EPA on enforcement actions to help counter DOE resistance.

We agree that EPA should make the TWRS Program a national cleanup priority and should advise DOE to elevate the program to a higher funding priority. We also agree that EPA needs to increase its participation with Ecology in oversight and enforcement of FFACO milestones for the program.

The Federal Managers Financial Integrity Act (FMFIA) requires the Regional Administrator to annually make a systemic

assessment of regional management controls that protect programs and resources from fraud, waste, mismanagement, and help control programs to achieve intended outcomes. After the assessment is made, the Regional Administrator is required to provide personal assurance that management controls are reasonable to ensure protection of programs, operations, and functions and to notify the EPA Administrator of any deficiencies in management controls. DOE's noncompliance with RCRA and the FFACO poses a significant threat to human health and the environment. Therefore, we believe that the need for additional oversight and enforcement of RCRA requirements and FFACO milestones by Ecology and the Region is a matter that should be reported as a management control deficiency to the Administrator.

In its response to our position papers, the Region stated:

> EPA and Ecology clearly support a position that effective oversight and/or enforcement of the TWRS Program is necessary... Region 10 believes that EPA and Ecology should be able to negotiate and apply an optimal mix of state and federal resources and authorities to accomplish the regulatory and environmental goal of full compliance and treatment of tank wastes.

## RECOMMENDATIONS

We recommend that the Regional Administrator:

2-1. Negotiate with Ecology to address oversight and enforcement responsibilities regarding DOE compliance with FFACO and RCRA requirements as part of the 2000/2001 Performance Partnership Agreement (PPA) process. Negotiations should consider:

a. Appropriate selection of enforcement and compliance tools available respectively to EPA and Ecology under RCRA, Washington's Hazardous Waste Management Act, and the Hanford FFACO, specifically considering the availability and suitability of each with respect to achieving DOE compliance.

b.Existing State and Federal compliance and penalty policies, including EPA's RCRA Civil Penalty Policy and Washington's Hazardous Waste Toxics Reduction Program Compliance Assurance Policy.

2-2.Negotiate with Ecology through the fiscal 2000/2001 PPA process specific enforcement or other programmatic actions directed towards timely resolution of tank waste treatment issues and establishment of appropriate enforceable milestones.

2-3.Consult with Ecology prior to and during FFACO change negotiations during fiscal 2000 to develop appropriate language addressing mitigation or prevention of environmental risks associated with extending waste treatment, waste retrieval, and closure milestones to be included in DOE FFACO change packages.

2-4.Consult with EPA National Program Managers to determine what actions can be taken at the EPA Headquarters level to achieve a higher priority, including receiving funding, on cleanup of the Hanford tanks.

2-5.Report the weaknesses in the Hanford TWRS Program as a management control deficiency in the annual FMFIA assurance letter to the EPA Administrator.

## REGION'S AND ECOLOGY'S COMMENTS

The Region and Ecology concurred with the recommendations and provided an implementation schedule for each recommendation. The Region and Ecology commented that they have already initiated efforts in response to Recommendation 2-2 as illustrated by EPA's February 3, 2000 letter to Ecology committing EPA support for a final tank waste determination for FFACO milestones. The Region and Ecology also said that they are continuing close collaboration and communication as resolution of tank waste milestone and Land Disposal Restriction reporting requirement disputes continue.

In addition, the Region and Ecology stated that they are already engaged in responding to Recommendation 2-3 through joint participation in current negotiation of tank waste treatment and retrieval milestones.

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# CHAPTER 3

## OVERSIGHT OF TANK SAFETY ISSUES NEED ATTENTION

Although DOE has responsibility for compliance with State and Federal hazardous waste regulatory requirements, Ecology has not provided sufficient oversight of some safety issues involving SSTs and DSTs. Specifically, Ecology: (i) has not ensured that DOE satisfactorily met a September 1998 FFACO milestone for the resolution of a flammable gas safety question for SSTs and DSTs; and (ii) was not timely in providing oversight on DOE's resolution of serious waste level growth and gas retention safety issues involving DST SY-101.

Unresolved flammable gas safety issues have caused significant delays in stabilizing the SSTs, and may cause additional delays in the TWRS Program and increased risks to human health and the environment. In addition, DST SY-101 may eventually lose double containment unless the safety issues for the tank are adequately and timely resolved, and plans to transfer the waste to another tank may create similar safety problems in the receiving tank. A loss of double containment increases the risk of a release of hazardous and radioactive wastes into the soil and groundwater.

Ecology was not able to effectively oversee and evaluate DOE's resolution of safety issues mainly because it has not placed sufficient emphasis on filling a safety position supporting the TWRS Program. This position became vacant during August 1998 and was not filled at the time of our audit in September 1999.

### BACKGROUND

RCRA Subtitle F, Section 6001 requires Federal departments and agencies engaged in any activity resulting, or which may result, in the disposal or management of solid or hazardous waste to comply with State and Federal hazardous waste regulations. Therefore, DOE, as the owner and operator of the Hanford Federal Facility, is required under RCRA to comply with the State of Washington's and EPA's hazardous waste regulations.

WAC Chapter 173-303-*Dangerous Waste Regulations* and 40 CFR, Part 265-*Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities* provide regulations applicable to interim status tank systems used to store or treat hazardous waste. WAC Chapter 173-303-400 and 40 CFR, Part 265, Subpart C require in part that hazardous waste treatment, storage, and disposal facilities be maintained and operated to minimize the possibility of a fire, explosion, or any unplanned sudden or non-sudden release of hazardous waste or hazardous constituents to air, soil, or surface water which could threaten human health or the environment.

The Hanford FFACO includes requirements and milestones that DOE must comply with in order to bring the Hanford Facility into compliance with RCRA and the State of Washington's Hazardous Waste Management Act. Among the FFACO requirements are milestones for mitigation and resolution safety issues for the SSTs and DSTs.

Ecology has responsibility for oversight and enforcement of the RCRA units at Hanford under both Washington's EPA approved Hazardous Waste Program and the FFACO. As the lead regulatory agency for the SSTs and DSTs, Ecology is required to provide regulatory oversight, including preparation of responses to documents submitted by DOE.

## RESOLUTION OF FLAMMABLE GAS SAFETY ISSUE WAS NOT VERIFIED

Ecology has not ensured that DOE satisfactorily met FFACO interim milestone M-40-09, which included a requirement for the resolution of a flammable gas safety question for SSTs and DSTs by the end of September 1998. Safety issues, principally flammable gas, were the primary causes cited by DOE in FFACO modifications delaying interim stabilization.

Radioactive waste in the tanks generates flammable gas, primarily hydrogen. The flammable gas represents a significant safety issue because it can be trapped in some waste types and released episodically, concentrating in the tank dome where it could burn or explode if ignited.

In 1990, DOE declared a flammable gas unreviewed safety question (USQ) based on the generation and possible ignition of flammable gas. A USQ is declared by DOE when aspects of the facility design or operation relied upon to authorize operation (the

authorization basis) may be inadequate. Closure of a USQ milestone should not occur until the related safety questions have been resolved.

In general, the USQ concluded there was inadequate analysis of flammable gas hazards and the controls to manage them. The original USQ, applicable to 23 tanks, was eventually expanded to cover 176 of the 177 SSTs and DSTs. DOE reported to Ecology during September 1998 that it completed the milestone for closing the flammable gas USQ. However, at the time of our audit fieldwork in July 1999 Ecology had not verified that the milestone had been satisfactorily met. Our review of the report DOE submitted to Ecology disclosed that DOE reported controls were adequate for safe storage of tank waste, but they were not adequate for global waste disturbing activities including pumping of the SSTs.

In its response to our position papers, Ecology said that the importance placed on interim milestone M-40-09 is somewhat exaggerated. Ecology stated that closing a USQ does not mean that all technicalities of the safety issue are understood. Ecology believes that major milestone M-40-00, which requires DOE to resolve all flammable gas safety issues by September 2001, is more significant.

We acknowledge that interim milestone M-40-09 does not close all flammable gas safety issues and has lesser significance than the major milestone M-40-00. However, we believe that Ecology needs to ensure that all milestones associated with flammable gas are adequately completed. Flammable gas has been an on-going problem which has been cited in FFACO modifications delaying interim stabilization since 1990 and needs to be resolved.

## OVERSIGHT OF SAFETY ISSUES FOR SY-101 WAS NOT TIMELY

Ecology was not timely in providing oversight of DOE's efforts to resolve serious safety issues involving DST SY-101. Ecology knew in January 1999 that the conditions in the tank had significantly deteriorated and posed a significant risk to human health and the environment. Yet, Ecology did not assign sufficient staff to oversee DOE's actions until June 1999.

### SY-101 Designated as Watch List Tank

Tank SY-101 contains approximately 1 million gallons of the most highly concentrated waste stored at Hanford. It has been designated as a Watch List tank since January 1991 as a result of

the tank's generation of a flammable mixture of gases that includes hydrogen, nitrogen, nitrous oxide, and ammonia. Until 1993, the waste in the tank retained gas and periodically released large volumes in sudden, buoyant displacement gas-release events approximately every 100 days. Some of these gas releases exceeded 10,000 cubic feet. This gas retention caused the waste level in the tank to rise and suddenly drop as the gas was released.

During July 1993, a mixer pump was installed in the tank to test the effectiveness of mixing waste at controlling the large gas release events and fluctuating waste level. DOE declared the tank mitigated during 1994 after the completion of a series of highly successful tests with the pump.

**Tank Conditions Deteriorated**

However, DOE notified Ecology in December 1997 that it had identified an unexplained rise in the tank's waste level despite continued use of the mixer pump. At that time, DOE reported that a small rise in the waste level had occurred in the tank over the previous 13-month period and that the rise was not considered to be an immediate safety risk. DOE also disclosed that it had increased mixer pump operations to reduce the waste level rise and was evaluating the effectiveness of the additional operations. In addition, DOE reported that it was developing an action plan to determine the cause and to control of the waste level rise.

In January 1999, DOE informed Ecology that the conditions in the tank had significantly deteriorated and posed a significant risk to human health and the environment. Specifically, DOE informed Ecology that the tank's waste level was rising at an accelerated rate and it estimated the tank would lose double containment by October 1999 if the waste level rise was not mitigated. DOE estimated that the tank would lose double containment at 458 inches when the waste level rose into the single contained dome space area of the tank. As of January 1999, DOE reported that waste level in the tank had reached just over 425 inches.

As of January 1999, DOE also told Ecology that it attributed the accelerated waste level rise to increased gas retention in a floating crust layer in the tank and that the increased gas retention elevated the risk of a large flammable gas release. DOE informed Ecology that it planned to mitigate the safety issues by October 1999 through: (i) removing at least 100,000 gallons of the waste from the tank; (ii) diluting it with water at a 1 to 1 ratio; and (iii) placing the diluted waste in another DST, DST SY-102, for storage.

DOE subsequently disclosed in an April 1999 revision to a USQ for the tank that the ongoing growth of the crust was causing the waste level increase and a commensurate decrease in tank head space. A decrease in head space increases the risk of fire, explosion, or structural failure because flammable gas releases from the waste are concentrated in a smaller area. The USQ also reported that the increased growth in the thickness of the crust could cause the bottom layer of the crust to encroach on the mixer pump suction and, as a result, degrade the effectiveness of the pump in mitigating large gas releases.

### Tank Advisory Panel Expressed Concern with Tank Conditions

During April 1999, DOE also requested advice on the resolution of the tank's safety issues from the Tank Advisory Panel (TAP), a panel of experts on nuclear and mixed wastes. The TAP commented that it should have been notified earlier about the conditions of the tank because the conditions had changed significantly over the 8 months since DOE last met with a sub-panel of its members. The TAP advised DOE that it was evident most of the gas generated by the waste was being retained in the tank and this additional safety concern heightened the urgency with which the gas retention problem, as well as the waste level rise, should be addressed.

The TAP also said that the current path forward for mitigation primarily focused on crust growth and that DOE's plan needed to be reviewed to ensure that increased gas retention was given equal attention. As a result, the TAP did not consider the initial transfer of waste from SY-101 as a solution to the safety issues. The TAP also recommended that DOE develop and evaluate potential solutions as soon as possible and before proceeding with additional transfers or other dilution methods.

Furthermore, the TAP expressed concern that transferring waste from the DST SY-101 to DST SY-102 might create similar safety issues in DST SY-102. The TAP stated:

> With regard to stability of SY-102 waste after the transfer we have been given only a cursory description of plans to study effects of mixing in SY-102. A recent report distributed during the meeting analyzes the possibility of a bouyancy driven gas release event (GRE) and finds that, under conservative tank conditions (should all solids in the waste remain solids), buoyant-type gas release is not fully

eliminated. While the case is said to be conservative, the data is yet to be collected to prove insufficient solids will be added to the tank to permit buoyant turnovers.

Consequently, to resolve safety concerns, the TAP recommended that DOE obtain a sufficient understanding of the kinetics of dissolution/precipitation and settling of solids in DST.

### Ecology's Oversight Was Insufficient Until June 1999

Although Ecology managers told us that the waste level rise and flammable gas retention issues of the tank were considered very serious, Ecology did not dedicate sufficient staff resources to monitor and formally evaluate DOE's remediation activities until the beginning of June 1999, or just 4 months before DOE estimated the tank might lose double containment. As a result of the significance of the concerns expressed by the TAP during April 1999, Ecology assigned two staff members on a part-time basis to oversee DOE's remediation activities for the tank. In addition, Ecology issued a letter to DOE on June 3, 1999 recommending immediate attention to the waste level and flammable gas safety issues. Ecology also requested additional information on conditions in the tank and DOE's planned actions to resolve the issues.

In its response to our position papers Ecology agreed that there was a lapse in oversight on the SY-101 safety issue between January 1999 and June 1999, during which critical developments within tank waste behavior were underway. Ecology said they made efforts to be as involved as possible during that time, including involvement in the April 1999 TAP meeting on this issue. Ecology also said that it issued another concern letter on SY-101 to DOE during September 1999.

## UNRESOLVED SAFETY ISSUES INCREASE RISKS TO THE ENVIRONMENT

Unresolved flammable gas safety issues have caused significant delays in stabilizing the SSTs, and may cause additional delays in the TWRS Program and increased risks to human health and the environment. Therefore, Ecology needs to ensure that all FFACO milestones requiring resolution of flammable gas safety issues are adequately completed by DOE.

In addition, Tank SY-101 may eventually lose double containment unless the safety issues for the tank are adequately and timely resolved. Furthermore, DOE's plan to avoid this hazard by

transferring waste from the tank may create similar safety problems in the receiving tank, Tank SY-102. A loss of double containment increases the risk of a release of hazardous and radioactive wastes into the soil and groundwater.

In its response to our position papers, Ecology stated the crust level growth has been static since June 1999, and as a result, the loss of double containment appears to lessened. However, Ecology agreed that the tank needs to be pumped and that this is anticipated to take place during mid-December 1999.

Ecology's comments are noted. We also note that subsequent to our fieldwork, DOE did complete an initial transfer of waste in December 1999, and as a result, the short term risk of loss of double containment appears to be mitigated. However, the safety issues have not been resolved. The TAP stated that the initial waste transfer is not the solution to the safety issues, and that DOE's current path forward does not adequately consider safety issues caused by increased gas retention. In addition, Ecology's September 9, 1999 letter to DOE expressed several concerns with DOE's plan to mitigate the crust growth and gas retention beyond the initial waste transfer. Ecology said the chemistry of the waste is not well understood, and raised concerns regarding the possibility of creating a reactive condition in the waste receiver tank.

If the safety issues are not adequately remediated, risks associated with gas retention in SY-101 may remain (including loss of containment), and similar problems may be created in the waste receiver tank.

## ECOLOGY HAS NOT PLACED SUFFICIENT EMPHASIS ON FILLING SAFETY POSITION

Ecology was not able to effectively oversee and evaluate DOE's resolution of safety issues, including the DST SY-101 issues, mainly because it has not placed sufficient emphasis on filling a safety position supporting the TWRS Program. This position became vacant during August 1998 and was still not filled at the time of our audit in September 1999. According to Ecology management, Ecology tried to fill the vacancy internally in response to a reduction in force of some other agencies within the Department. However, the internal recruitment was unsuccessful. As a result, Ecology was in the process of trying to fill the vacancy through sources external to Ecology.

According to the project manager for TWRS storage operations, Ecology needs to fill a half-time safety position in order to provide adequate oversight coverage for TWRS Program safety issues. In a December 1998 justification for filling the safety position vacancy, Ecology's project manager responsible for SST and DST storage operations said that many of the safety issues for the TWRS Program have not been addressed because Ecology staff assigned to safety issues shrank over the past 2 years from approximately 120 percent of a full time position to the current empty status. In the justification for filling the safety position vacancy the project manager stated:

> Safety is often the excuse DOE uses to explain delays… Safety played an important role in recent TWRS successes such as the PCHB decision in favor of Ecology on the C-106 Tank Retrieval Issue and current Interim Stabilization negotiations. Therefore, it is imperative that this position be given a high priority and be filled as soon as possible.

In its response to our position papers, Ecology concurred that the safety position was unfilled between August 1998 and June 1999. However, Ecology believed that even when no staff were expressly dedicated pertinent safety issues were still adequately addressed.

We acknowledge that Ecology was involved in safety issues to some extent during the period between August 1998 and June 1999. Although two staff were assigned on a part-time basis to oversee DOE's safety activities for DST SY-101, Ecology's safety position was still unfilled as of September 1999. The lack of an evaluation of DOE's completion of the FFACO USQ milestone, and the lack of oversight over the DST SY-101 safety issues until June 1999, show a need for improvement in Ecology's oversight of DOE's resolution of safety issues. Given their importance, adequate resources need to be continually committed to safety issues.

## RECOMMENDATIONS

We recommend that the Regional Administrator:

> 3-1.Negotiate fiscal 2000/2001 PPA commitments with Ecology to oversee TWRS program safety issues.

3-2.Review Ecology's progress towards meeting these commitments during mid-year and end of year PPA evaluations. It is important that the commitments address Ecology's safety position staffing shortage.

**REGION'S AND ECOLOGY'S COMMENTS**

The Region and Ecology concurred with the recommendations and provided an implementation schedule for each recommendation.

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# CHAPTER 4

## ECOLOGY IS NOT CONDUCTING ENOUGH TANK INSPECTIONS

Although DOE is responsible for compliance with State and Federal hazardous waste regulations, Ecology, as the lead regulator, did not conduct a sufficient number of tank inspections to assess DOE compliance with RCRA.

Specifically, Ecology inspected only 22 percent of the tanks over a period of approximately 7 years even though RCRA, as amended by the Federal Facility Compliance Act, required thorough annual inspections of Federal facilities. In addition, inspection coverage for the tanks did not meet inspection commitments specified in PPA workplans for the State's fiscals 1998 and 1999. Ecology had not increased the number of inspections although 7 of the 8 inspections conducted during the 7-year period ended February 1999 identified serious compliance issues.

These conditions occurred because: (i) Ecology was not placing a sufficiently high priority on conducting tank inspections; and (ii) the Region was not monitoring PPA inspection commitments for Hanford**.**

### BACKGROUND

Section 3007 of RCRA, as amended by the Federal Facility Compliance Act of 1992, requires EPA or states with EPA approved hazardous waste programs to conduct a thorough inspection of each Federal facility that treats, stores, or disposes of hazardous wastes on an annual basis. The purpose of the inspection is to enforce compliance with RCRA.

The Hanford Facility qualified for interim status, and the SSTs and DSTs are currently operating under interim status requirements. WAC Chapter 173-303-*Dangerous Waste Regulations* and 40 CFR, Part 265-*Interim Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities* provide regulations applicable to interim status tank systems used

to store or treat hazardous waste. The WAC Chapter 173-303-400 and 40 CFR, Part 265, Subpart J include requirements for assessment of the integrity of tank systems, containment and detection of releases, general operating requirements, responses to leaks or spills, disposition of leaking or unfit for use tank systems, and closure and post closure care.

## INSPECTION COVERAGE WAS INADEQUATE

Ecology inspected only 22 percent of the tanks over a period of approximately 7 years even though RCRA, as amended by the Federal Facility Compliance Act, required thorough annual inspections of Federal facilities. Ecology's inspection coverage for the tanks also did not meet PPA workplan commitments for fiscals 1998 and 1999. The required number of inspections had not been conducted although 7 of the 8 inspections conducted during the 7-year period ended February 1999 identified serious compliance issues.

### Small Percentage of Tanks Have Been Inspected

Although thorough annual inspections of the Hanford Facility were required by RCRA, Ecology inspected only 39 of the 177 (22 percent) SSTs and DSTs to determine whether the tanks were in compliance with interim status regulations over a 7-year period.

Ecology performed only 8 tank/tank farm[16] inspections during the 7-year period from January 1992 through February 1999 which assessed SST or DST compliance with the interim status regulations for tank systems. Ecology identified 28 "tank farm" inspections of various scopes performed during this period, including inspections of waste drums, waste containers and training. However, only 8 of these inspections covered SST or DST compliance. Additionally, no tank inspections were performed during the 3-year period between May 1993 and May 1996.

Furthermore, the inspections covered only 21 of the 149 SSTs and 18 of the 28 DSTs. The inspected tanks were located in 4 of the 12 SST tank farms and 3 of the 6 DST tank farms. Ecology did not conduct inspections of any tanks located in 8 (67 percent) of the SST tank farms and 3 (50 percent) of DST tank farms during the 7-year period.

[16] Inspections conducted by Ecology were of either individual tanks or tank farms. A tank farm is a group of tanks that were constructed together and are located in the same geographical area. Of the eight inspections, 5 were of individual tanks and 3 were of tank farms.

In Ecology's response to our position papers regarding the small number of tank inspections, Ecology said that oversight of tank farms includes efforts beyond the compliance inspection staff, including staff involved with permitting and closure plan development, characterization, interim stabilization, and FFACO milestones.

Acknowledging the importance of these efforts, we believe they do not replace the role of inspections. The Federal Facility Compliance Act specifically states that inspections are required to enforce compliance with RCRA.

## Inspection Coverage Did Not Meet PPA Commitments

Ecology's inspection coverage for the SSTs and DSTs did not meet inspection commitments specified in PPA workplans for the State's fiscals 1998 and 1999. The PPA's purpose is to establish the Region's and Ecology's mutual goals, objectives, activities, and performance measures to meet the environmental and public health priorities of the State of Washington. Towards meeting this purpose, the PPAs between Ecology and the Region for the State's fiscals 1998 and 1999 included workplans of activities that Ecology was to accomplish each year. The workplans for both years included SST and DST tank farm inspections at Hanford. These workplan commitments amount to a six year inspection cycle for all SSTs and DSTs.

Although the fiscal 1998 PPA specified that Ecology was to inspect one SST tank farm and one DST tank farm, it only met the DST tank farm (SY Tank Farm) inspection requirement. With respect to SSTs, Ecology only inspected one tank (Tank SX-104) during the year. In addition, Ecology did not inspect any tanks during fiscal year 1999 even though the PPA required 2 SST and 2 DST tank farm inspections. Thus, rather than inspect 6 of the 18 SST/DST tank farms during the 2 years, only 1 tank farm plus 1 tank were inspected. If the fiscal 1998 and 1999 rate of inspections continues, it will take about 18 years to inspect all tanks.

In its response to our position papers, Ecology agreed that the general tank farm inspections described in the PPA have not been conducted. Ecology also said they have ceased implementation of the "six year inspection cycle" at tank farms in previous plans. Ecology stated a comprehensive inspection of SST tank farms is underway, as well as a review of the FFACO milestone for DST integrity assessment. Ecology also stated that next year's inspection planning will be decided beginning February 2000.

**Inspections Identify Serious Compliance Issues**

Ecology had not increased the number of inspections even though 7 of the 8 inspections that were conducted identified serious compliance issues. Ecology's inspections disclosed that DOE consistently failed to comply with requirements to: (i) provide adequate leak detection systems; (ii) adequately inspect or respond to deficiencies in tank systems; and (iii) adequately respond or have measures to respond to leaks, spills, and disposition of unfit for use tank systems. DOE had also failed to timely notify Ecology of indications of leaks of radioactive waste, a very serious violation. The results for the 7 inspections where significant compliance issues were identified are summarized below.

- Inspections of SY Tank Farm, April 1998, and DST SY-101, February 1992. Ecology's February 1992 inspection of DST SY-101 found: (i) a leak detection device was incorrectly set[17] for more than 2 years; (ii) leak detection equipment was inoperable for at least 3 months; and (iii) a leak detection pit was filled with liquid of an unknown composition rendering critical monitoring equipment non-functional. The inspection report concluded that "a leak from the tank system to the environment could go or may have gone undetected for extended periods of time."

  Although DOE reported that the violations identified during Ecology's 1992 inspection were corrected, Ecology's April 1998 inspection found that the violations had persisted or recurred. There was no record of any Ecology inspections of the tank during the 6 years between the 1992 and 1998 inspections.

- Inspection of SST SX-104, April 1998. Ecology's inspection found that DOE pumped waste from tank SX-104 into transfer lines knowing that heat trace equipment to prevent the line from plugging was not working. Consequently, the transfer line clogged resulting in unnecessary exposure of workers to radioactive waste. The inspection also found DOE had not concluded whether

[17] The leak detection device was incorrectly installed 2½ feet above the tank floor. It should have been installed between ⅛ to ½ inch above the tank floor in order to ensure detection of leaks of less than several thousand gallons.

the tank was leaking more than 4 months after a drop in liquid level was observed, and had failed to meet requirements to remove waste from an unfit for use tank system as timely as possible to prevent harm to the environment. Additionally, DOE failed to execute the pumping of the tank as required by the FFACO.

- Inspection of SST BX-111, May 1993. Ecology's inspection, performed in response to indications of a release of dangerous waste from the tank, found DOE failed to: (i) inspect data from monitoring and leak detection equipment daily; (ii) immediately report to Ecology indications of a release of radioactive mixed waste; and (iii) immediately provide reports requested by Ecology during the inspection.

- Inspection of C-SST Farm, December 1992. Ecology's inspection found that liquid level and tank temperature detection instruments were frequently out of service, and that leak detection drywells were not monitored daily and did not provide adequate primary leak detection.

- Inspection of SST T-101, November 1992. Ecology's inspection found that between April 1992 and September 1992 the tank leaked approximately 7,425 gallons of extremely hazardous and radioactive waste and that the tank may be continuing to leak. The inspection also found that the tank's leak detection systems and devices were frequently out of service, and when operating, these systems and devices were inadequate. The inspection report noted that Ecology was not notified of leakage from the tank until 6 months after monitoring data indicated the tank had begun leaking.

- Inspection of SSTs C-105 and C-106, August 1992. Ecology's inspection found that a malfunction in the liquid level monitoring equipment had not been corrected for approximately 3 months, and that records showed no readings of liquid level measurement data for 43 days. Ecology's report stated that as liquid level monitoring systems now stand, data is often poor or inadequate, equipment failures are common, controls are often relaxed, and management's overall level of concern is less than necessary.

## REASONS FOR INSUFFICIENT INSPECTION COVERAGE

We attribute the lack of inspections to two causes: (i) Ecology was not placing a sufficiently high priority on conducting tank inspections; and (ii) the Region was not monitoring inspection commitments in the PPA .

### Ecology Was Not Placing Sufficient Priority on Inspections

Ecology was not placing a sufficiently high priority on conducting tank inspections. According to Ecology's inspection staff, vacancies in inspector positions for the TWRS Program and other priorities such as investigations of reported tank leaks by DOE prevented Ecology from following the annual inspection plans. With respect to vacant inspector positions, during the audit we noted that only 3 of the 5 inspector positions for the TWRS Program were filled; 1 of which was filled in February 1999.

Ecology agreed in its response to our position papers that inspector turnover and other priorities had reduced the number of inspections initiated. Ecology stated it anticipates full staffing of inspector positions by January 2000 and, after appropriate training, the ability to implement a balanced inspection oversight program.

### Region Was Not Monitoring PPA Commitments

While Section 3007 of RCRA requires thorough annual inspections of Federal facilities that treat, store, or dispose of hazardous wastes, the Region apparently concluded that resource constraints prevented inspecting all Hanford tanks annually. Based on the fiscal 1998 and 1999 PPA workplans, the Region apparently concluded that a 6-year cycle of conducting inspections of all 177 tanks would be reasonable.

Although the PPAs specified that Ecology and the Region would assess the progress, as well as identify adjustments and additional actions that need to be taken throughout the terms of the agreements, the Region did not monitor the inspection commitments to determine if they were met. Staff of the Region's Office of Waste and Chemicals Management stated that they had relied on Ecology to ensure that the inspection commitments were met.

In its response to our position papers, the Region stated it monitors Ecology inspection PPA commitments through mid-year and end-of-year evaluations. Ecology's response said it believes the Region has monitored and enforced inspection efforts at Hanford through reviews of PPA commitments, oversight inspections, and a multi-media inspection performed in 1998.

The Region's and Ecology's comments are noted. However, we found the Regions's fiscal 1998 year-end and fiscal 1999 mid-year program evaluation reports for Ecology did not address PPA inspection commitments for Hanford. The purpose of the PPA is to ensure that the State's environmental priorities are being met. Therefore, Hanford inspection commitments should be monitored by the Region in order to assess the progress, as well as identify adjustments and additional actions that need to be taken throughout the terms of the agreement.

## DOE VIOLATIONS AND RELEASES OF HAZARDOUS WASTE MAY GO UNDETECTED

The limited number of tank inspections conducted by Ecology indicate that there are significant weaknesses in DOE's monitoring program for tank leaks. Without adequate inspection coverage, DOE violations of State and Federal hazardous waste regulations, including unreported releases of hazardous waste, may go undetected.

DOE's monthly waste tank summary reports identify that all eight SST tank farms that have not been inspected since at least 1992 have had at least one tank designated as an "assumed leaker"[18]. Such releases pose serious human health and environmental risks.

## RECOMMENDATION

We recommend that the Regional Administrator:

4-1.Establish annual EPA and Ecology inspection commitments through the existing 2000/2001 PPA process and in accordance with the Compliance Assurance Agreement Between the Washington Department of Ecology and the United States Environmental Protection Agency for the Hazardous Waste Program (1997)[19], including a

[18] The integrity classification assigned to a waste storage tank when monitoring data indicate a loss of liquid attributed to a breach of the tank's integrity.

[19] The Compliance Assurance Agreement Between the Washington Department of Ecology and the United States Environmental Protection Agency for the Hazardous Waste Program (1997) defines the respective roles and responsibilities of the two agencies for achieving compliance with Federal and State hazardous waste laws and regulations. The agreement also establishes oversight criteria, performance measures, and oversight procedures to be used by the Region.

mid-year and end-of-year review of commitment. EPA's review of Ecology inspection and compliance commitments should be in accordance with EPA/State Agency Agreement on Compliance Assurance Principles (May 1997)[20] and Compliance Assurance Evaluation Principles (July 1998)[21].

**REGION'S AND ECOLOGY'S COMMENTS**

The Region and Ecology concurred with the recommendation and provided an implementation schedule.

[20] The purpose of the EPA/State Agency Agreement on Compliance Assurance Principles (May 1997) is to clarify the roles of the states and the Region in compliance and enforcement matters, foster a more collaborative approach, enhance the sharing of information, and continue to improve performance measurement in compliance assurance for environmental programs. The principles also outline criteria for performance measurement and oversight by the Region.

[21] The Compliance Assurance Evaluation Program Principles (July 1998) clarifies the Region's expectations for delegated state compliance assurance programs. The principles also define the elements of a successful State compliance assurance program and formulate the basic operating principles for the Region's evaluation of a compliance assurance program.

# CHAPTER 5

## LEAK DETECTION AND INVESTIGATION PROCEDURES DO NOT PROVIDE ADEQUATE PROTECTION TO THE ENVIRONMENT

Effective leak detection systems have not been installed by DOE for all Hanford tanks. In addition, DOE has not always conducted adequate, timely, or documented investigations of suspected tank leaks. Specifically, we found:

- Original leak detection systems installed in 58 of the 149 SSTs were no longer effective.

- An investigation had not been conducted into a possible ongoing leak from one SST that leaked in the past.

- Investigations were not completed timely for suspected leaks from two SSTs that leaked in the past.

- The investigation results of a suspected leak from one SST were not documented.

These conditions occurred mainly because Ecology has not placed sufficient emphasis on ensuring that DOE has implemented an effective leak detection and investigation program. Specifically, Ecology has not: (i) required DOE to establish a leak detection program for all SSTs that meets State and Federal regulatory requirements; and (ii) has not provided sufficient oversight and enforcement over DOE's leak assessment activities.

As noted in Chapter 2, at least 1 million gallons of highly toxic and radioactive waste has leaked from 67 of Hanford's 149 SSTs, some of which has already reached the groundwater. Without effective leak detection systems and an effective leak investigation process, there is no assurance that tank leaks will be identified and remediated timely. Minimizing the extent of leaks and an effective leak investigation process for the SSTs are critical to preventing additional groundwater contamination.

## BACKGROUND

DOE, as the owner and operator of the Hanford Federal Facility, is required to comply with State and Federal hazardous waste regulations under RCRA Subtitle F, Section 6001.

WAC Chapter 173-303-*Dangerous Waste Regulations* and 40 CFR, Part 265-*Interim Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities* include requirements for containment and detection of tank releases for interim status tank systems used to store or treat hazardous waste. The WAC Chapter 173-303-400 and 40 CFR, Part 265, Subpart J require that tank systems provide a leak detection system which is capable of detecting a leak within 24 hours, or within the earliest practicable time if existing technologies or site conditions do not allow detection within 24 hours.

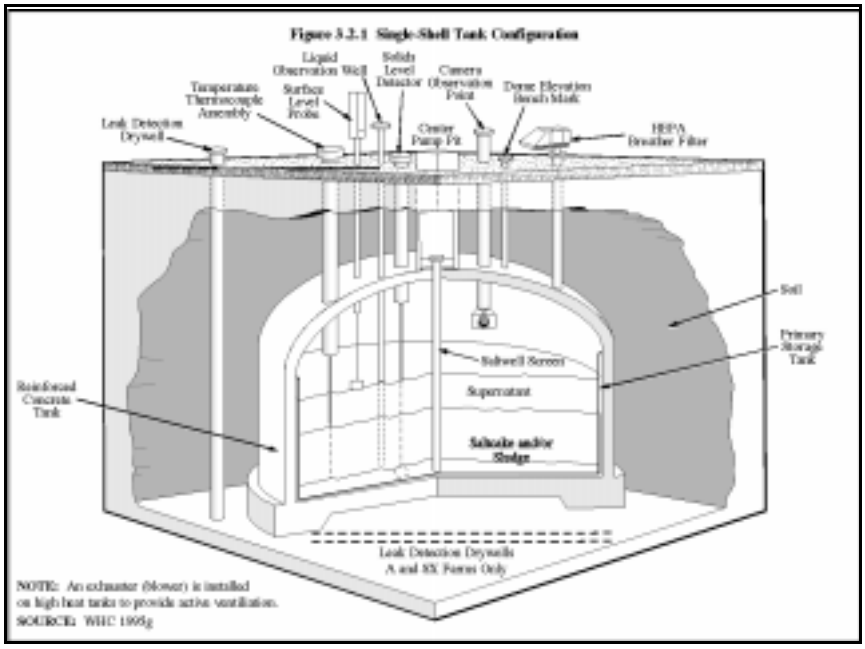
Ecology has the responsibility for oversight and enforcement of the RCRA units at Hanford under both Washington's EPA authorized Hazardous Waste Program and the FFACO. Therefore, it has responsibility for overseeing and enforcing DOE's compliance with State and Federal laws and regulations which apply to the SSTs and DSTs.

## LEAK DETECTION SYSTEMS WERE NOT INSTALLED

Currently, 58 of the 149 aging SSTs do not have effective leak detection systems. Thirty-nine of the 58 SSTs, or 67 percent, have been designated as "assumed leakers". All 58 tanks have been interim stabilized, but they still contain a total of 6.3 million gallons of high level radioactive waste in the form of liquid, sludge and saltcake. Forty-one contain drainable liquid totaling approximately 500,000 gallons[22].

The 58 tanks were identified as having no primary or secondary leak detection systems in DOE's Operating Specification Document (OSD), Operating Specifications for Tank Farm Leak Detection and Single Shell Tank Intrusion Detection. The OSD establishes primary and backup leak detection systems as well as monitoring frequencies for the SSTs. These leak detection systems consist of in-tank liquid level measurement devices and liquid

[22] The amount of drainable liquid in each tank ranges from 1,000 to 48,000 gallons. Approximately one third of them contain more than 10,000 gallons of drainable liquid.




**SST Configuration Showing Various Leak Detection Devices (Source: Final Environmental Impact Statement for the TWRS, DOE and Ecology, April 1996)**

observation wells[23]. This document listed "none" for primary and backup leak detection systems and did not specify a monitoring frequency for each of the 58 tanks.

In its response to our position papers, Ecology explained that the surface level measuring devices installed in the 58 tanks were ineffective because the tanks were interim stabilized. With respect to the surface level measuring devices, Ecology said that the devices were not effective because the tanks either did not contain drainable liquid waste or contain liquid waste at levels which are too low to accurately measure. Ecology also said that it was possible that a new technology could monitor the liquid level in the tanks. However, Ecology suggested that it may be more productive to monitor the vadose zone underneath the tanks. Ecology explained that vadose zone monitoring would provide not only information on the integrity of the tanks, but would also provide much needed data regarding past leak behavior and identify whether tanks were continuing to leak.

[23] Liquid observation wells are used to monitor the liquid level in SSTs and extend to within 1 inch of the bottom of the waste tank. Gama and neutron probes are used in the wells to measure the liquid level.

We acknowledge Ecology's comments with respect to the ineffectiveness of current surface level measuring devices with measuring tank waste that is not drainable or contains low amounts of liquid. In our opinion, vadose monitoring systems which ensure timely identification of tank leaks would meet the intent of the State and Federal regulations.

## LEAK INVESTIGATION WAS NOT CONDUCTED

DOE had not conducted a formal leak investigation to determine if SST BY-105 was leaking even though the liquid waste level in the tank has been decreasing at a rate of about 0.6 inches a year since 1994. A drop of 0.6 inches in this tank is the equivalent of about 1,700 gallons.

The tank contains hazardous chemical and radioactive wastes. In addition, it contains 63 tons of cement that was added in 1966 as part of a tank solidification pilot operation. The tank was designated as an assumed leaker in 1984, 15 years ago. DOE estimated that the tank released approximately 8,000 gallons of waste as a result of the leak. As of the end of March 1999, DOE estimated that the tank contained 192,000 gallons of drainable liquid including 186,000 gallons of pumpable liquid.

In response to the leak, Ecology established a FFACO milestone for DOE to interim stabilize the tank by September 1991. Because of unresolved safety issues and pumping complications created by the cement, the original milestone was extended from September 1991 to December 1997 and then to September 1999 under the FFACO.

Interim stabilization of the tank was extended again under the Interim Stabilization Consent Decree, which became effective in August 1999. The Consent Decree requires DOE to start interim stabilization of the tank by July 2001. Ecology staff informed us that BY-105 was not scheduled for interim stabilization sooner under the Consent Decree because: (i) the tank was no longer leaking; and (ii) other tanks were identified as posing a greater risk to the environment due to their waste content and higher waste volume.

However, liquid waste level monitoring data for the tank covering the period from January 1985 to January 1999 shows that the tank's liquid level started decreasing in January 1994 at a steady

rate of about 0.6 inches a year. From January 1994 to January 1999 the waste level fell from about 144 inches to about 141 inches. When we asked Ecology staff about the downward trend, we were informed that they were unaware of the waste level decrease. In response to our inquiry, Ecology requested that DOE provide an explanation for the downward trend.

DOE's response to Ecology's inquiry identified that a formal leak investigation had not been conducted on the decrease in liquid level. However, DOE speculated that the decrease in the tank's liquid waste level was caused from a redistribution of the waste in the tank. DOE explained that the crust level measurement in the tank fell at about the same time as the liquid level started falling in the tank and that the crust level has been rising steadily since it fell in January 1994. DOE said that the crust and liquid level anomalies appeared to be related and theorized that a section of crust which was suspended above the liquid waste fell into the liquid. According to DOE, this section of crust may be absorbing the liquid waste and causing the crust level and liquid level measurements to rise and fall, respectively.

Ecology staff told us that DOE's explanation indicated that DOE had not conducted a rigorous enough investigation into the decrease in waste level. Because DOE had not completed a formal leak investigation on the tank, we believe that there is no assurance that the steady decrease in the tank's waste level is not the result of a new leak.

## INVESTIGATIONS WERE NOT TIMELY

Although SSTs SX-104 and B-111 had leaked in the past, investigations into recent suspected leaks were not completed timely by DOE.

### SST SX-104 Was Not Investigated Timely

DOE did not investigate timely a suspected leak of SST SX-104, even though the tank had leaked in the past and had not been interim stabilized.

SST SX-104 was designated as an assumed leaker in 1988 and DOE estimated that about 6,000 gallons leaked from the tank at that time. In response to the leak, DOE pumped approximately 113,000 gallons of waste from the tank during 1988 and 1989. Because the tank was designated as an assumed leaker, Ecology established a FFACO milestone for DOE to interim stabilize the

tank by September 1990. However, the milestone was revised to require DOE to start pumping the tank by September 1997 after four extensions. The extensions were made because flammable gas safety issues with the tank had not been resolved. DOE missed the milestone and did not resume pumping the tank until April 1998. As of September 1999, the tank was still undergoing interim stabilization.

In December 1997, DOE reported to Ecology that the waste level in the tank fell approximately 2 inches, a decrease of -7 standard deviations[24]. At that time, the tank contained 201,000 gallons of drainable liquid including 195,000 gallons of pumpable liquid hazardous and radioactive wastes. In response to the reported decrease in waste level, Ecology immediately initiated a compliance inspection of the tank.

During the December 1997 inspection, Ecology found that DOE made a determination that the decrease in waste level was caused from atmospheric pressure. However, Ecology concluded that DOE had not performed a thorough evaluation because it could not provide sufficient evidence to support that the tank had not leaked.

DOE did not complete an investigation that was acceptable to Ecology until April 1998, or about 4 months after the decrease in waste level was identified. In April 1998, DOE submitted an atmospheric pressure study on the tank to Ecology. The study concluded that the decrease in waste level was attributable to atmospheric pressure and gas retention in the tank rather than a leak. After reviewing the study, Ecology accepted DOE's conclusion that the tank had not leaked.

Although Ecology accepted DOE's explanation for the decrease in waste level, Ecology concluded that DOE had not established adequate procedures for tracking and evaluating suspected tank leaks. As a result, Ecology issued DOE a notice of correction in November 1998 addressing violations and concerns identified during its inspection of the tank. In the letter, Ecology stated:

> Ecology is concerned about the facility's ability to determine, in a timely fashion, when a

[24] Ecology considers a tank to be leaking when the tank's waste level decreases by more than three standard deviations outside of the normal waste level range for the tank.

tank is actually leaking. There is no action for this concern required by this letter; however, Ecology will be addressing this issue in the on-going investigation of tank B-111.

**SST B-111 Was Not Investigated Timely**

DOE's investigation of a suspected leak from SST B-111 was not completed timely even though Ecology advised DOE that its concerns with DOE's leak investigation process would be addressed during the investigation of the tank.

SST B-111 was designated as an assumed leaker in 1978 and was interim stabilized during 1985. DOE estimated that about 8,000 gallons leaked from the tank and that it contained 22,000 gallons of drainable liquid including 16,000 gallons of pumpable liquid hazardous and radioactive wastes as of March 1999.

In early October 1998, DOE reported to Ecology that the tank's waste level decreased in September 1998 by approximately 1.5 inches, a decrease in excess of -3 standard deviations. DOE evaluated the cause for the decrease in waste level by conducting two leak investigations over the period from October 1998 to June 1999.

The two evaluations were conducted using a new leak assessment process that DOE developed in response to Ecology's concerns with the procedures previously used for evaluating Tank SX-104. Under the revised process, a team of experts conducted a probabilistic assessment of whether the tank leaked using monitoring data for the tank. The procedure's guidelines designate a tank as an assumed leaker when the probability that a leak occurred is assessed at greater than 50 percent.

The first assessment was conducted in October 1998 and arrived at a mean probability of 55 percent that the tank leaked. The assessment also identified that the decrease could have been caused from a gas release. DOE concluded that the evidence of a new tank leak was relatively weak even though the probability of a leak was assessed at greater than 50 percent**.** Because the assessment results showed a high level of uncertainty on the cause of the waste level decrease, Ecology requested that DOE identify additional monitoring data, including hydrogen gas release data, in order to provide a more accurate conclusion.

DOE did not complete a new assessment until June 1999, 8 months after it first reported the decrease in the tank's waste level. Based on the results from the second assessment, DOE concluded that the decrease in waste level was caused from a small gas release or other level adjustment rather than a leak. The conclusion was based on a low probability of 5.6 percent that the tank leaked in September 1998. After meeting with DOE in July 1999 on the leak assessment results, Ecology concurred with DOE's leak assessment conclusion.

In its response to our position papers, Ecology stated:

> We concur that leak determinations by DOE take too much time. We would like to point out however that leak investigations vary in complexity and level of effort. It is difficult to agree on a hard and fast time period in which a leak determination must be completed. The fact that DOE reacted appropriately by starting the leak determination effort and notifying Ecology indicates that the process, including the new process developed after SX-104, is working as intended. Our primary concerns with the current efforts are that DOE does not fully include Ecology in all levels of the determination review, and that more can be done by DOE to expedite the process.

## LEAK INVESTIGATION WAS NOT DOCUMENTED

Ecology has no assurance that an adequate investigation of a suspected leak from SST SX-102 was conducted because DOE did not document its investigation results.

Tank SX-102 was listed as a leaking tank for a short time in 1993 after DOE identified a decrease in the tank's liquid level. However, the tank was reclassified as "sound" later that year after DOE's re-analysis of the waste level monitoring data and measurement of evaporation thermodynamics suggested that the tank had not leaked. As of September 1999, the tank was not interim stabilized. DOE estimated that the tank contained 224,000 gallons of drainable liquid including 216,000 gallons of pumpable liquid hazardous and radioactive wastes as of March 1999.

Our review of DOE's SX Tank Farm Report identified that Tank SX-102 may have leaked in the past. The report states that

distribution of contamination in the vadose zone for SST SX-102 indicates that the tank may have leaked at some time before the mid-1970s. The report also states that the contamination detected beneath the tank suggests that the leak created two plumes and the plumes may have been the result of more than one leak. As a result, the report recommends that the tank's integrity classification be revised from sound to assumed leaker.

However, the tank's integrity classification was not revised to assumed leaker as recommended by the report and Ecology staff were unable to explain what actions DOE had taken in response to the report's findings on the tank. In response to our inquiry, Ecology requested DOE to identify the actions it took to determine whether the tank had leaked. In its response to Ecology's request, DOE stated:

> Tank SX-102 instrument data was re-evaluated. The in-tank information, primarily neutron ILL, showed no departure from the predicted evaporation rate so there were no changes to the tank classification. The technical staff at the time felt that the Cesium in the drywell could have come from a variety of sources other than an SX-102 leak, while the in-tank ILL data was fairly conclusive of an evaporation trend only. There was no procedure in place in 1996 to convene a full leak assessment panel or to issue a formal document of the assessment, so the tank remained classified as "sound, based primarily on the steady ILL data.

In order to determine whether the tank is currently leaking, we reviewed: (i) waste level data for the tank covering the period of over 18 years from January 1981 to April 1999; and (ii) evaluation documentation supporting DOE's reclassification of the tank in 1993 to a sound classification. While our review identified that the tank's waste level has been on a steady decrease for a period of over 18 years, we found no evidence that the tank leaked during the period. However, we were unable to verify that the tank's current sound integrity classification was correct because DOE did not document its investigation of the suspected leak reported in the SX Tank Farm Report.

With respect to the tank's waste level decreases, we determined that DOE evaluated the trend and concluded that the waste level decrease was caused from evaporation of liquid in the tank.

## INSUFFICIENT EMPHASIS PLACED ON LEAK DETECTION AND INVESTIGATION PROGRAM

We found that the weaknesses in leak detection occurred mainly because Ecology has not placed sufficient emphasis on ensuring that DOE has implemented an effective leak detection and investigation program. Although 58 of the SSTs do not have effective leak detection systems in operation, Ecology has not required DOE to establish a leak detection program for all SSTs that meets State and Federal regulatory requirements.

In addition, Ecology has not provided sufficient oversight and enforcement over DOE's leak assessment activities. We acknowledge that Ecology compliance staff conduct tank inspections, review tank monitoring data, and coordinate with DOE staff and contractors in response to suspected tank leaks that are reported to Ecology. In addition, we acknowledge that DOE did develop a new leak assessment process in response to Ecology's November 1998 Notice of Correction addressing violations identified during an inspection of SST SX-104. However, DOE's inadequate response to the waste level decrease in BY-105, continued inability to complete leak investigations timely, and failure to not always document leak investigation results show that Ecology needs to provide additional emphasis on oversight and enforcement of leak assessment activities conducted by DOE.

## CONCLUSION

As noted in Chapter 2, at least 1 million gallons of highly toxic and radioactive waste has leaked from 67 of Hanford's 149 SSTs, some of which has already reached the groundwater. Without effective leak detection systems and an effective leak investigation process, there is no assurance that tank leaks will be identified and remediated timely. Minimizing the extent of leaks and an effective leak investigation process for the SSTs are critical to preventing additional groundwater contamination.

Further, DOE currently plans to use hydraulic sluicing to remove most of the hard salt cake and sludge from SSTs with a sound integrity classification. This process could cause additional releases from tanks that are leakers. Therefore, it is essential that the integrity classification for each SST is accurate in order to

ensure future waste retrieval activities provide sufficient protection to workers and the environment.

## RECOMMENDATIONS

We recommend that the Regional Administrator:

5-1. Assist Ecology in preparing a strategy for addressing DOE actions for SSTs not currently in compliance with interim status leak detection requirements. The strategy should consider technical impractibility, and performance capabilities of non-traditional leak detection systems. Additional activities to be performed by Ecology pursuant to this strategy should be documented through the fiscal 2000/2001 PPA process.

5-2. Negotiate with Ecology appropriate inspection and enforcement responses to suspected tank leaks under interim status requirements and document these commitments through the fiscal 2000/2001 PPA process.

## REGION'S AND ECOLOGY'S COMMENTS

The Region and Ecology concurred with the recommendations and provided an implementation schedule for each recommendation.

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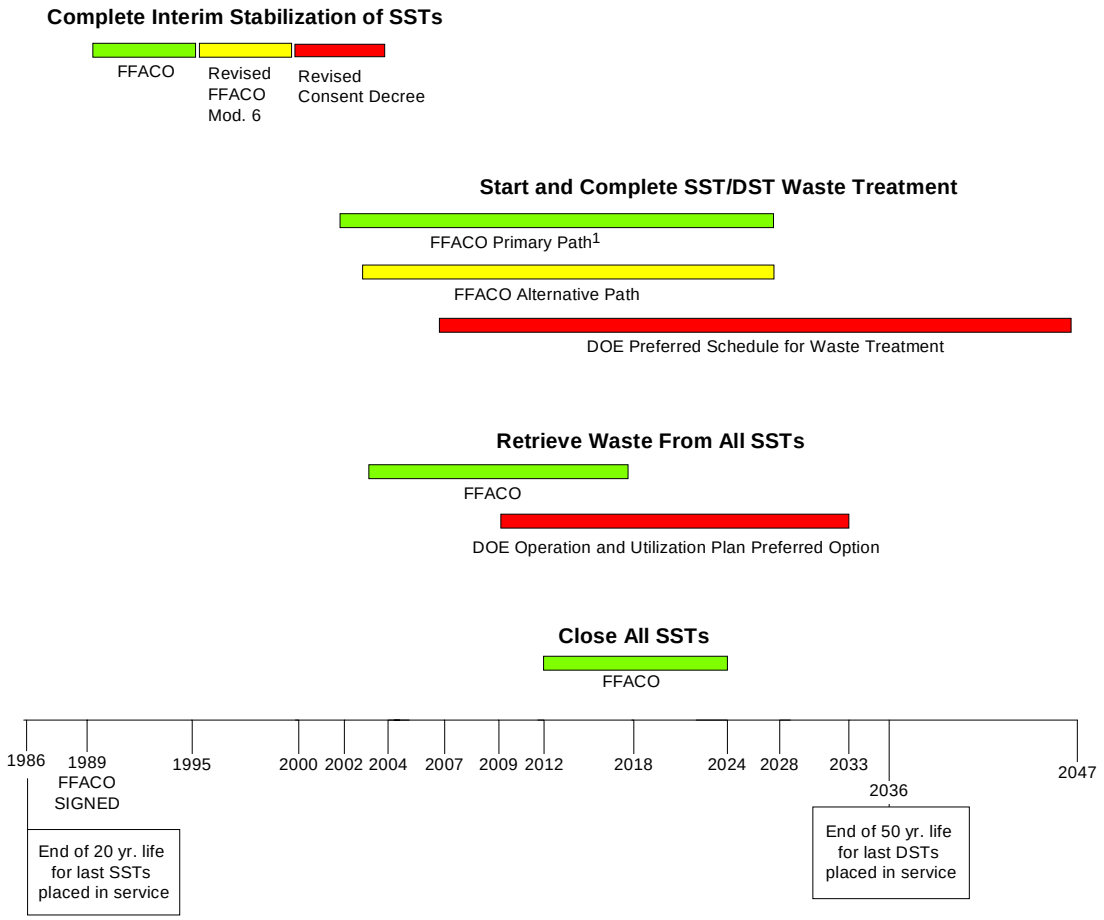
# EXHIBIT 1

## TIMELINE OF SELECTED FFACO MILESTONES FOR THE TWRS PROGRAM AND ACTUAL OR PROPOSED REVISIONS




1 The FFACO primary path requires completion of treatment of Low Activity Waste by 2024 and High Level Waste by 2028.

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# APPENDIX A

## AUDIT SCOPE AND METHODOLOGY

This section describes the audit scope and methodology, including sample selection for our review of regulatory oversight of the TWRS Program.

We performed our audit in accordance with the Government Auditing Standards issued by the Comptroller General of the United States. Audit fieldwork was performed between November 1998 and January 2000. The audit generally covered Ecology's and the Region's management controls in effect for the 26-month period from July 1997 through September 1999. We also reviewed relevant oversight and enforcement records of Ecology which covered periods prior to and after this 26-month period which we deemed necessary for adequate evaluation of program activities.

We interviewed State of Washington officials in Ecology's Nuclear Waste Program and discussed our audit results with an official in the State's Office of the Attorney General. We also interviewed officials in Region 10's Office of Waste and Chemicals Management and Office of Regional Council. In addition, we interviewed officials from the State of Oregon's Office of Energy and the Yakima Indian Nation which are stakeholders of the Hanford Federal Facility. We also reviewed applicable laws, regulations, and records maintained by Ecology and the Region.

The scope included a review of Ecology's and the Region's management controls associated with oversight and enforcement of: (i) FFACO milestones associated with the TWRS Program; and (ii) DOE compliance with State and Federal hazardous waste regulations applicable to interim status tank systems. We obtained an understanding of management controls through inquiries, observations, and inspections of documents and records. We assessed the control environment, policies and procedures, and risk of the two areas listed above.

The management control deficiencies that were identified in the audit are described in this report, along with recommendations for corrective actions. We also reviewed the Region's 1997 and 1998 annual FMFIA assurance letters to the Administrator.

**FFACO Milestones**

We focused on FFACO milestones for: (i) interim stabilization; (ii) waste treatment; (iii) waste retrieval and closure of the tanks; (iv) DST capacity; and (v) resolution of flammable gas to evaluate regulatory oversight of the TWRS Program.

Interim Stabilization

We reviewed all modifications to major milestones for interim stabilization of the SSTs, milestones M-05-00 and M-41-00, as well as interim milestones covering a period of over 10 years from May 1989 to September 1999. We also reviewed Ecology's enforcement activities covering this same period for missed milestones.

Waste Treatment

We reviewed compliance with waste treatment major milestones M-50-00, M-51-00, M-60-00, and M-61-00 as well as judgmentally selected interim milestones. We selected key interim milestones that were or may be effected by DOE's August 1998 Phase I contract amendment.

Waste Retrieval and Tank Closure

Major milestone M-45-00 requires retrieval of the waste from the SSTs and their complete closure. We reviewed compliance with the major milestone and judgmentally selected interim and target milestones. Our sample included an interim milestone requiring retrieval of waste from SST C-106. The sample also included key interim and target milestones that may be effected by DOE's August 1998 Phase I contract amendment.

DST Capacity

In order to determine whether DST space requirements for support of waste retrieval and treatment had been adequately evaluated, we reviewed compliance with major milestones M-46-00D and M-46-00E. These milestones required DOE to submit annual DST volume projections to Ecology by September 30, 1997 and 1998.

Flammable Gas Resolution

Major milestone M-40-00 requires mitigation/resolution of tank safety issues for high priority Watch List tanks. We judgmentally selected interim milestone M-40-09 for review because it required resolution of a USQ involving flammable gas by September 1998.

**Compliance with State and Federal Regulations**

In order to evaluate oversight and enforcement of DOE compliance with Washington's and EPA's hazardous waste regulations for interim status tank systems, we reviewed: (i) response actions for safety issues involving DST SY-101; (ii) inspection coverage for the SSTs and DSTs and enforcement responses to violations; (iii) leak detection systems in use for the SSTs and DSTs; and (iv) the response process for actual and suspected tank leaks.

DST SY-101 Safety Issues

During the audit, serious safety issues involving DST SY-101 came to our attention. As a result, we reviewed compliance and enforcement documents and records for the tank covering the period from December 1997 to September 1999.

Inspections

To evaluate the adequacy of Ecology inspections, we reviewed all Hanford SST and DST inspections performed by Ecology between January 1992 and February 1999. We used the same inspections to evaluate the adequacy and timeliness of Ecology enforcement taken as a result of DOE violations of State and Federal hazardous waste laws and regulations.

Leak Detection Systems

We reviewed DOE's leak detection system operating specification documents for all 177 SSTs and DSTs covering tank operations for the period from July 1997 to June 1999.

Leak Response Process

Of the 67 SSTs that were designated as assumed leakers, three of the tanks (BY-105, BY-106, and SX-104) were not interim stabilized as of January 1999. We selected all three tanks for review because they had been designated as assumed leakers since the 1980's.

Two other SSTs (SX-102 and SX-109) were selected for review because preliminary information obtained during our fieldwork indicated that adequate investigations may not have been conducted into suspected leaks from the tanks.

We also selected one other SST (B-111) for review because the tank was designated as an assumed leaker in 1978, was suspected of leaking again in 1997, and was under investigation during our fieldwork.

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# APPENDIX B

## REGION 10 AND STATE DEPARTMENT OF ECOLOGY RESPONSE TO THE DRAFT REPORT

Attached are the Region's and Ecology's response to the draft report.

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**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**REGION 10**
**1200 Sixth Avenue, Seattle WA 98101**

**February 22, 2000**

Reply To
Atm Of: WCM- 127

Truman R. Beeler, Divisional Inspector General for Audits
United States Environmental Protection Agency
Office of the Inspector General for Audits
Western Audit Division
75 Hawthorne Street
19th Floor, Mail Code I-1
San Francisco, CA 94106-3901

Re: Concurrence with Draft Report on the Tank Waste Remediation System (TWRS) Program for the Hanford Federal Facility
EPA/Ecology ID No. WA7 89000 8967

Dear Mr. Beeler:

EPA Region 10 (EPA) and the Washington State Department of Ecology Nuclear Waste Program (Ecology) are in receipt of your January 21, 2000 memo requesting comment and concurrence with the referenced draft audit report. After review of the report and each of the recommendations, we concur in full with both the facts as presented in each finding, and with the associated recommendations. EPA and Ecology fully support the findings identified in the audit report, particularly the lack of progress on the part of Department of Energy (DOE) in addressing the significant threats posed by Hanford tank wastes. We intend to move forward in a timely manner with each of the recommendations, and believe our current activities, described below. demonstrate our resolve to address delays in the TWRS program. For recommendations based upon Performance Partnership Agreement (PPA) commitments, we expect to begin these discussions in the near future and conclude with a revised PPA document by mid-summer, 2000, consistent with our established PPA cycle. Further details of our response activities are enclosed.

As documented in the audit report, Ecology and EPA have been engaged in negotiations with the Department of Energy (DOE) to establish milestones in the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) relating to tank waste retrieval, construction and operation of a tank waste treatment system, and compliance concerns related to the RCRA Land Disposal Restriction (LDR) program. Despite extensive efforts on the part of both agencies, these negotiations concluded on January 31, 2000 with no agreement reached. DOE's eleventh-hour proposals for both tank waste treatment milestones and LDR dispute resolution served only to reinforce EPA's and Ecology's belief that DOE remains unwilling to commit to necessary work and be accountable for progress toward enforceable milestones. As a result, Ecology asked EPA to join in development and issuance of a final dispute determination to resolve these issues. EPA responded in a February 3, 2000 letter to Ecology strongly



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endorsing Ecology's position, and stating in no uncertain terms EPA's concern with DOE failures to complete work, fulfill milestone commitments, and demonstrate accountability for progress with Hanford environmental cleanup. We believe these clear and decisive positions established by EPA and Ecology with respect to tank waste and LDR compliance are fully consistent with recommendations in the audit report, and reflect our commitment to implementing the audit recommendations. Noted communications between EPA and Ecology are enclosed for your information.

Finally, we would like to thank you for the opportunity to work closely and collaboratively with you and your staff throughout the audit process, including development of effective and implementable recommendations. We feel confident that the final report will be an important asset to us as we continue to work toward resolving Hartford tank waste issues. Should you have any questions, please feel free to contact us at (206) 553-1847 or (360) 407-7150 , respectively.

Sincerely,

(Sig.)
Richard Albright, Director
Office of Waste and Chemicals Management
EPA Region 10

(Sig.)
Mike Wilson, Program Manager
Nuclear Waste Program
Washington Department of Ecology

Enclosures (3)

cc: Janet Kesler, Audit Coordinator, Region 10

**EPA Region 10**
**Hanford Inspector General Audit**
**Tank Waste Remediation System**
**Recommendation Implementation Schedule**

Recommendation 1:

Negotiate with Ecology to address oversight and enforcement responsibilities regarding DOE compliance with FFACO and RCRA requirements as part of the Fiscal 2000/2001 PPA process.

Region 10 will initiate these discussions with Ecology during the second quarter of EPA's FY2000 (all subsequent commitment dates refer to the federal fiscal year) as part of the established PPA process. A revised PPA including agreed-upon responsibilities will be finalized during the third quarter of FY2000.

Recommendation 2:

Consult with EPA National Program Managers to determine what action can be taken at the EPA Headquarters level to achieve a higher priority, including receiving funding, on cleanup of the Hartford tanks.

In conjunction with Ecology and resolution of Tn-Party disputes. EPA will communicate with one or more national program mangers in the Office of Solid Waste and Emergency Response, Office of Enforcement and Compliance Assurance, and/or the Office of the Administrator in the second or third quarter of FY2000. Timing and content of this request will be dependant on prowess of tank waste TPA issues resolution.

Recommendation 3:

Report the weaknesses in the Hanford TWRS Program as a management control deficiency in the annual Federal Managers Financial Integrity Act assurance letter to the EPA Administrator.

Region 10 will incorporate weaknesses in the Hanford TWRS program as potential FY2000 vulnerabilities as part of mid-year update in the third quarter of FY2000 to the Management Integrity Act 1999 Assurance Letter, issued October, 1999. We believe an update to the 1999 letter better reflects the significance and timing of current tank waste development than including the TWRS program in the 2000 Assurance Letter.

Recommendation 4:

Negotiate Fiscal2000/2001 PA commitments with Ecology as necessary to oversee TWRS Program safety issues.

See response to Recommendation 1 above.

Recommendation 5

> Establish annual EPA and Ecology inspection commitments through the Fiscal 2000/2001 PPA process in accordance with the Compliance Assurance Agreement Between the Washington Department of Ecology and the United States Environmental Protection Agency for the Hazardous Waste Program (1997), including a mid-year and end-of-year review of commitment.
>
> See response to Recommendation 1 above. In addition, EPA and Ecology will complete a review of commitment in the FY2000 mid-year and end-of-year meetings in the second and fourth quarters of FY2001. This schedule will be consistent with establishing a final update to the 2000/2001 PPA in the third quarter of FY2000.

Recommendation 6:

> Assist Ecology in preparing a strategy for addressing DOE actions for SSTs not currently in compliance with interim status leak detection requirements.
>
> EPA and Ecology will develop this strategy and incorporate any resulting actions into the updated PPA to be completed during the third quarter of FY2000.

Recommendation 7:

> Negotiate with Ecology appropriate inspection and enforcement responses to suspected tank leaks under interim status requirements and document these commitments through the FY2000/2001 PPA process.

See response to Recommendation 1 above.

**UNITED STATES ENVIRON MENTAL PROTECTION AGENCY**
**REGION 10**
**1200 Sixth Avenue**
**Seattle, WA 98101**

March 10, 2000

Reply To
Attn Of: WCM- 127

Truman R. Beeler, Divisional Inspector General for Audits
United States Environmental Protection Agency
Office of the Inspector General for Audits
Western Audit Division
75 Hawthorne Street
19th Floor, Mail Code I-1
San Francisco, CA 94106-3901

Re: Updated Concurrence with Draft Report on the Tank Waste Remediation System (TWRS) Program for the Hanford Federal Facility
EPA/Ecology ID No. WA7 89000 8967

Dear Mr. Beeler:

In response to your verbal request through Mike Owen of your office to update the EPA and Ecology concurrence with the draft final report cited above, please find a revised attachment to our February 22, 2000 concurrence letter that includes the proposed response to each audit recommendation.

Should you have any questions, please feel free to contact us at (206) 553-1847 or (360) 407-7150, respectively.

Sincerely.

(Sig.)
Richard Albright, Director

Office of Waste and Chemicals Management
EPA Region 10

(Sig.)

Mike Wilson, Program Manager
Nuclear Waste Program
Washington Department of Ecology

Enclosures (3)

cc: Janet Kesler, Audit Coordinator, Region 10

**EPA Region 10**
**Hanford Inspector General Audit**
**Tank Waste Remediation System**
**Recommendation Implementation Schedule**

Recommendation 1 (Chapter 2, Recommendation 1):

Negotiate with Ecology to address oversight and enforcement responsibilities regarding DOE compliance with FFACO and RCRA requirements as part of the Fiscal 2000/2001 PPA process.

Region 10 will initiate these discussions, addressing items a.) and b.) of the recommendation, with Ecology during the second quarter of EPA's FY2000 (all subsequent commitment dates refer to the federal fiscal year) as part of the established PPA process. A revised PPA including agreed-upon responsibilities will be finalized during the third quarter of FY2000

Recommendation 2 (Chapter 2, Recommendation 2):

Negotiate with Ecology through the Fiscal 2000/2001 PPA process specific enforcement or other programmatic actions directed towards timely resolution of tank waste treatment issues and establishment of appropriate enforceable milestones.

See response to Recommendation 1 above. In addition, EPA and Ecology have already initiated efforts in response to this recommendation as illustrated by EPA's February 3, 2000 letter to Ecology committing EPA support for a final tank waste determination for TPA milestones. EPA and Ecology are continuing close collaboration and communication as resolution of tank waste milestone and Land Disposal Restriction reporting requirement disputes continues.

Recommendation 3 (Chapter 2, Recommendation 3):

Consult with Ecology prior to and during FFACO change negotiations during FY2000 to develop appropriate language addressing mitigation or prevention of environmental risks associated with extending waste treatment, waste retrieval, and closure milestones included in DOE FFACO change packages.

EPA will negotiate through the PPA process described in the response to Recommendation 1 above appropriate levels of consultation during FY2000 to address this recommendation. In addition, EPA will address this recommendation during EPA review of TPA change packages for major milestones relating to tank wastes.

EPA and Ecology are already engaged in responding to this recommendation through joint participation in current negotiation of tank waste treatment and retrieval milestones.

Recommendation 4 (Chapter 2, Recommendation 4):

Consult with EPA National Program Managers to determine what action can be taken at the EPA Headquarters level to achieve a higher priority, including receiving funding, on cleanup of the Hanford tanks.

In conjunction with Ecology and resolution of Tri-Party disputes, EPA will communicate with one or more national program mangers in the Office of Solid Waste and Emergency Response, Office of Enforcement and Compliance Assurance, and/or the Office of the Administrator in the second or third quarter of FY2000. Timing and content of this request will be dependant on progress of tank waste TPA issues resolution.

Recommendation 5 (Chapter 2, Recommendation 5):

Report the weaknesses in the Hanford TWRS Program as a management control deficiency in the annual Federal Managers Financial Integrity Act assurance letter to the EPA Administrator.

Region 10 will incorporate weaknesses in the Hanford TWRS program as potential FY2000 vulnerabilities as part of mid-year update in the third quarter of FY2000 to the Management Integrity Act 1999 Assurance Letter, issued October, 1999. We believe an update to the 1999 letter better reflects the significance and timing of current tank waste development than including the TWRS program in the 2000 Assurance Letter.

Recommendation 6 (Chapter 3, Recommendation 1):

Negotiate Fiscal2000/2001 PPA commitments with Ecology as necessary to oversee TWRS Program safety issues.

See response to Recommendation 1 above.

Recommendation 7 (Chapter 3, Recommendation 2):

Review Ecology's progress toward meeting these commitments during mid-year and end-of-year PPA evaluations. It is important that the commitment address Ecology's safety position staffing shortage.

EPA will address this recommendation through the mid-year review meetings, and provide documentation in mid-year and end-of-year reports.

Recommendation 8 (Chapter 4, Recommendation 1):

> Establish annual EPA and Ecology inspection commitments through the Fiscal 2000/2001 PPA process in accordance with the Compliance Assurance Agreement Between the Washington Department of Ecology and the United States Environmental Protection Agency for the Hazardous Waste Program (1997), including a mid-year and end-of-year review of commitment.
>
> See response to Recommendation 1 above. In addition, EPA and Ecology will complete a review of commitment in the FY2000 mid-year and end-of-year meetings in the second and fourth quarters of FY2001. This schedule will be consistent with establishing a final update to the 2000/2001 PPA in the third quarter of FY2000.

Recommendation 9 (Chapter 5, Recommendation 1):

> Assist Ecology in preparing a strategy for addressing DOE actions for SSTs not currently in compliance with interim status leak detection requirements.
>
> EPA and Ecology will develop this strategy and incorporate any resulting actions into the updated PPA to be completed during the third quarter of FY2000.

Recommendation 10 (Chapter 5, Recommendation 2):

> Negotiate with Ecology appropriate inspection and enforcement responses to suspected tank leaks under interim status requirements and document these comrmtments through the FY2000/2001 PPA process.

See response to Recommendation 1 above.

*STATE OF WASHINGTON*

DEPARTMENT OF ECOLOGY
*P.O. Box 47600 Olympia, Washington 98504-7600*
*(360) 407-6000 TDD Only (Hearing Impaired) (360) 407-6006*

*January 31, 2000*

Mr. Chuck Clarke, Regional Administrator
U. S. Environmental Protection Agency, Region 10
1200 Sixth Avenue
Seattle, Washington 98101

Dear Mr. Clarke:

**RE: Hanford tank waste treatment negotiations and associated Land Disposal Restrictions dispute under the Hanford Federal Facility Agreement and Consent Order (HFFACO)**

As you know, negotiations with the U. S. Department of Energy (DOE) regarding its Hanford site high-level radioactive tank wastes have been in progress throughout this past year with little success. Today, the period for concluding these negotiations expired with no agreement reached. Consequently, by February 14, 2000, I expect to issue a Final Determination requiring that DOE move forward in the construction and operation of a tank waste treatment complex and that wastes are retrieved from DOE's leaking single-shell tanks in a timely manner.

I am writing you today to ask for your assistance in ensuring that the environmental and human health risks posed by DOE's leaking tanks, and DOE's seeming inability to bring its facilities into compliance with hazardous waste law are not aggravated by further delay. Specifically, I am requesting that the Environmental Protection Agency join the Department of Ecology in the development and issuance of this Determination and our closely associated Determination regarding DOE compliance with "RCRA" Land Disposal Restrictions. Your assistance on this critical environmental compliance project would be of great help, and would be deeply appreciated by Governor Locke, Attorney General Gregoire, I, and the citizens of the State. I would be pleased to meet with you to discuss this issue further and to respond to any questions you or your staff may have.

Sincerely,

(Sig.)
Tom Fitzsimmons
Director

cc: Carol Browner, USEPA HQ
Governor Gary Locke
Attorney General Christine Gregoire
Merilyn Reeves, HAB
Washington Congressional Delegation

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**REGION 10**
**1200 Sixth Avenue Seattle**
**Washington 98101**

February 3, 2000

Reply To
**Attn Of: ORC-158**

Tom Fitzsimmons, Director
State of Washington Department of Ecology
P.O. Box 47600
Olympia, Washington 98304-7600

Re: Hanford tank waste treatment negotiations and associated Land Disposal Restrictions disputes under the Hanford Federal Facility Agreement and Consent Order (HFFACO)

Dear Mr. Fitzsimmons:

This is in response to your letter, dated January 31, 2000, requesting that the Environmental Protection Agency (EPA) join the Department of Ecology (Ecology) in the development and issuance of a final dispute determination under the HFFACO that would require the Department of Energy (DOE) to move forward with construction and operation of a tank waste treatment complex and retrieve wastes from Hartford's leaking single shell tanks in a timely manner. You also asked if we would join you in issuing a final dispute determination on DOE compliance with RCRA Land Disposal Restrictions (LDR). You can count on our assistance and full support. EPA shares your concern that DOE has failed to make adequate progress in addressing the significant threats posed by the Hanford tank wastes and must commit to a program that ensures that the work is started and completed on schedule.

The retrieval and treatment of the Hanford site high-level radioactive tank waste (HLW) is the largest and most pressing environmental project in the DOE complex. It's priority is underscored by the continuing failure of DOE's single-shell tanks (SST), resultant loss of HLW to area soils and groundwater, the fact that DOE's adjacent double-shell tanks are nearing capacity and design life, and the delays the tank waste program has experienced to date.

It is appalling that after 18 months of negotiations we don't have agreement on a program to address what certainly is one of the nation's most severe environmental problems. On January 31,2000, the final day of the negotiation period, DOE submitted its latest proposal for resolving the dispute. It is clear from that proposal that DOE's position is that it will not commit to complete the work necessary to address this

compliance with LDR requirements is a critical complement to the tank waste milestones to be established through the final determination.

EPA stands ready to join the Department of Ecology in the development and issuance of final determinations that will require DOE to move forward with construction and operation of a tank waste treatment complex, retrieve wastes from DOE's leaking single shell tanks in a timely manner, and ensure compliance with LDRs in a manner that conforms to hazardous waste law, the Federal Facility Compliance Act, and the HFFACO.

If you have any questions, please don't hesitate to call me at (206) 553-1234.

Sincerely,
(Sig.)
Chuck Clarke
Regional Administrator

cc: Richard T. French, DOE Office of River Protection
Governor John Kitzhaber, State of Oregon
Keith Klein, DOE Richland Field Office
Attorney General Christine Gregoire, State of Washington
Governor Gary Locke, State of Washington
Merilyn Reeves, Hanford Advisory Board
Lonnie Selam Sr., Yakama Nation
Antone Minthorn, Confederated Tribes of the Umatilla
Sam Penney, Nez Perce Tribe
Washington Congressional Delegation

# APPENDIX C

## REPORT DISTRIBUTION

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Associate Administrator for Congressional and Legislative Affairs
Associate Administrator for Communications, Education and Public Affairs
Comptroller

Region 10

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Ecology

Director for Washington Department of Ecology