DOE/RL-2002-68

Hanford's Groundwater Management Plan:
Accelerated Cleanup and Protection

March 2003

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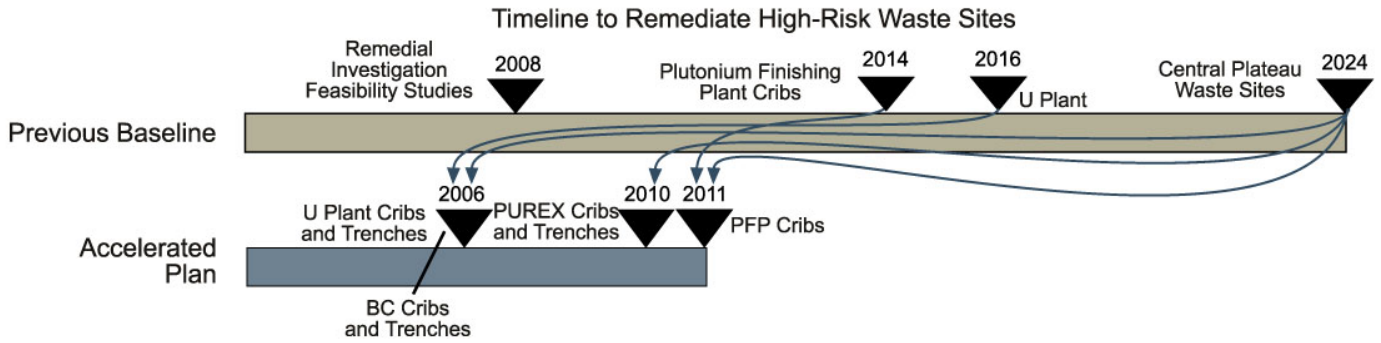
Executive Summary

Protection of Hanford's groundwater requires an aggressive plan to limit and control the migration of contaminants already in the soil and the groundwater. The U.S. Department of Energy (DOE), through its primary management contractor, Fluor Hanford, Inc. (FHI), has developed a plan in consultation with the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) to accelerate cleanup, which will return groundwater to its beneficial use where practicable or will at least prevent further degradation.

> As a regulatory and policy objective in both the RCRA and CERCLA programs, "EPA expects to return usable ground waters to their beneficial uses wherever practicable, within a time frame that is reasonable given the particular circumstances of the site. When restoration of ground water to beneficial uses is not practicable, EPA expects to prevent further migration of the plume, prevent exposure to the contaminated ground water, and evaluate further risk reduction."
>
> —40 CFR 300.430(a)(1)(iii)(F)

The previous baseline shows remediation beginning in 2008 and extending to 2024. However, the new accelerated schedules illustrated in this document show that the baseline will begin in 2004 and be completed by 2012. Specific results that can be expected using this accelerated plan for cleanup include the following:

1. **Remediate High-Risk Waste Sites** – Clean up waste sites that pose the highest risk to groundwater (completed in 2011 instead 2024); see Section 2.1.1 and Appendix, Schedules A.2, A.3, and A.4.
2. **Shrink the Contaminated Area** – Reduce the contaminated surface area so it can be released for other purposes (completed in 2009 instead of 2024); see Section 2.1.2 and Appendix, Schedule A.5.
3. **Reduce Recharge** – Reduce the transport of contaminants to groundwater from natural and artificial recharge (completed in 2012 instead of 2024); see Section 2.1.3 and Appendix, Schedule A.6.
4. **Remediate Groundwater** – Implement final remedial actions at pump-and-treat sites (completed in 2006 instead of 2016); see Section 2.2 and Appendix, Schedule A.7.
5. **Monitor Groundwater** – Determine the groundwater monitoring needs for long-term stewardship of the Central Plateau and evaluate new technologies that may be more effective; see Section 2.3 and Appendix, Schedule A.8.



Plans to deal with waste sites in close proximity to the tank farms require further work and will depend greatly on the strategy employed to close the tanks. The regions selected for completion by 2012 avoid those areas immediately adjacent to tank farms until an integrated approach to waste site remediation and tank closure can be developed.

Area Closure Strategy

Layered across these activities to clean up and protect groundwater is an area closure concept. This approach entails the complete clean up of all facilities within a region around any given operable unit or similar cleanup site. The main features include the following:

- Clean up all facilities within a region and the associated waste sites that represent several operable units.
- Have parallel cleanup operations rather than sequential.
- Apply what DOE learns from the low-risk sites to high-risk sites.
- Complete cleanup or move to long-term stewardship.

To prevent further groundwater degradation, restore major portions of the groundwater beneath the Hanford Site, and move more rapidly to final remediation and long-term stewardship, the accelerated FHI approach to groundwater cleanup focuses on the following areas:

- **100 and 300 Areas** — move from interim actions to final decisions for groundwater in coordination with the cleanup actions under the River Corridor contractor.
- **Central Plateau** — reach final decisions by using ongoing characterization, monitoring, and assessment activities to develop and implement early actions to protect and restore groundwater outside the Core Zone.

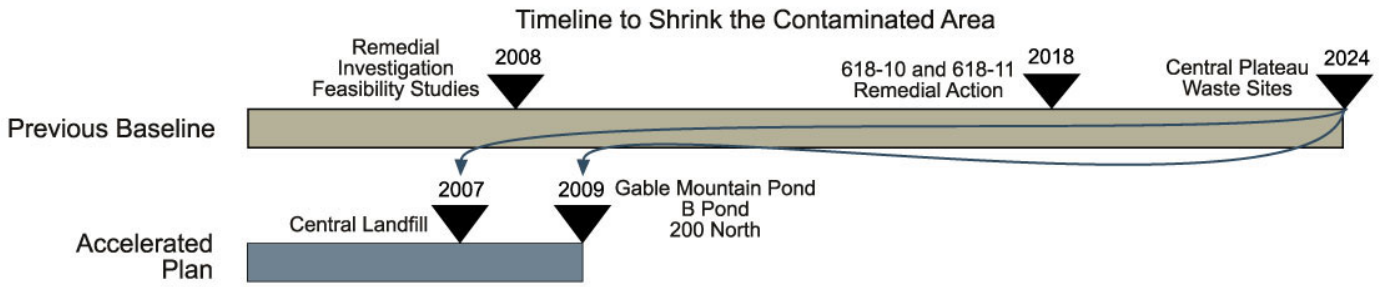
The approach for implementing early actions within the Central Plateau is on an area-by-area basis (Figure S.1). When performed on an area basis, these coordinated efforts to control sources, implement remedial actions, and assess and monitor impact will place major portions of the Central Plateau into long-term stewardship monitoring starting in 2006.

Under this accelerated plan, the following actions will be completed by FHI by the end of FY 2006:

- Remediate 54 waste sites.
- Decommission 420 high-risk wells.
- Complete four records-of-decision for waste site remediation.
- Complete integrated monitoring system (at least 59 new wells).
- Develop final groundwater remedial actions for 200-UP-1, 100-HR-H, and 100-NR-2 areas.
- Complete water line and infrastructure upgrades to reduce recharge.

Program Management

To effectively manage the Groundwater Protection Program, FHI created an integrated organization (see Section 3). The groundwater protection work is organized around key functional areas, allowing major portions of the work to be centralized for the entire

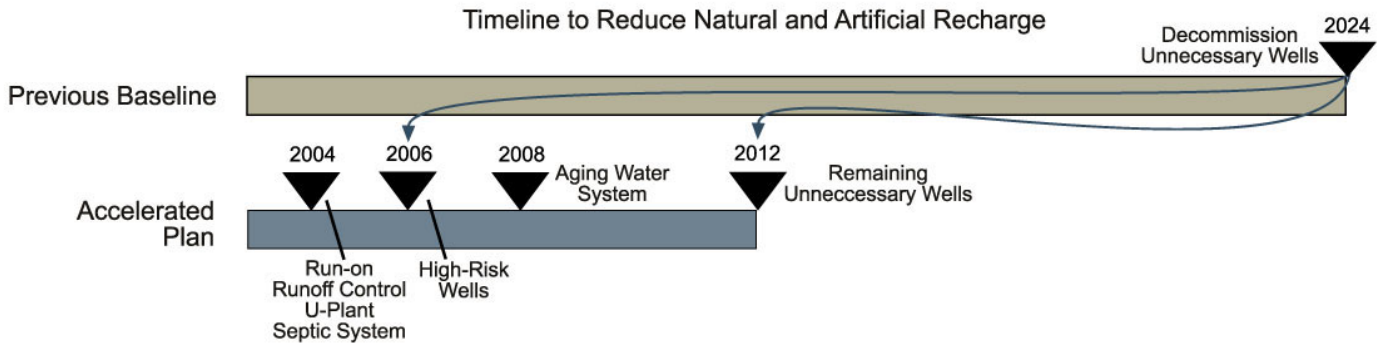


Hanford Site. Managing the work in an integrated manner accelerates cleanup and makes it more efficient by coordinating projects, avoiding duplication, and assuring consistent decisions (see Appendix, Schedule A.13).

Communications

Key to the success of cleanup at the Hanford Site is involving and communicating with the public and tribal nations. The range of information resources and public involvement opportunities provided by the Groundwater Protection Program is outlined in Section 4 and includes the Hanford Advisory Board, monthly open meetings, regulatory meetings, information sessions, work groups, and technical reports. The program maintains a web site to assure that information is easily accessible (http://www.hanford.gov/cp/gpp/).

This accelerated plan shows how DOE/RL will meet the requirements of DOE Order 435.1 to protect and remediate groundwater. Actions are consistent with the Tri-Party Agreement and applicable Washington State and federal regulations. It supercedes the *Hanford Site Ground Water Protection Management Plan* (DOE/RL-89-12) issued in 1995 and the *Management and Integration of Hanford Site Groundwater and Vadose Zone Activities* (DOE/RL-98-03) issued in 1998. This plan also contains the implementing actions to comply with the guidance issued by EPA in *Methods for Monitoring Pump-and-Treat Performance* (EPA/600/R-94/123). This accelerated plan provides a sound technical basis for completing groundwater protective actions at the Hanford Site.



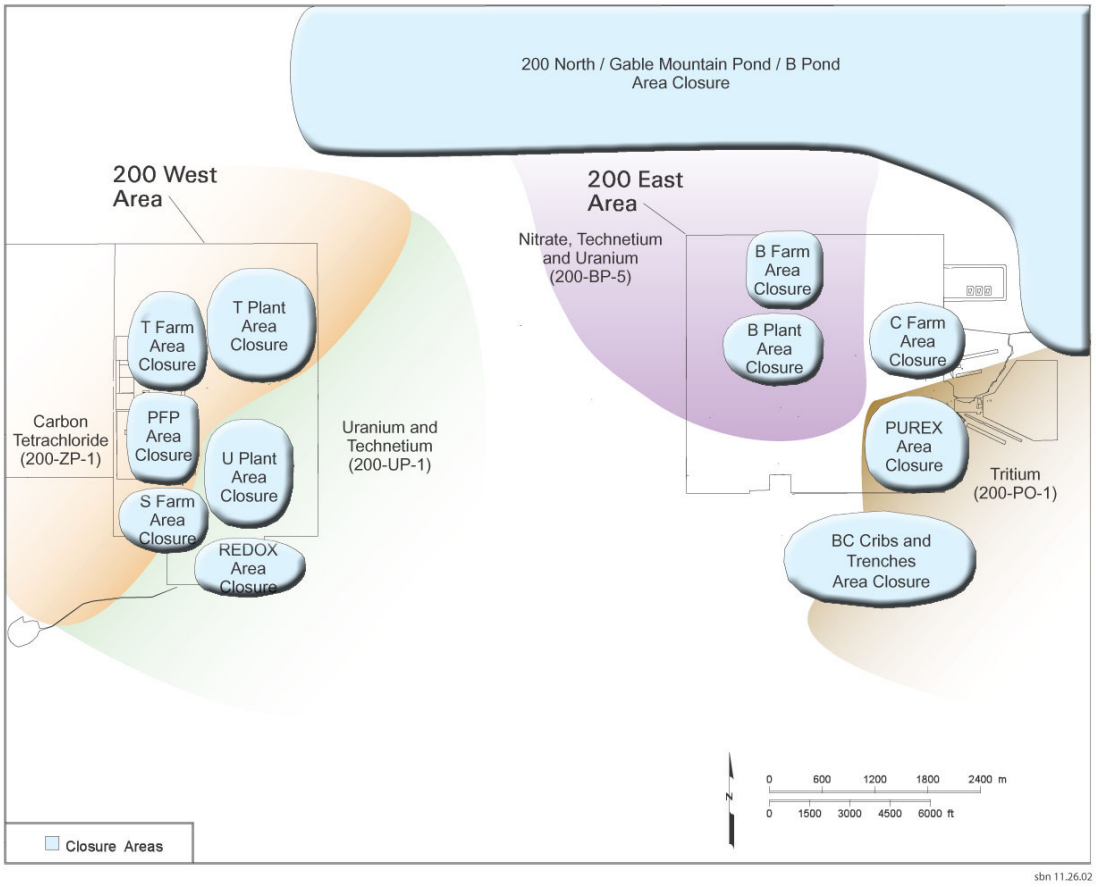
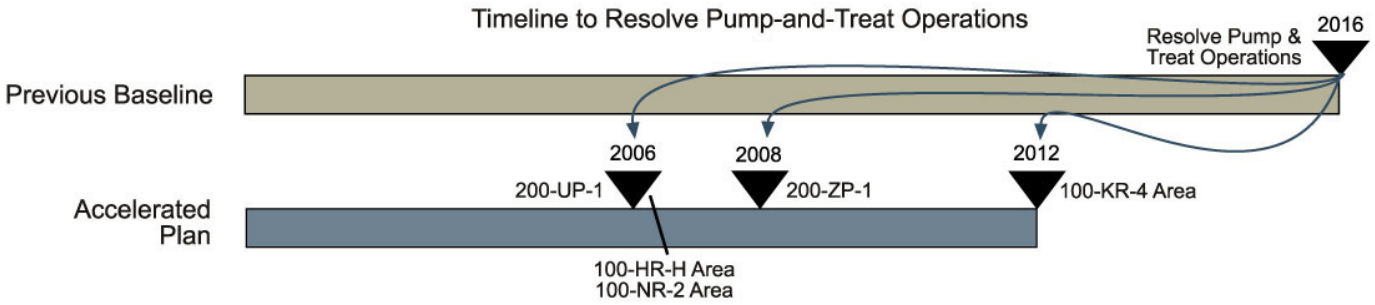


Figure S.1. *Area closure approach to Central Plateau remediation.*



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1.0 Introduction

In FY 2002, the U.S. Department of Energy (DOE) created a plan to transform and accelerate cleanup of the Hanford Site. The previous baseline required too much time, unrealistic levels of funding, and delayed the reduction of risk.

DOE is accelerating cleanup of groundwater on the Hanford Site from the original date of 2024 to 2012, and possibly sooner, by making more aggressive assumptions, changing the technical strategy and management approach, and investing in science and technology.

This accelerated plan draws on the recommendations resulting from DOE's Environmental Management review conducted early in 2002 and on the ideas that emerged from the year long DOE, regulator, and contractor Cleanup, Constraints, and Challenges Team process including acceleration of groundwater protection actions.

On March 5, 2002, DOE signed a letter of intent with the Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA) to cooperatively develop approaches to accelerate site cleanup. The *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE/RL-2002-47) fulfills the commitments contained in that letter. On June 28, 2002, Ecology, EPA, and the Oregon State Office of Energy sent a letter to DOE's Assistant Secretary, Jessie Roberson, expressing support for a final plan that incorporates the work of the Cleanup, Constraints, and Challenges Team into the strategic initiatives.

The performance management plan (DOE/RL-2002-47) demonstrates a true partnership between DOE and the regulators to accelerate cleanup. In it, six strategic initiatives (Figure 1.1) are defined that require additional near-term investments to put DOE in position to end the environmental management mission at the Hanford Site by 2035. In each case, these initiatives identify work required by the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement; Ecology et al. 1998) and invest additional resources in those projects to achieve early completion. Acceleration of Hanford's Groundwater Protection Program is specifically addressed in Initiative 6. Each of the other five initiatives is driven largely by the need to protect Hanford's groundwater, which is the primary pathway for contaminants to reach the Columbia River from the Hanford Site.

The fundamental goal of DOE's Groundwater Protection Program is to protect human health and the environment from Hanford contamination. The program is a key piece of DOE's overall Hanford cleanup strategy.

***Figure 1.1**. Strategic initiatives to accelerate cleanup of the Hanford Site.*

1.1 Purpose

The purpose of this document is to articulate FHI's accelerated cleanup and protection of Hanford's groundwater and associated ecosystems including the vadose zone soil, the riparian zone where groundwater discharges into the Columbia River, and the Columbia River itself.

Hanford groundwater protection, remediation, and monitoring actions are guided by both federal and Washington State regulations. The primary requirements are contained in the Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) implemented in accordance with the provisions of the Tri-Party Agreement (Ecology et al. 1998), and the Atomic Energy Act of 1954. DOE, in conjunction with the regulators, developed a regulatory strategy for the groundwater protection efforts at Hanford. This effort was summarized in the draft *Hanford Site Groundwater Strategy* (DOE/RL-2002-59) by the Tri-Parties.

The draft *Hanford Site Groundwater Strategy* (DOE/RL-2002-59) focuses primarily on the regulatory requirements and policy for the protection, remediation, and monitoring of Hanford groundwater and for communicating these policy-level agreements, plans, progress, and results with tribal nations, stakeholders, and the public. This plan activates those policies and the commitments in the Tri-Party Agreement (Ecology et al. 1998), moving from investigation to remediation and closure or post-closure care and long-term stewardship.

To move to a final conclusion for groundwater, FHI will investigate characterization, assessment, and technology needs and aggressively seek and implement remedial alternatives, protective measures, and closure approaches (Figure 1.2). DOE and the regulators have developed a framework for how risk assessments will be performed to guide remedial decisions. This framework and the subsequent actions described in this plan represent the necessary steps to complete the tasks described within the *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE/RL-2002-47).

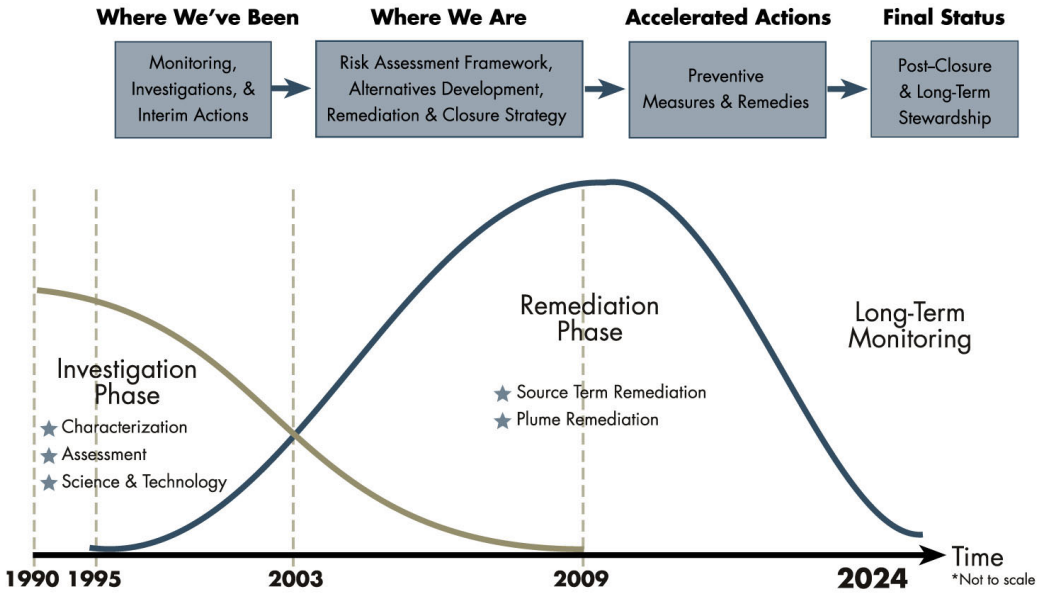


Figure 1.2. *Implementation phases of groundwater protection.*

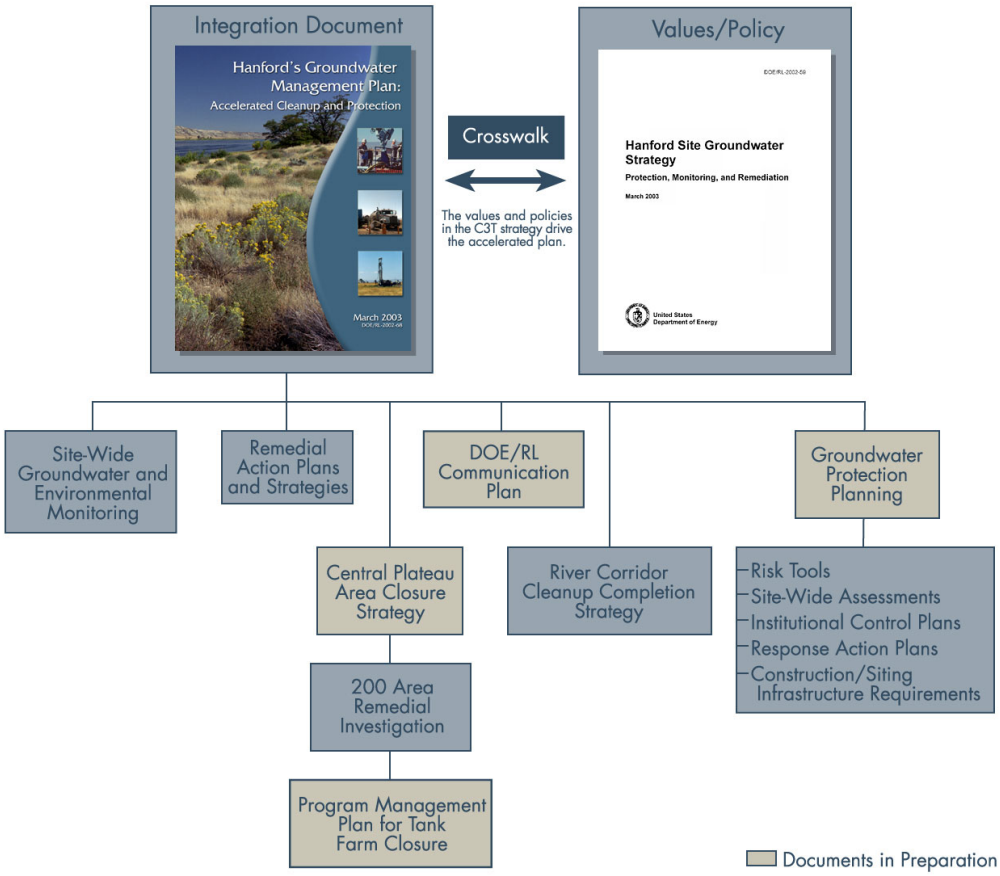


Figure 1.3. *The above illustration shows some of the documents that this accelerated plan relies on for guidance.*

This integrated management plan to accelerate groundwater cleanup (Figure 1.3) is closely linked to the draft *Hanford Site Groundwater Strategy* (DOE/RL-2002-59), the annual site-wide groundwater monitoring report (Hartman et al. 2002), the environmental report (Poston et al. 2002), and the River Corridor cleanup strategy (DOE/RL-2002-54). Actions will be implemented through the remedial action work plans that have been developed (e.g., DOE/RL-97-36) and the 200 Area remedial investigation (DOE/RL-98-28). Other documents that will serve to guide this plan as it progresses include such things as the Central Plateau closure strategy, the program management plan for tank farm closure, groundwater protection planning, and DOE/RL's communication plan; all these documents are under preparation.

1.2 Responsibility

There are currently four prime contractors with a role in the protection and remediation of groundwater at the Hanford Site: the River Corridor contractor, the Central Plateau contractor, the tank farm operations contractor, and Pacific Northwest National Laboratory. The Central Plateau contractor (FHI) has the overall responsibility of integrating the groundwater protection activities. The objective of the first three contractors is to complete cleanup actions to support shrinking the size of the Hanford Site to the Core Zone by 2012 and complete DOE's Environmental Management mission by 2035 or sooner. The Pacific Northwest National Laboratory is responsible for science and technology as well as monitoring the groundwater. The

risk framework, which has been adopted by DOE and their regulators, provides the basis for establishing the Central Plateau Core Zone.

1.3 History

The legacy of 50 years of defense production lingers below the surface of the Hanford Site (Figure 1.4). According to estimates, 1.7 trillion liters (450 billion gallons) of liquid waste, some containing radionuclides and hazardous chemicals, have been released to the ground on the Hanford Site since 1944. Much of this contamination remains above the water table, but some reached groundwater.

The major chemical contaminants present in Hanford groundwater include carbon tetrachloride, chromium, and nitrate. Major radioactive contaminants include iodine-129, strontium-90, technetium-99, tritium, and uranium. Figure 1.5 illustrates the extent of the contaminant plumes at the Hanford Site.

As a result of the past disposal practices, over 207 square kilometers (80 square miles) of Hanford's groundwater has contaminant levels greater than federal and state drinking water standards. Hanford groundwater is not a primary source of drinking water, but it flows into the Columbia River, which is a major drinking water source.

However, Hanford groundwater does not impact the water quality of the Columbia River. The Washington State Department of Ecology and the U.S. Geological Survey both gave the Columbia River the highest rating for water quality — Class A, meaning "Excellent" — from the Grand Coulee Dam to the Washington/Oregon border. A Class A rating means that the Columbia River is suitable for all types of water supplies, fish and shellfish habitat, wildlife habitat, human recreational activities, and commerce and navigation. Drinking water downstream of Hanford meets all regulatory drinking water standards.

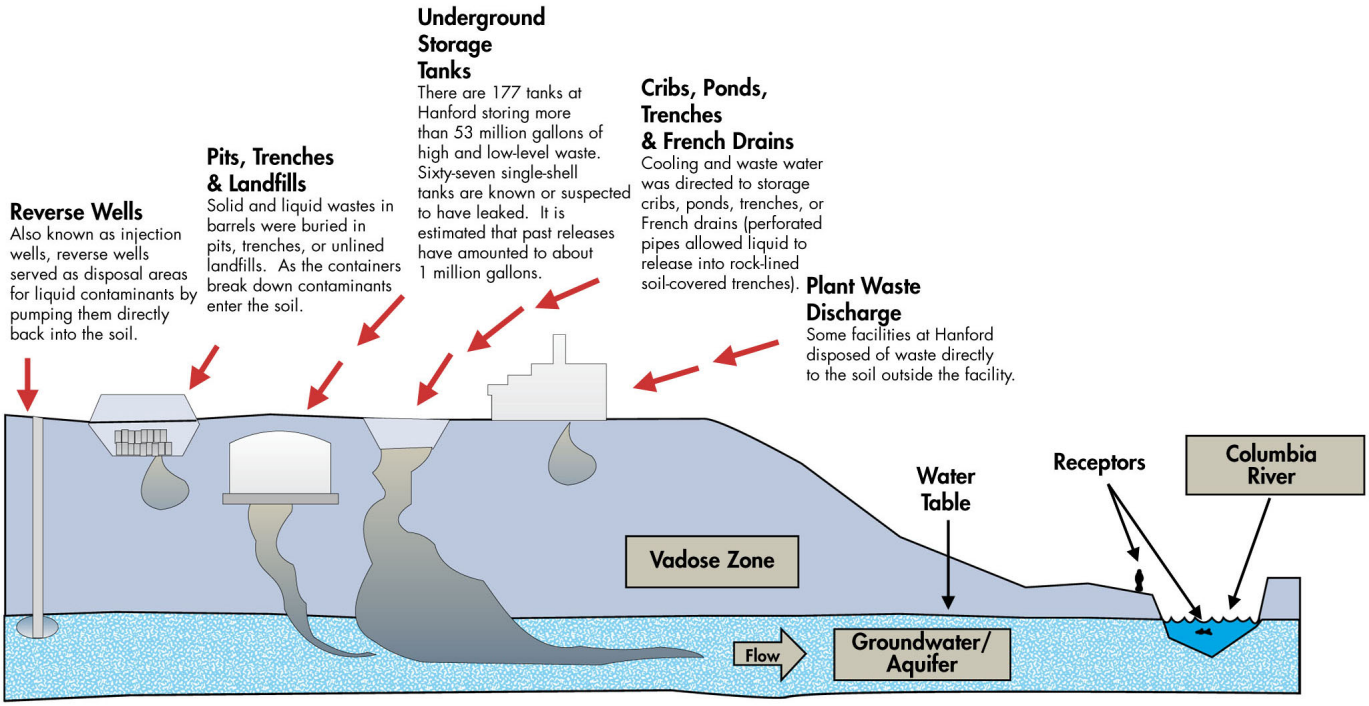


Figure 1.4. *Sources of Hanford groundwater contamination.*

During the defense production era, the vast quantities of liquid discharged to the soil resulted in a "mounding" of the groundwater in and around the 200 Areas. Since the discharge of liquid waste ceased in the mid-1990s, these mounds have diminished, which has slowed the release of contaminants to the groundwater and lengthened travel time to the Columbia River.

1.4 Current Operations

The goal of current operations at the Hanford Site is to minimize adverse impact to existing groundwater plumes, protect the Columbia River, and restore groundwater beneath the Hanford Site. Liquid waste generated from operations throughout the site is treated to comply with the appropriate standards and routed to locations for discharge that limit the impact on existing groundwater contaminant plumes. Work continues to remove liquids remaining in single-shell waste tanks to eliminate the potential for future leaks from these structures.

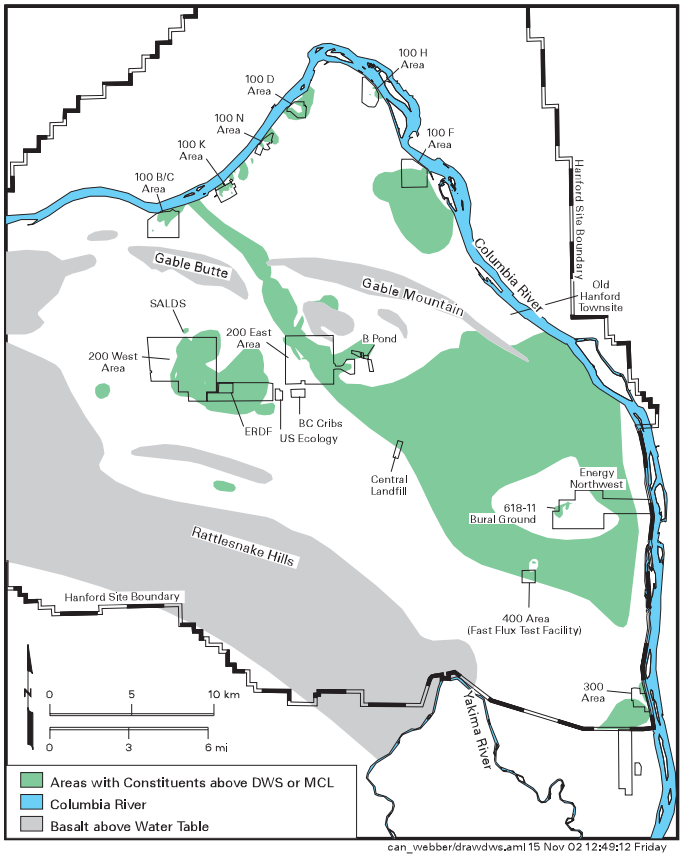


***Figure 1.5**. Distribution of major radionuclides and hazardous chemicals in groundwater at concentrations above maximum contaminant levels or drinking water standards, fiscal year 2001.*

Groundwater Protection Actions

In addition to remediation, a key to protecting the Columbia River is to stop the flow of contaminants into Hanford's groundwater. This includes assuring no new contaminants are introduced and removing existing contaminants or the mechanisms that could drive contaminants into the groundwater. In addition to the active remediation measures, other sitewide actions to protect groundwater include:

- Stopping unpermitted discharge of liquids to the soil — completed in 1995.
- Completing cleanup of the 1100 Area and the North Slope and deleting them from the National Priorities List (first such deletion in the DOE complex) — completed in 1996 and 1998, respectively.
- Removing contaminated soil from the river corridor — 3.2 million tons removed to date.
- Moving spent nuclear fuel away from two aging storage basins along the Columbia River — 15 million curies removed to date.
- Transferring liquid waste from underground single-shell tanks — to be completed in 2004.

Five active pump-and-treat operations are presently containing existing plumes, reducing the mass of contaminants in the groundwater, and protecting sensitive aquatic species in the Columbia River (Figure 1.6; Table 1.1). The primary contaminants addressed through these actions are carbon tetrachloride, chromium, strontium-90, technetium-99, and uranium. In addition to these systems, a technique called in situ

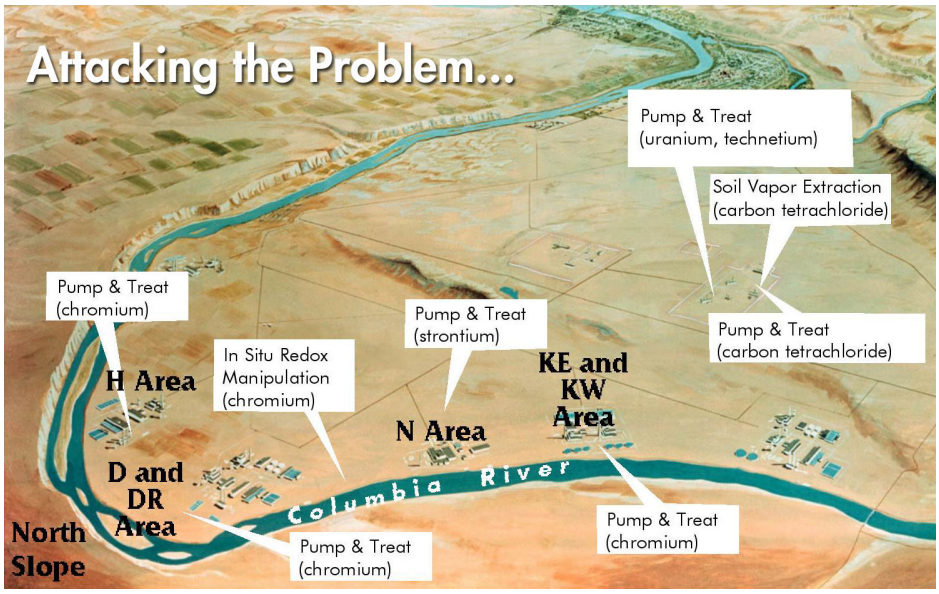


***Figure 1.6**. Hanford's ongoing groundwater remediation actions.*

redox manipulation reduces toxicity and immobilizes chromium. A soil-vapor extraction system intercepts carbon tetrachloride in the soil column before reaching the groundwater (see Figure 1.6).

There are approximately 207 square kilometers (80 square miles) of contaminant plumes affecting groundwater quality within the Hanford Site. The largest of these is the tritium plume, a dilute plume covering 181 square kilometers (70 square miles). Because of the dilute nature of the plume and the short half-life (12.3 years) of tritium, this plume is expected to attenuate naturally through radioactive decay. The Tri-Party Agreement (Ecology et al. 1998) provides the regulatory basis to protect, preserve, and where possible, restore Hanford groundwater. Table 1.2 provides a summary of the major milestones that directly support groundwater protection and source control actions.

1.5 Accelerated Plan

Protection of Hanford's groundwater requires the development and execution of an aggressive plan to limit and control the continued migration of contaminants already in the soil and the groundwater. To do this, FHI will perform the following tasks:

> "Groundwater monitoring will be performed to support cleanup decisions and to verify that land-based disposal units are properly designed and operated to prevent impact to groundwater."
>
> —Draft *Hanford Site Groundwater Strategy*

- Prevent degradation (see Section 2.1)
  - Remediate high-risk waste sites.
  - Shrink the contaminated area.
  - Reduce natural and artificial recharge.
- Remediate groundwater (see Section 2.2)
- Monitor groundwater (see Section 2.3)

These program elements are shown in Figure 1.7. Layered across them is an area-by-area closure strategy (see Figure S.1). When performed on an area basis, these coordinated efforts to control sources, implement

Table 1.1. Removal of groundwater contaminants.

Location	Startup Date	Contaminant	Mass Removed (Groundwater Processed) Through FY 2002
Groundwater Pump-and-Treat Systems			
100-D Area	1997	Hexavalent chromium	122.1 kilograms (679.1 million liters)
100-H Area	1997	Hexavalent chromium	28.4 kilograms (749.7 million liters)
100-K Area	1997	Hexavalent chromium	175 kilograms (1,559 million liters)
100-N Area	1995	Strontium-90	1.26 curies (755.4 million liters)
200-West Area (200-ZP-1) Operable Unit	1994	Carbon tetrachloride	6,874 kilograms (1,891 million liters)
200-West Area (200-UP-1) Operable Unit	1994	Carbon tetrachloride	22.2 kilograms (609 million liters)
	1994	Nitrate	23,186 kilograms (609 million liters)
	1994	Technetium-99	90.3 grams (609 million liters)
	1994	Uranium	158.3 grams (609 million liters)
Soil-Vapor Extraction			
200-West Area	1992	Carbon tetrachloride	77,798 kilograms

Table 1.2. The federal government seeks to mitigate potential effects to groundwater reflected by the milestones established within the Tri-Party Agreement.

TPA Milestone	Description	Date
River Corridor Contractor		
M-16-00A	Complete 100 Area Response Actions	December 2012
M-16-00B	Complete 300 Area Remedial Actions	December 2018
Central Plateau Contractor		
M-13-00	Submit 200 Area Remedial Investigation/Feasibility Study Work Plans	December 2004
M-15-00	Complete 200 Area Remedial Investigation/Feasibility Study Process for all Non-Tank Farm Operable Units	December 2008
M-16-00	Complete Remedial Actions for all Non-Tank Farm Operable Units	September 2024
M-20-00	Submit Part B Permit Application or Closure/Post Closure Plans for all RCRA Treatment, Storage, and Disposal Units	December 2008
M-24-00	Install RCRA Monitoring Wells	Annually
Tank Farm Contractor		
M-45-00	Complete Closure of all Single-Shell Tank Farms	September 2024

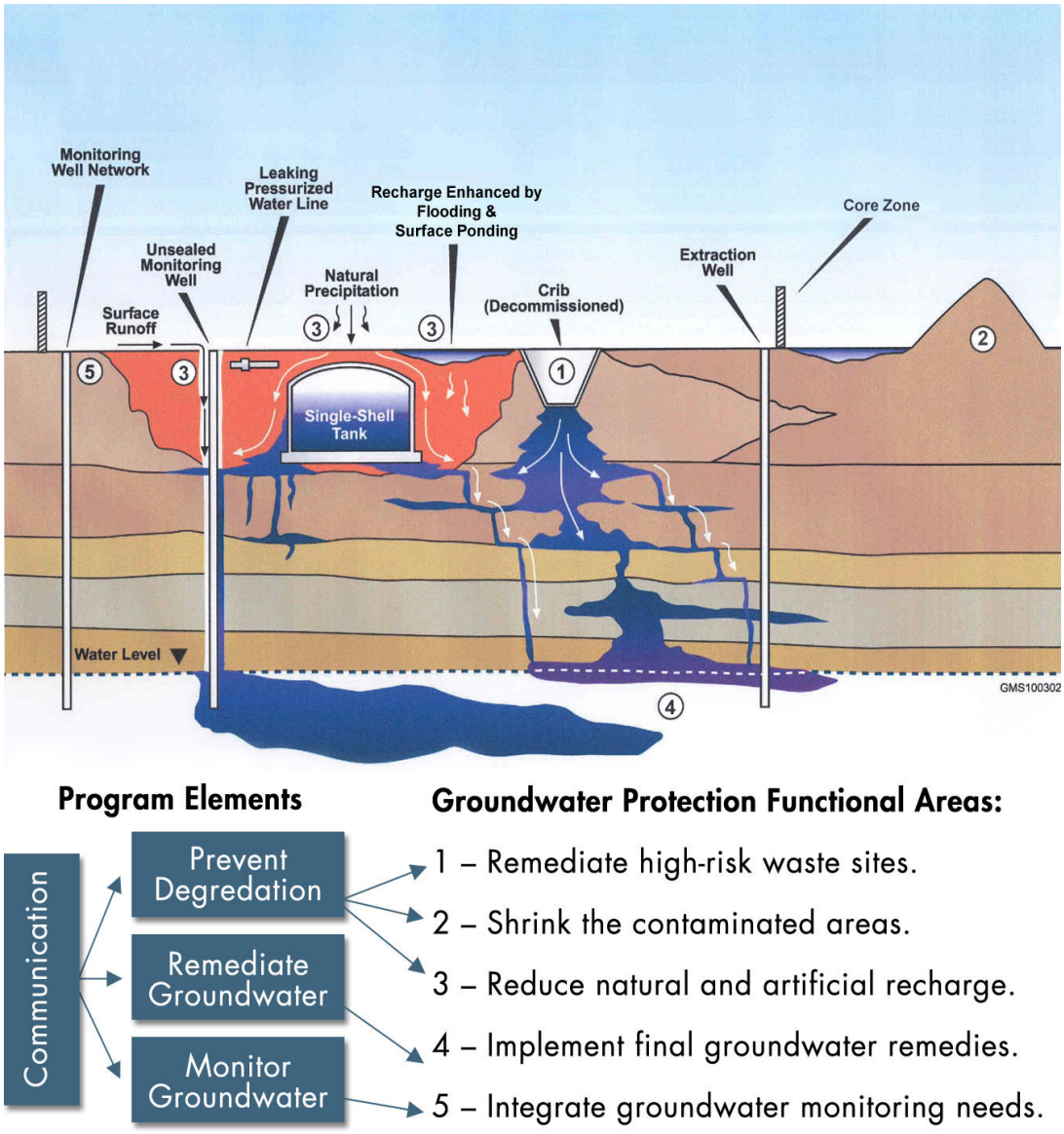


Figure 1.7. *Hanford's accelerated cleanup approach.*

remedial actions, and assess and monitor impact will place major portions of the Central Plateau into long-term stewardship monitoring starting in 2006.

This accelerated plan includes FHI's specific groundwater protection actions, strategies, and remedial approaches (Section 2); integrated management approach to accelerate actions to protect groundwater (Section 3); a communication plan for sharing plans, progress, and results (Section 4); and the detailed implementation schedules for the Groundwater Protection Program (Appendix).

2.0 Acceleration of Groundwater Protection

FHI has established an approach to aggressively accomplish the groundwater protection mission as mandated under the overarching EPA objectives by applying the program elements shown in Figure 1.7:

- Prevent degradation.
- Remediate groundwater.
- Monitor groundwater.

> "EPA expects to use a combination of methods, as appropriate, to achieve protection of human health and the environment. In appropriate site situations, treatment of the principal threats posed by a site, with priority placed on treating waste that is liquid, highly toxic or highly mobile, will be combined with engineering controls (such as containment) and institutional controls, as appropriate, for treatment residuals and untreated waste."
>
> —40 CFR 300.430 (a)(1)(iii)(C)

Actions are underway that are necessary to prevent further degradation of groundwater, restore major portions of the groundwater beneath the Hanford Site, and move more rapidly to final remediation and long-term stewardship. These actions are based on recent changes to the Tri-Party Agreement regarding the Columbia River Corridor and the Central Plateau. In the 100 and 300 Areas, coordinating these new activities with the cleanup actions being undertaken by the River Corridor contractor will allow final decisions for groundwater. At the Central Plateau, the strategy to achieve final closure decisions is to develop and implement early actions to protect and restore groundwater outside the Core Zone. Figure 2.1 shows the major remediation areas on the Hanford Site.

Using this approach, FHI is implementing measures aimed at reducing current risk, while positioning the site for final remedies and closure actions (Figure 2.2).

A number of measures will be undertaken to prevent further degradation of the groundwater on the Hanford Site:

- Remediate high-risk waste sites on the Central Plateau.
- Remediate waste sites exterior to the Core Zone (including the 100 and 300 Area waste sites).
- Implement infrastructure improvements to minimize and/or eliminate negative effects caused by artificial and natural recharge conditions.
- Develop and implement the process to complete the remedial efforts using the U Plant Area as a pilot.

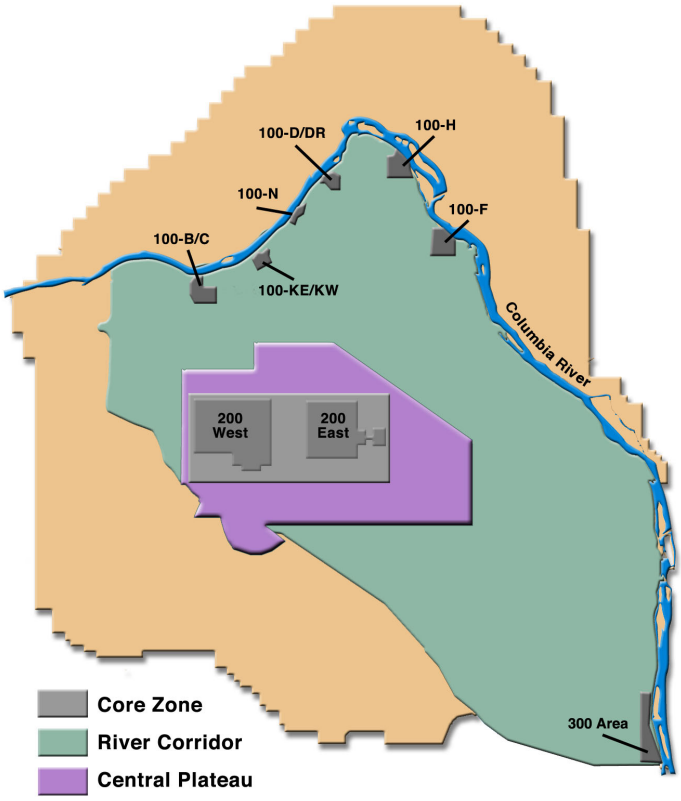


***Figure 2.1**. Major remediation areas on the Hanford Site.*

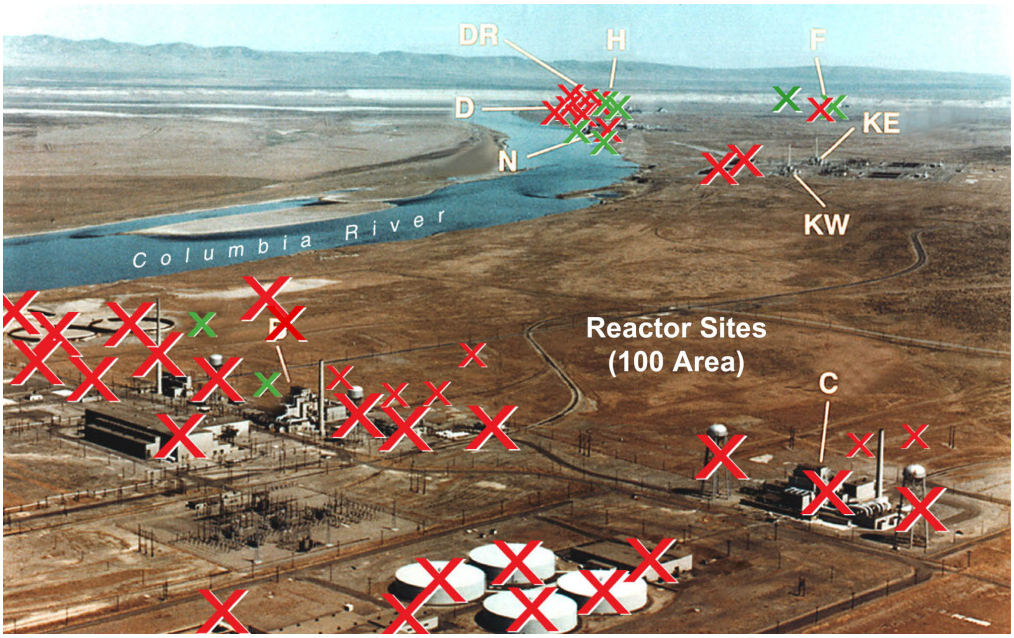


***Figure 2.2**. Reducing risk in the 100-B/C Area. Remediated waste sites are crossed out indicating progress in this important region of the Hanford Site (red = completed; green = in progress).*

Also during this phase, efforts will be undertaken to resolve interim pump-and-treat actions and establish final groundwater remedies. Thus, upon completion of this initial phase (by 2012 at the latest — and much sooner for a number of the elements), the only remaining actions will be to:

- Complete the source area remediation and tank farm closures within the Core Zone.
- Operate and maintain final groundwater remedies.
- Perform compliance and verification monitoring that will set the stage for the post-closure care and long-term stewardship of groundwater on the Hanford Site.

Implementing early actions within the Central Plateau on an area basis will provide a direct link between primary contaminant sources and the associated groundwater plumes. When performed on an area basis, these coordinated efforts to control sources, implement remedial actions, and assess and monitor impacts will place major portions of the Hanford Site into long-term stewardship monitoring.

Table 2.1 identifies the regions selected for early remediation and closure along with the primary source operable units within that region and the associated groundwater operable unit. In each region, with the exception of the Central Landfill, remedial investigation/feasibility studies are well underway and provide a sound basis for early action. In addition, by pursuing these remedies for an entire region many of the waste sites, unplanned releases, and other lower risk sites could be dealt with in the confirmatory sampling after area cleanup decisions are reached. These efforts would not only take care of these sites on a much faster schedule, but also would provide important characterization data to assure successful completion of all remedial investigation/feasibility studies by December 2008.

Confirmatory sampling is done at the site to be remediated to make sure the decision is correct for that specific site. This sampling also provides the data needed to decide cover dimensions and how deep the excavation needs to be if material is going to be removed.

This chapter summarizes actions included in baseline plans and accelerated actions included in the *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE/RL-2002-47) to prevent degradation of groundwater, to remediate the contaminated groundwater, and monitor groundwater conditions and the effectiveness of the remedial actions.

2.1 Prevent Degradation

Two key actions that will prevent future groundwater contamination are remediation of Hanford's waste sites, including tanks containing high-level waste, and reducing the transport of contaminants to groundwater by reducing natural and artificial recharge.

Once groundwater becomes contaminated, it is difficult and costly to remediate. Therefore, prevention of future groundwater contamination is the primary means of protecting groundwater.

During the past 7 years, 237 waste sites have been cleaned up to regulatory standards. A total of 3.2 million tons of contaminated material has been removed from sites near the Columbia River and 5.3 billion liters (1.4 billion gallons) of contaminated groundwater have been pumped from the ground and treated. In the process, 51 of the high-risk liquid waste disposal sites in the 100-B/C, 100-D, and 100-H Areas were remediated and backfilled as well as two high-risk sites in the 100-N Area.

2.1.1 Remediate High-Risk Waste Sites

At waste sites along the Columbia River, baseline plans are to complete remediation by 2012 through the River Corridor contractor. Remediation of Central Plateau waste sites, including closure of single-shell tank farms and other sites not included in the work of the River Corridor contractor, is planned for completion

Table 2.1. Central Plateau high-risk closure areas (excluding tank farms).

Closure Area	Key Contaminants	Completion Dates	Previous Completion Dates	Primary Source Operable Unit	Groundwater Operable Unit
High-Risk Waste Sites					
U Plant Cribs	Uranium, Technetium-99	2006	2016	200-PW-2	200-UP-1
BC Cribs	Technetium-99	2006	2016	200-TW-2	200-PO-1
PFP Cribs	Plutonium, Carbon Tetrachloride	2011	2016	200-PW-1	200-ZP-1
PUREX Cribs	Tritium, Iodine-129, Nitrate	2010	2017	200-PW-2	200-PO-1
Shrink the Contaminated Area					
200 North, Gable Pond, B Pond	Strontium-90, Tritium	2009	2026	200-CW-1 &3	200-PO-1 & BP-5
Central Landfill	Volatile Organic Solvents	2007	2026	200-SW-2	200-PO-1

by 2024. This plan accelerates completion of high-risk waste sites as shown in Table 2.1, but does not include waste sites by the tank farms. This approach would complete all actions for regions outside the Core Zone of the Central Plateau (except the 618-10 and 618-11 burial grounds) as well as deal with many of the high-risk waste sites responsible for existing groundwater contamination beneath the Hanford Site.

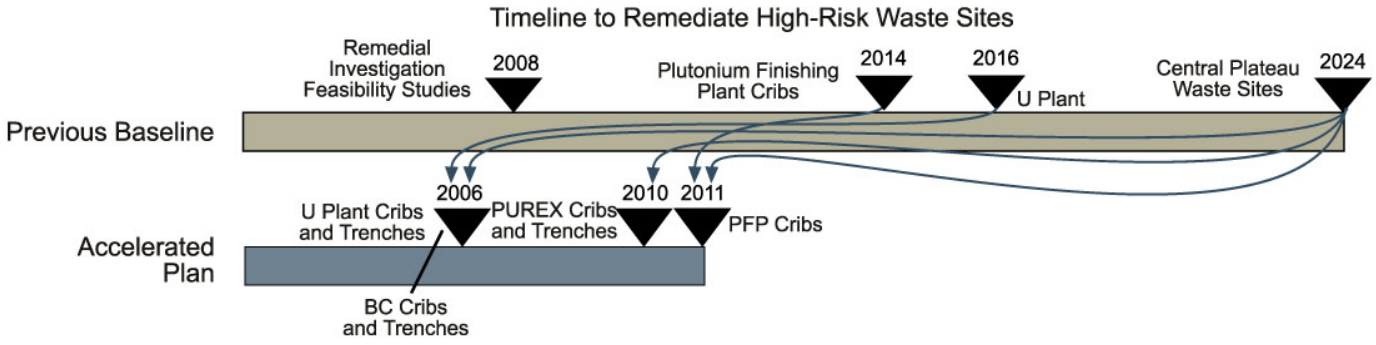
Plans to deal with waste sites in close proximity to tank farms require further work and will depend greatly on the strategy employed to close the tanks. The regions selected for completion avoid those areas immediately adjacent to tank farms until a compatible approach to waste site remediation and tank closure can be developed. Similarly, efforts are underway to further enhance the waste site approach by addressing excess facilities within the regions as presented in the performance management plan Initiative 5 (DOE/RL-2002-47).

The *Waste Site Remedial Action Master Schedule* presents the major efforts to complete remediation of waste sites (see Appendix, Schedule A.2). This baseline plan is substantially accelerated through the actions included in the *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE/RL-2002-47).

Actions to remediate high-risk waste sites focus on sites with large inventories of contaminants and existing groundwater plumes or sites with large inventories where early action may prevent or significantly reduce future groundwater impacts. Another factor considered during the evaluation process was the extent to which other facilities may interfere with the implementation of the action or regulatory approach. This plan accelerates the remediation of four high-risk waste sites including (1) the U Plant waste sites containing technetium-99 and uranium, (2) the BC cribs and trenches (located south of the 200 East Area) that contain a significant inventory of technetium-99 (over 600 curies), (3) the Plutonium Finishing Plant cribs that contain carbon tetrachloride and plutonium, and (4) the PUREX Plant cribs that received iodine-129 that has affected groundwater.

The baseline plan for remediation of the Central Plateau waste sites is substantially accelerated through actions proposed in the *Performance Management Plan for the Accelerated Cleanup of the Hanford Site*.

The actions proposed to accelerate remediation of these sites are shown in the *High Risk Waste Sites Master Schedule* (see Appendix, Schedule A.3). The remediation to be applied to these sites has not yet been determined. Possible remedial alternatives include the installation of surface barriers to reduce the infiltration of water that drives contaminants through the soil to the groundwater. In some cases, barriers will be applied to sites as they are; in others, waste materials may need to be removed, treated, and disposed of. Accelerated actions at these high-risk waste sites are scheduled for completion by 2011 (Figure 2.3).



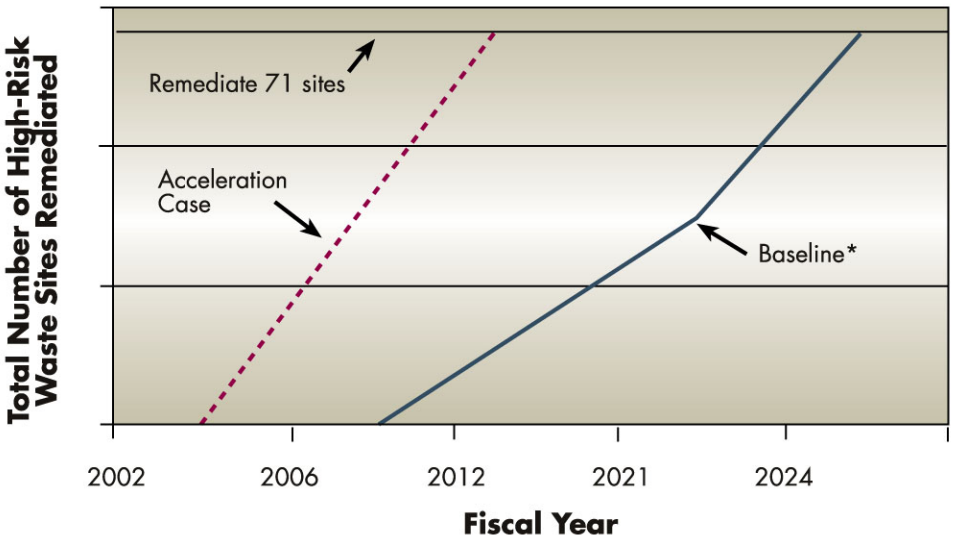


***Figure 2.3**. High-risk waste site remediation.*

scheduled until after 2008. However, several of the sites for which barrier placement may be the logical alternative are within the area adjacent to U Plant and could be remediated in conjunction with the U Plant Canyon Disposition Project. A coordinated approach to link Canyon Disposition with waste site remediation would address nearly all of the waste sites and facilities in the southeast portion of the 200 West Area. This strategy accelerates the work so that remediation is completed by 2006 rather than 2016 (see Appendix, Schedule A.3).

U Plant Cribs and Trenches. The U Plant and its companion facility, the Uranium Oxide Plant, were used to recover uranium from tank waste and produce uranium oxide, which was shipped offsite for reuse. These processes produced liquid waste containing high concentrations of technetium-99 and uranium that was disposed to cribs and trenches in the U Plant area. Elevated levels of both technetium-99 and uranium are present in groundwater at concentrations that exceed the criteria used to initiate early action. In addition, data suggests that only a small portion of the inventory has migrated into the groundwater; the majority of these contaminants still reside in the vadose zone.

The U Plant produced liquid waste high in technetium-99 and uranium that was disposed to cribs and trenches. Data suggests that the majority of these contaminants still reside in the vadose zone. Preliminary investigations indicate that release of these contaminants to groundwater may be reduced by using a surface barrier. A coordinated approach to link this remediation with similar remediation in the same area could accelerate the work so that it is completed in 2005.

Release of these two contaminants to the groundwater can be substantially reduced through the installation of surface barriers to limit the amount of infiltration through the contaminated soil beneath the cribs and trenches that received this waste. A barrier constructed to the RCRA Subtitle C specifications, with some minor modifications, and an effective vegetative cover can reduce infiltration through the contaminated soil by as much as a factor of fifty over the conditions that currently exist at these sites. Under the previous baseline, such actions were not

BC Cribs and Trenches. During the 1950s, much of the tank waste produced at B Plant and T Plant was reprocessed to recover uranium. This processing occurred at U Plant, and waste was either directly disposed to the soil or was put into a tank, or series of tanks, allowing most of the solids to settle. The remaining supernatant was discharged to the soil. This waste represents some of the most concentrated radioactive and hazardous waste disposed to the ground at Hanford.

Most of the liquid waste disposal sites that received this waste were located immediately adjacent to the tank farm complex except for the BC cribs and trenches, which are located south of the 200 East Area. The BC cribs and trenches received in excess of 189 million liters (50 million gallons) of this scavenged tank waste. Based on inventory estimates, this group of sites contains the largest inventory of technetium-99 disposed to the soil. Groundwater monitoring data for the BC cribs and trenches is limited, but little of the inventory from these sites appears to have reached the water table. These waste sites have also released radioactive particles to the surface, which has created a large radiation controlled area around the BC cribs and trenches.

Releases of technetium-99 from these waste sites could potentially lead to future groundwater contamination that would require active remediation. The earlier these sources are remediated, the less likely contaminants will reach groundwater. The location of these sites in the southeast portion of 200 East Area also means that in addition to the extensive inventory of contaminants, the location is such that releases to the groundwater would be outside the recently defined Core Zone boundary. If a barrier is chosen for the remedial action, the design of the barrier for these sites would be expected to be similar to those suggested for the U Plant cribs and trenches, a modified RCRA Subtitle C design. In addition, a long-term monitoring system for these sites also is needed to monitor performance of the remedy after construction is complete.

The remediation of the BC cribs and trenches, and other sites immediately adjacent to tank farm waste management areas, was not previously scheduled until the tank farms were undergoing closure after 2018. This strategy accelerates the work so that remediation is completed by 2006 (see Appendix, Schedule A.3).

PUREX Cribs and Trenches. A number of cribs and trenches surrounding the PUREX Plant received high volume process condensates and process waste. These sources are located in the southeast portion of 200 East Area near the Central Plateau boundary. These sites are recognized as the primary sources of the iodine-129, tritium, and nitrate groundwater plumes between the Central Plateau and the Columbia River. The extent of the tritium and nitrate groundwater contamination has diminished since liquid discharges to these sites was stopped in the early 1990s. These sites have the potential to release additional iodine-129 at concentrations requiring active groundwater remediation.

The PUREX cribs and trenches are in need of remediation to limit infiltration and slow the migration of contaminants in the vadose zone. A barrier of a RCRA Subtitle C design, or a modification of that design, appears to be the preferred surface barrier for this type of site. These sites are located within the 200 East Area and should require few other actions. Some sites may be located in close proximity to other facilities and may be precluded from early action, but most of the significant cribs and trenches are located south and southeast of the PUREX Plant. The PUREX cribs and trenches are currently scheduled for remediation by 2017; this accelerated plan shows completion by 2010 (see Appendix, Schedule A.3).

Plutonium Finishing Plant Sites. Several waste sites located near the Plutonium Finishing Plant received waste containing carbon tetrachloride and plutonium. These contaminants each represent significant future risk but from distinctly different risk pathways. Carbon tetrachloride is a primary driver for ongoing groundwater remedial actions, while the most significant potential risk from plutonium would be from direct exposure should someone dig into the waste site in the future (i.e., an intruder pathway). Each of these

Several sites near the Plutonium Finishing Plant received waste containing carbon tetrachloride and plutonium. While both of these contaminants represent future risk, the difficulty in treating them comes from the incompatibility of the remedies that could be employed to reduce the risk. Selection of the appropriate remedial measures for these sites will be complicated and will ultimately require a series of actions.

contaminants justifies designating these areas as high-risk sites, but the difficulty comes from the incompatibility of the remedies that could be employed to reduce the risk from these waste sites.

Selection of the appropriate remedial measures for these sites will be complicated and will ultimately require a series of actions. The large inventory of carbon tetrachloride in the vadose zone and the groundwater will require aggressive action to contain and reduce mass. In addition, investigation is needed to determine the vertical extent of contamination in the groundwater. If it is determined that carbon tetrachloride deeper in the aquifer also requires active remediation, then beginning those actions early will help minimize any delay in dealing with the plutonium contamination.

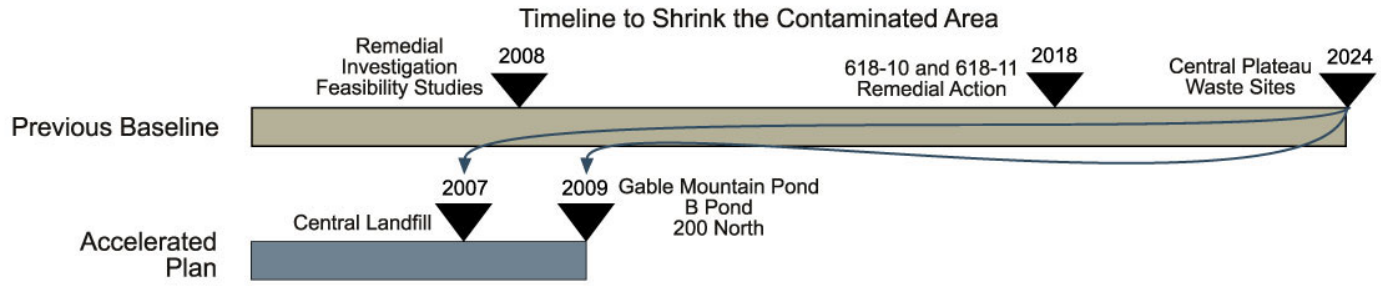
For plutonium contamination, the likely remedial alternatives are isolation with a barrier system like the Hanford Barrier, or removing the contaminated soil, and, if required, treating it and shipping it offsite. In either case, reducing the available amount of carbon tetrachloride in the vadose zone and groundwater prior to the actions to isolate or remove soil from these sites would help prevent the need for future drilling to control groundwater contamination in and around the barrier system and would limit the worker exposure to carbon tetrachloride during removal of the plutonium-contaminated soil. The Plutonium Finishing Plant cribs and trenches are currently scheduled for remediation by 2014. This strategy accelerates the activities so work on these sites is completed in 2011. The *Plutonium Finishing Plant Master Schedule* is included in the Appendix (Schedule A.4).

2.1.2 Shrink the Contaminated Area

This plan accelerates the remediation of several groups of waste sites located outside the exclusive waste management portion of the Central Plateau. Early remediation and closure of these sites would substantially reduce the contaminated area at Hanford and help to achieve the vision of only limited contamination outside the exclusive waste management area. Most of the sites in this area are contaminated only slightly and do not represent high-risk sites; however, their remediation and closure is a required element of the 200 Area cleanup. Some of these sites have released radioactive and hazardous substances to the groundwater, but in most cases, the residual contamination is not at levels requiring interim action. Early completion of actions at these sites would expedite cleanup of the Central Plateau and assist in controlling the release of certain contaminants to the groundwater. The actions to accelerate remediation of these sites is shown in the *Shrink the Contaminated Area Master Schedule* (see Appendix, Schedule A.5).

"Shrinking the contaminated area" describes DOE's objective to remediate waste sites outside the Central Plateau on the Hanford Site so those areas can be released for other uses as soon as possible.

200 North Area. The 200 North Area was once an area where railcars containing spent nuclear fuel were stored for a period of several weeks to months to allow radionuclides with very short half-lives to decay prior to reprocessing. Spent fuel stored in this way required



a constant flow of water through the railcars to thermally cool the elements. The cooling water was then disposed at several sites within the 200 North Area.

Within the 200 North Area, there are a number of other small waste sites, contaminated structures, and several contaminated railcars that were not included in the scope of the previous cleanup decision. For remediation of this area to be complete, it will be necessary to develop cleanup plans for these sources of contamination as well as the major waste sites. Including these actions together will allow early completion of this geographic area and help to shrink the contaminated area of the Central Plateau. The 200 North sites are currently scheduled for remediation by 2026. This strategy accelerates the activities so the work is completed in 2009 (see Appendix, Schedule A.5).

A CERCLA decision for cleanup of the 200 North Area was issued as part of the remaining sites decision for the 100 Area. The remedy for these sites is to remove contaminated material, treat as necessary, and dispose it in the Environmental Restoration Disposal Facility. This action is nearly identical to the cleanup of spent fuel storage liquid waste sites in the 100 Area and could easily be accelerated.

Gable Mountain and B Pond Complex. The Gable Mountain Pond and B Pond areas are a series of interconnected ponds and ditches used to receive large volumes of slightly contaminated steam condensate and cooling water from process operations at the PUREX and B Plants. These sites have relatively low levels of residual contamination and few significant groundwater plumes.

The remedy for these sites is not expected to be as extensive as at the high-risk sites. Many of these sites do not require barriers to control infiltration since little residual contamination remains in the vadose zone beneath these ponds and ditches. These large ponds maybe candidates for surface stabilization with clean topsoil and revegetation, as the remedy, or selective removal of contaminated soil, stabilization and revegetation could be the preferred alternative. Monitored natural attenuation appears to be the most likely remedy for the groundwater. Gable Mountain Pond and B Pond are currently scheduled for remediation by 2026. The proposed CERCLA plan will be issued for public comment in late summer 2003, with a decision expected by 2004 and completion of remedial action in 2009 (see Appendix, Schedule A.5).

Nonradioactive Dangerous Waste Landfill. The Nonradioactive Dangerous Waste Landfill and the associated Solid Waste Landfill located between the Central Plateau and the Wye Barricade also are candidates for early action. These sites are among the farthest sites outside the exclusive waste management area. Although not considered high-risk sites, these sites have released volatile organic solvents to the groundwater at concentrations that exceed water quality standards.

Use of monitored natural attenuation may be a viable choice for remediation at the Nonradioactive Dangerous Waste Landfill and others areas on the Hanford Site. Using natural attenuation is sometimes a preferred remedy because it does not transfer contamination from one location to another. Rather, the contamination is broken down in place and converted usually to non-toxic products. Monitored natural attenuation has been previously used at Hanford to meet remedial action objectives to restore groundwater. For example, the plume of organic solvents beneath the former Horn Rapids Landfill in the 1100 Area is being addressed through natural attenuation. A CERCLA review (EPA 2001) determined that monitored natural attenuation complied with the remedial action objectives for the Horn Rapids Landfill. (Note: Although long-term monitoring will be required at the former Horn Rapids Landfill, it was removed from the National Priorities List in 1996.)

In addition, the remedial actions for the Nonradioactive Dangerous Waste Landfill could include the emplacement of a RCRA Subtitle C design surface

barrier similar to those proposed for the cribs and trenches in the 200 Areas. The adjacent Solid Waste Landfill and Central Landfill should not require an infiltration barrier and could likely be closed with a standard RCRA Subtitle D Solid Waste Landfill cover. These landfills are currently scheduled for remediation by 2026. This strategy accelerates the activities so the work could be completed in 2007 (see Appendix, Schedule A.5).

"Natural attenuation" refers to the ability of groundwater to rid itself of contamination resulting from a spill or disposal of hazardous waste. Tests have demonstrated that it is an effective form of remediation at sites with aquifers composed of granular sediment.

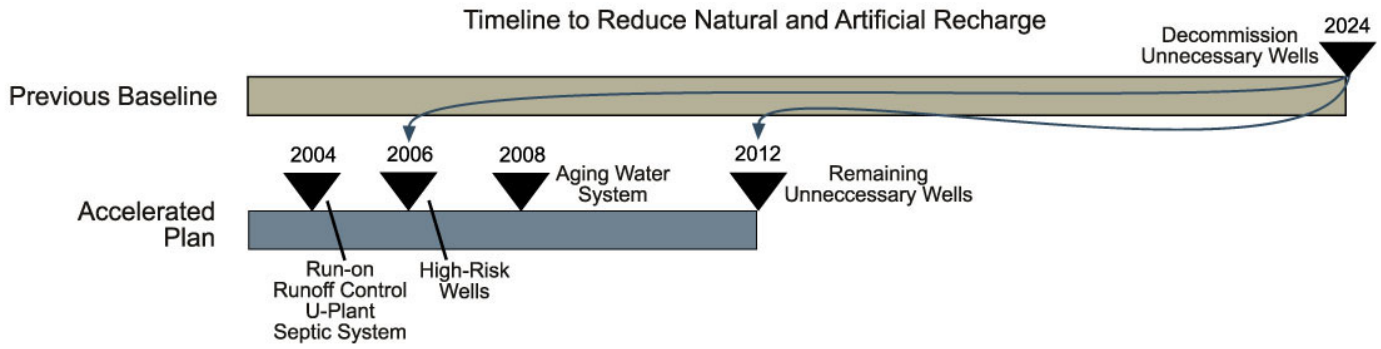
The basic concept of natural attenuation is not new. Bacteria that naturally inhabit groundwater are able to break down chemicals that were once thought to be non-biodegradable. For example, components of gasoline such as benzene, toluene, xylene, and ethylbenzene are now known to biodegrade in groundwater to carbon dioxide and water. Other contaminants, including chlorinated solvents (e.g., dry-cleaning solvents), can also biodegrade under certain conditions. In some cases, natural biodegradation may break down contaminants in groundwater faster than they can be removed by engineered systems. DOE is using monitored natural attenuation in conjunction with other technologies to remediate groundwater on the Hanford Site.

618-10 and 618-11 Burial Grounds. These burial grounds contain transuranic waste and are considered higher-risk sites for both their inventory and their potential to contaminate groundwater. New retrieval and treatment capabilities are being investigated with the intent of accelerating retrieval to beat the 2018 Tri-Party Agreement Milestone (Ecology et al. 1998). The DOE HQ-EM-50 Office of Science and Technology is expected to provide technologies to support this goal. A possible work schedule is included in the Appendix (Schedule A.10).

2.1.3 Reduce Natural and Artificial Recharge

Infiltration of water to the vadose zone provides the driving force for downward migration of contaminants in the vadose zone at the Hanford Site. Water in the vadose zone may come from such things as natural precipitation, wastewater disposed to cribs, leaks from tanks, leaking water lines, septic tanks, or drain fields.

Efforts to reduce recharge started in earnest in 1987, as plans were developed to discontinue disposal of liquid waste streams to the soil. Over the next 2 years, the number of liquid waste streams was drastically reduced, and waste streams containing radioactive contaminants were routed through the 200 Area



treatment facility in compliance with the Tri-Party Agreement Milestone M-17 (Ecology et al. 1998). These actions have eliminated the disposal of unpermitted wastewater on the Central Plateau. The focus of baseline and accelerated actions are on eliminating the inadvertent and natural recharge to further protect Hanford's groundwater.

Actions to reduce natural and artificial recharge were completed during fiscal year 2001 for 200 West Area tank farms. Actions for 200 East Area tank farms were completed in 2002. The installation of prototype surface cover (sealant) to stabilize tank farm surfaces is being considered for 2004.

In 1998, DOE's Office of River Protection initiated a program to reduce natural and artificial recharge in and around tank farms to reduce the potential for contaminants in the vadose zone to be carried to groundwater. The program has four major components:

- Design and construct surface water run-on control measures upgradient of single-shell tank farms.
- Abandon leaking pressurized water lines adjacent to single-shell tank farms.
- Upgrade monitoring drywells at single-shell tanks to include leak tight caps.
- Install surface cover (sealant) for stabilization purposes.

Reduce Infiltration at Existing Waste Sites. An action to limit the infiltration of water through waste sites, burial grounds, and tank farm waste management areas has been the use of berms. These berms reduce the potential for water to pond on top of these facilities and flush contaminants from the soil column into the groundwater or for water to become contaminated by a surface contamination area and runoff from the waste site and contaminate adjacent land. Water can often pond on a waste site as a result of an intense rainstorm or as a result of melting snow. Although precipitation at Hanford is low on an annual basis, much of the total infiltration is a result of these types of events.

A survey of the waste site burial grounds and other facilities is needed to identify locations where run-on and runoff controls are appropriate. These actions may be more important in areas where final remedies may take many years, such as waste sites immediately adjacent to tank farms.

The actions proposed to reduce infiltration are shown in the *Eliminate Recharge Conditions Master Schedule* (see Appendix, Schedule A.6). Actions to be taken to reduce infiltration at existing waste sites will be similar to the actions being completed in and around tank farms. Berms will be constructed to prevent surface water from flowing onto waste sites, and areas around waste sites will be graded to allow snowmelt and other precipitation to run off the sites rather than infiltrate. This action can be completed by the end of 2004.

Wells that do not meet regulatory standards for construction will be eliminated to reduce the potential for them to act as a pathway for contaminated water to reach the groundwater.

Well Decommissioning. Nearly 7,000 wells have been drilled on the Hanford Site. Many of these wells were drilled prior to the institution of well construction requirements to limit the possible migration of water down the well casing to the groundwater. In many cases, these wells were drilled through waste sites or immediately adjacent to the waste sites for the purpose of monitoring releases to the groundwater. These wells provide potential pathways for surface water runoff or artificial recharge from the surface to ingress on waste contained within the vadose zone and drive contaminants in the waste toward the groundwater. Decommissioning of these aging wells represents a sound pollution prevention measure to protect Hanford groundwater (Figure 2.4). These actions have not been previously considered as high priority actions and,

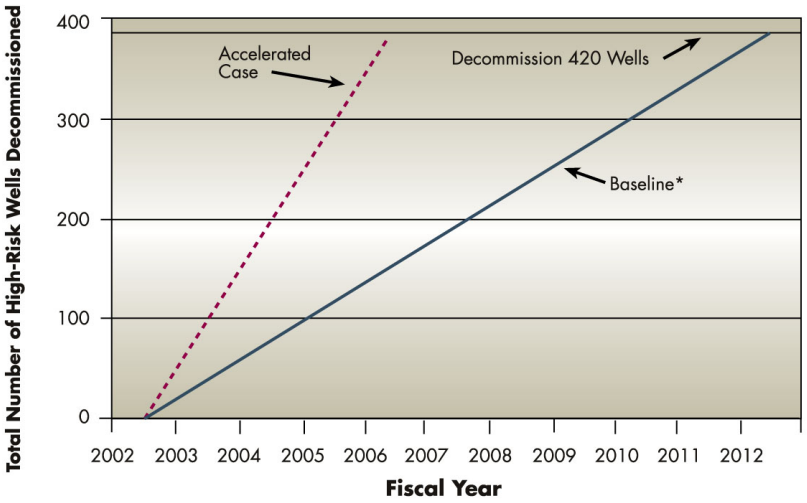


***Figure 2.4**. High-risk wells decommissioned.*

therefore, have not been funded at levels that would significantly reduce the number of wells requiring decommissioning.

Out of the nearly 7,000 wells located at Hanford, less than half of them are in use. It is estimated that it would take in excess of thirty years to decommission all wells not needed for monitoring or other purposes. A large number of these wells are in areas that will be subject to remedial and closure actions over the next few years. In addition, about 420 of these wells are considered high priority due to their proximity to waste sites and the potential for these wells to provide pathways for water to leach contaminants from the subsurface.

A two-phase approach will be used to address well decommissioning. The first phase will be to continue to decommission the high-risk wells at a fairly consistent rate. The second phase would emphasize the well decommissioning associated with ongoing and upcoming remedial or closure actions to limit preferential pathways, to remove impediments to surface barrier installation, and to put in place the post-closure monitoring network needed to monitor releases to the groundwater. Ninety-nine wells were decommissioned during fiscal year 2001. Well decommissioning is not currently in the Hanford baseline; however, an accelerated action will decommission high-risk wells by 2006 and the remaining wells by 2018.

Leaking Water Lines. Ruptured waterlines also represent a significant source of artificial recharge within the Central Plateau (Figure 2.5). Unlike sanitary sewer systems where the location and volume of the discharges are known, leaking water lines represent a far more difficult problem to diagnose. Like sewer systems, these leaks have the potential to flush contaminants from the vadose zone into the groundwater or to simply accelerate the movement of contaminants within the groundwater flow system. Over the past few years, a number of leaks have been detected in areas around the tank farm waste management areas that clearly have contributed to groundwater contamination.

A systematic evaluation of the water lines will be performed to determine if any of these water lines are located near waste sites that are subject to near-term remedial or closure actions. Moving water lines away from waste sites that are to be isolated with surface barriers will eliminate the potential for leaking lines to flush contaminants from the vadose zone. In some situations, a field survey of the lines will be performed

***Figure 2.5**. Fixing or abandoning leaking water lines can help reduce recharge.*

to identify areas where this type of situation may exist. Finally, water lines to certain inactive facilities may not be needed and could simply be capped and shutdown.

Accelerated actions related to the treatment of Hanford's water lines have several components (Figure 2.6). They include eliminating water lines near waste sites when possible and testing them to assure they are not leaking when they cannot be eliminated. In addition, pumps in the Hanford Site water supply system will be changed to reduce water line pressure so that leaks are less likely to occur and less water will be lost if they do. Repair and removal of leaking water lines is currently handled as failure occurs. This strategy provides for accomplishing the work needed to protect groundwater by 2008.

A number of separate actions may be needed to address the issues created by the deterioration of the water system. The primary efforts should focus on upgrading the system to provide for the long-term needs of the Hanford Site.

Septic Systems. Since the initial efforts to control the discharge of liquids from process operations was complete in 1995, additional emphasis has been placed on further reducing the amount of liquid discharged to the soil within the 200 Areas. The remaining liquid discharges within the 200 Areas are primarily sanitary sewer systems. Continuing liquid waste disposal practices have the potential to leach contaminants from the vadose zone into the groundwater and/or simply increase the volume of contaminated groundwater.

Within the Central Plateau, the ongoing uranium pump-and-treat operations have the potential to be adversely affected by continuing sanitary sewer discharges. The septic system that may adversely affect

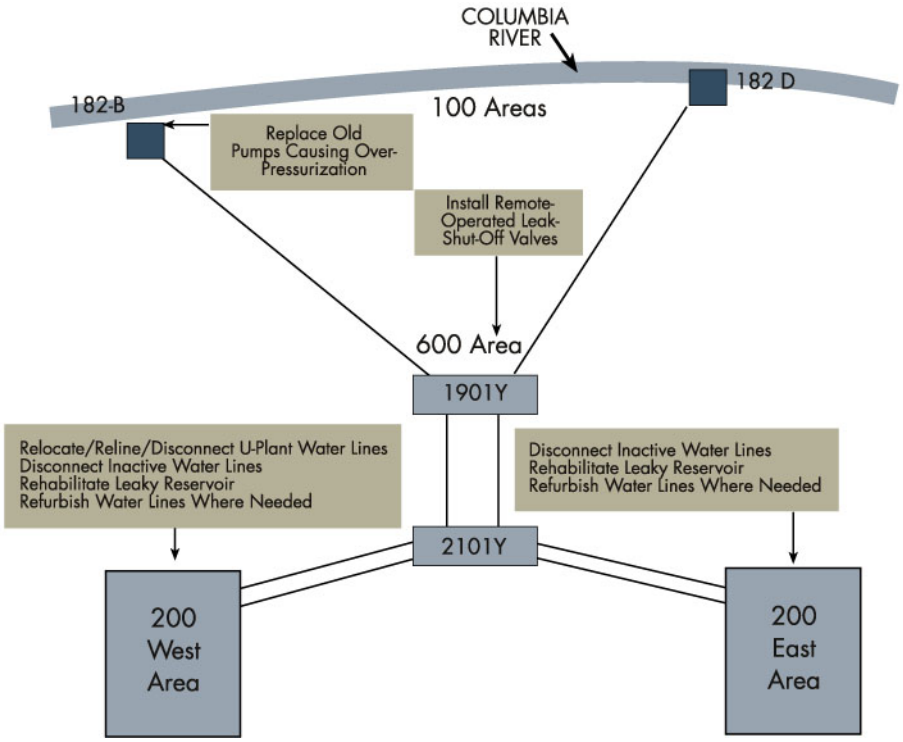


***Figure 2.6**. Planned 2003-2006 water supply system work to eliminate artificial recharge in contaminated areas.*

the pump-and-treat operations is 2607-W5. This discharge location is approximately 30.5 meters (100 feet) from the 216-U-1 and 216-U-2 cribs. The 216-U-1 and 216-U-2 cribs are a major source of technetium-99 and uranium in the vadose zone that could be leached from the soil by the adjacent septic discharges. The volumes from this particular system are relatively small, but the size of the pump-and-treat operation is approximately 190 liters (50 gallons) per minute, so the volume of recharge needed to impact the existing remedy may be much smaller.

The performance management plan (DOE/RL-2002-47) specifies that discharge to this system will be eliminated by September 2004. Other systems will be evaluated and any further actions will be identified by September 2004.

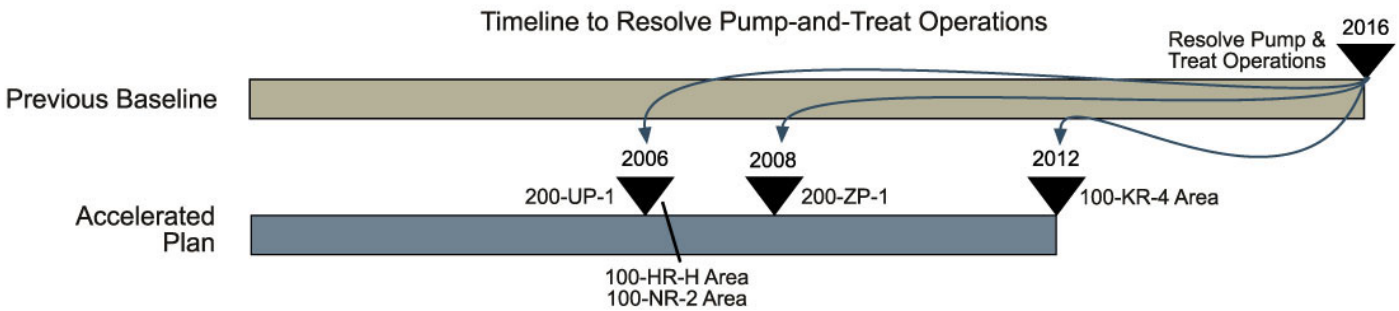
2.1.4 U Plant and Plutonium Finishing Plant Closures

Accelerated actions outlined in the performance management plan (DOE/RL-2002-47) include developing a plan to optimize the timing and sequencing to dispose of excess facilities and remediate waste sites that pose the highest threat to groundwater by May 2003 and implement a U Plant record of decision by December 2003. Remediation of U Plant waste sites, demolition of the canyon facility, and installation of covers would be completed by September 2011. The actions proposed to accelerate closure of the U Plant region are included in the *U Plant Closure Master Schedule* (see Appendix, Schedule A.9).

2.2 Remediate Groundwater

The strategy to initiate groundwater interim remedial actions was based on protecting the Columbia River aquatic environment, and containing and reducing contamination in the Central Plateau. These actions have been underway for several years and during that period much has been learned about these cleanup methods. Several activities are ongoing or planned to further evaluate the risk and impact from the contaminant plumes in an effort to move these interim actions to final remedies. The goal of these evaluations is to develop the needed technical, scientific, and performance data to establish final remedial action objectives. In addition, these evaluations will help implement final remedies as the source control measures for the waste sites responsible for these plumes are completed.

What is pump-and-treat? Several contaminant plumes in the 100 Areas are of special concern because they are so close to the Columbia River. FHI is pumping contaminated groundwater from the chromium and strontium-90 plumes, treating it to remove the contaminants, and injecting the clean water back into the aquifer. The primary purpose of these pump-and-treat systems is to reduce the amount of contamination entering the Columbia River and protect the ecosystem until a final cleanup solution is in place.



The sections that follow describe the efforts planned to move from interim actions to final remedies for each of the groundwater actions within the River Corridor and the Central Plateau. *The Groundwater Remediation Master Schedule* is included in the Appendix (Schedule A.7)

2.2.1 River Corridor Interim Remedial Action Strategy

Interim actions are currently underway to intercept elevated concentrations of chromium and strontium-90 entering the Columbia River in four of the reactor areas. Actions in 100-H, 100-D, and 100-K Areas were taken to protect aquatic species from chromium contamination entering the river through springs and seeps, while actions at 100-N Area are focused on reducing the potential impact of strontium-90 from N Springs on the Columbia River. The progress to date and the activities needed to further develop final remedial action objectives on an area-by-area basis are described in the following sections.

2.2.1.1 100-H Area

Over the last 10 years, a number of significant actions have been taken to remove the sources of chromium in the 100-H Area, which along with the operation of the pump-and-treat system (Figure 2.7) have dramatically reduced the potential impact of chromium on aquatic life. In the early 1990s, the 183-H basins that stored highly concentrated chromium waste were emptied and removed from service. In addition, remediation of waste sites in the vicinity of the H Reactor that received liquid waste containing chromium was completed in early 2000. Together, these actions have substantially eliminated the sources of chromium contamination responsible for the existing groundwater

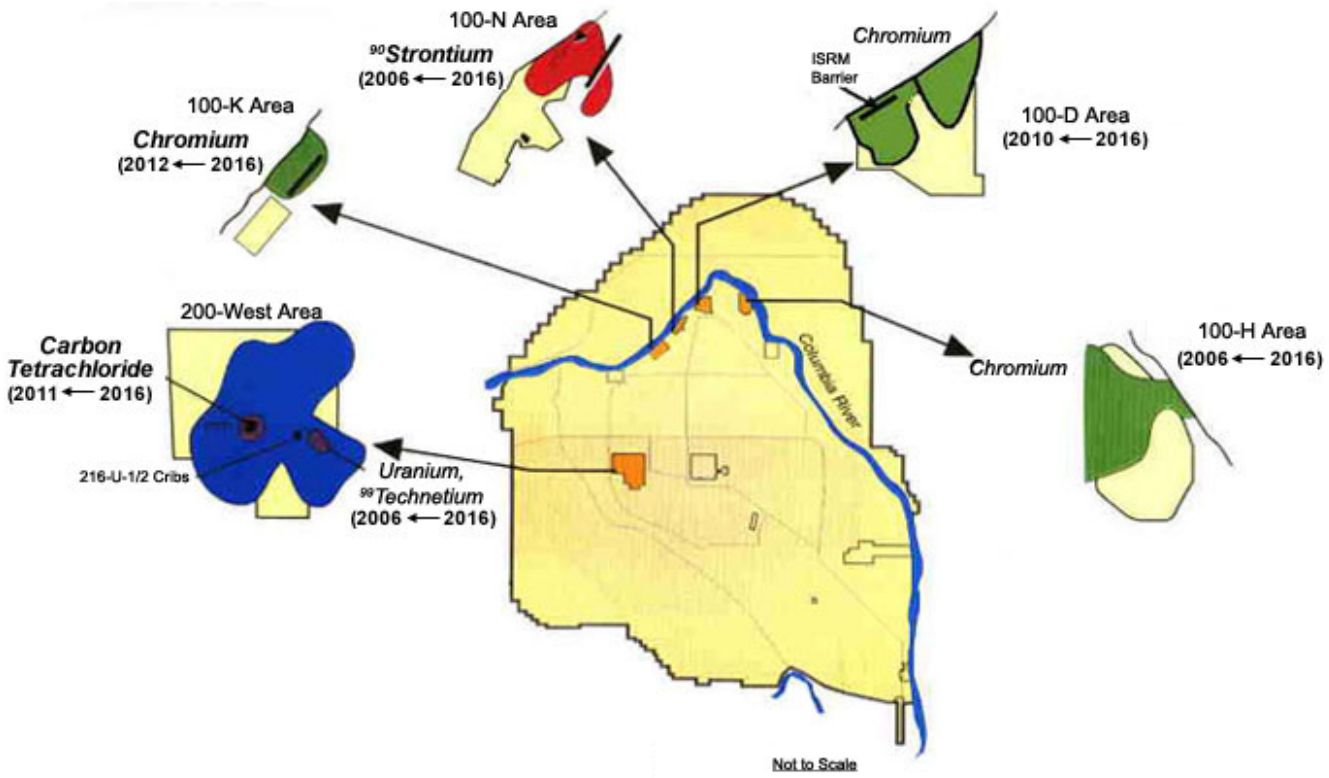


Figure 2.7. *Hanford Site groundwater pump-and-treat systems help contain contaminant plumes and reduce the amount of contamination entering the Columbia River.*

Removing the 183-H basins from service and completing waste sites to receive chromium from H Reactor have substantially eliminated the sources of chromium contamination in 100-H Area. In addition, the pump-and-treat system has been effective at intercepting chromium contaminated groundwater before it enters the Columbia River and has reduced the nature and extent of the groundwater plume. Data suggest that these actions have been effective at reducing the ecological risk from chromium and the remediation may be completed in the near future.

plume and its impact on the Columbia River environment (Figure 2.8). The pump-and-treat operations have also been effective at intercepting chromium contaminated groundwater before entering the river and, over time, have reduced the nature and extent of contamination in the groundwater plume.

Monitoring data gathered from springs and seeps along 100-H Area suggest that these actions have been effective at reducing the ecological risk from chromium. Over the next two to three years, these data along with the annual performance reports on the pump-and-treat operations are expected to demonstrate that these combination of actions have enabled the Groundwater Protection Program to achieve the remedial action objectives of the pump-and-treat record of decision (ROD 1996a).

2.2.1.2 100-D Area

In the 100-D Area, measures have only recently been completed to remove the high-risk waste sites responsible for the chromium groundwater plume. Additional time is needed to evaluate the effectiveness of these efforts, but there is no reason to believe that these actions would be any less effective than the measures used in the 100-H Area to eliminate future releases to the groundwater.

In addition to the pump-and-treat system used to capture the chromium plume from 100-D Area before it reaches the Columbia River, a second more concentrated region within the plume is also undergoing treatment using an in situ treatment to reduce the toxicity and mobility of chromium already in the groundwater. This technique, called in situ redox manipulation, causes the mobile chemical species chromate to be chemically reduced to a less mobile form. Chromium concentrations in the plumes beneath 100-D Area will require continued treatment for some

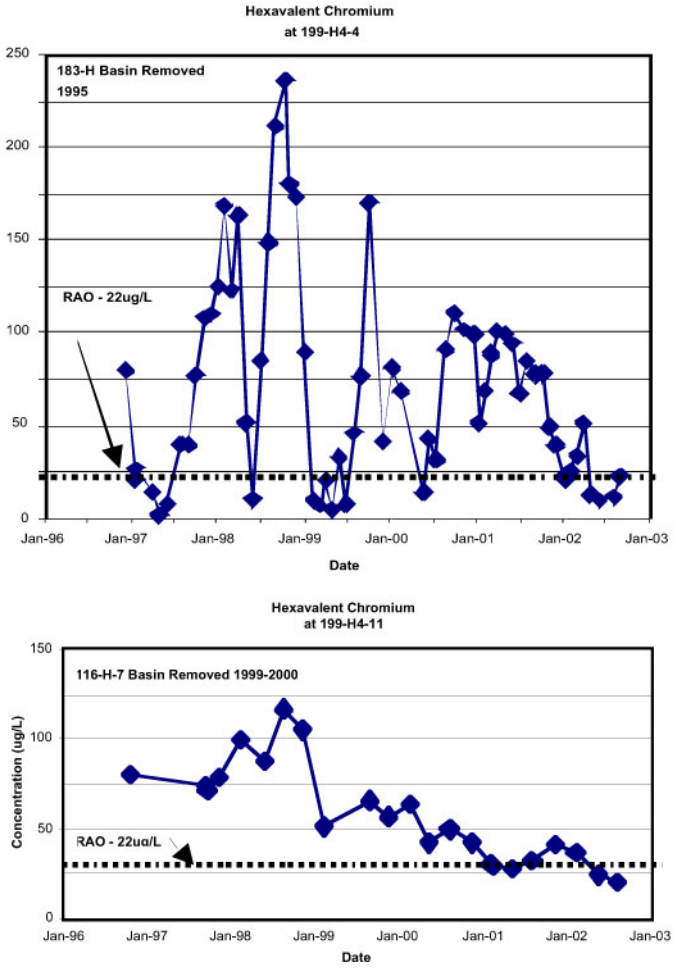


***Figure 2.8**. Chromium concentrations at 100-HR-H Area are declining; remedial action objectives are being achieved and have contributed to reducing the ecological risk from chromium.*

time into the future, but it is anticipated that achieving the remedial action objectives for this plume is likely after all source actions are complete by 2010.

2.2.1.3 100-K Area

Pump-and-treat systems in the 100-K Area have been operating for several years with only marginal success. The success of these actions in the other areas has been in large part due to the efforts that have removed the bulk of the contaminated soil and reduced the continuing release of chromium into the groundwater. Actions to remove the sources in 100-K Area are scheduled to begin in 2003, but will not be complete until the end of 2012. Achieving the remedial action objectives for this interim remedy is unlikely until the primary sites responsible for the chromium contamination are remediated.

2.2.1.4 100-N Area

Active liquid waste disposal operations at 100-N Area did not cease until mid-1992. These disposal operations released millions of gallons per year of reactor cooling water from N Reactor containing high concentrations of strontium-90 into the soil immediately adjacent to the Columbia River. In some parts of the groundwater plume, strontium-90 was thousands of times its drinking water standard, and although no aquatic water quality standard for strontium-90 was available, the shear magnitude of these releases were considered sufficient cause to initiate action.

Because strontium-90 in groundwater is tightly bound to the aquifer sediments, it represents a threat to groundwater quality well into the future. A number of technologies to slow the release of strontium-90 to the Columbia River will be evaluated; plus, studies are underway to evaluate the impact of strontium-90 on the aquatic ecosystem. These studies will help the Groundwater Protection Program re-evaluate how well the pump-and-treat system at the 100-N Area protects the ecosystem and assess the need for alternative measures.

The effectiveness of the pump-and-treat operations in limiting the discharge of strontium-90 to the Columbia River at N Springs has been questioned throughout its period of operation. The major reason concentrations of strontium-90 in groundwater were reduced occurred as a direct result of ending the discharge of contaminated liquids to the soil column in the early 1990s. Much of the strontium-90 remaining in the groundwater beneath 100-N Area is tightly bound to the aquifer sediments and represents a threat to groundwater quality well into the future, making the return to beneficial use for this portion of the aquifer unrealistic.

A number of technologies other than pump-and-treat have been tested or are planned to be tested to assess their effectiveness for the long-term protection of the Columbia River ecosystem. Previously, technologies including impermeable barriers constructed of steel and sorptive permeable barriers of clay-like materials were evaluated as alternatives to pump-and-treat systems. Investigation determined neither barrier was a suitable replacement for pump-and-treat. Tests are now planned to evaluate two additional technologies that may be candidates to replace the pump-and-treat systems. One alternative under consideration would use deep-rooted vegetation to absorb strontium-90 from the groundwater along the shoreline; then, the contaminated vegetation would be removed and disposed on the Central Plateau. A second method under consideration would be to develop a chemical barrier that would further immobilize strontium-90 in the soil and limit its release to the river through N Springs.

In addition to the evaluation of new and innovative technologies to slow the release of strontium-90 to the Columbia River, studies are underway to evaluate the actual impact of strontium-90 on the aquatic ecosystem. A number of species are now being assessed to determine bioaccumulation rates and the potential impact to organisms exposed to strontium-90. These efforts, in conjunction with the evaluation of new and innovative technologies, should enable the Groundwater Protection Program to re-evaluate how well the pump-and-treat systems protect the ecosystem and

assess the need for additional measures to mitigate the impacts. Evaluation of the technologies, risks, and potential impacts of strontium-90 are expected to be complete in 2006.

2.2.2 Central Plateau Interim Remedial Action Strategy

Interim actions are currently underway at two locations within the 200 West Area to reduce the mass and contain the high concentration portions of the technetium-99 and uranium plume in the groundwater beneath U Plant and carbon tetrachloride in the soil and groundwater beneath the Plutonium Finishing Plant. Further evaluation of these actions is needed to assess the potential impact of these contaminant plumes on the groundwater resources.

2.2.2.1 U Plant Area

Pump-and-treat operations are ongoing to contain and reduce the mass of technetium-99 and uranium in the groundwater adjacent to U Plant. Unlike the 100 Areas interim actions, the remedial action objectives for these sites are not based on compliance with the drinking water or other aquatic water quality standards. Substantial reductions in the concentrations of uranium and technetium-99 have been detected throughout the plume (Figure 2.9). It is likely that the remedial action objective to cease treatment by 2006 will be achieved.

Efforts are now underway to evaluate the mobility of uranium and technetium-99 in the vadose zone and the groundwater, to assess the potential impact of these contaminants and their associated sources on downgradient water quality, and to set final remedial action objectives. Much of this activity is focused on refining our understanding of the transport of uranium in the subsurface and developing a better conceptual model of how it migrates in the groundwater.

Should it be determined that technetium-99 and uranium still represent a risk to groundwater even though the interim action cleanup objectives were met, an alternative to the current use of the Effluent Treatment Facility as the treatment facility will be required by 2006. However, at that time the capacity of the Effluent Treatment Facility will be completely utilized to support retrieval of tank waste from single-shell tanks.

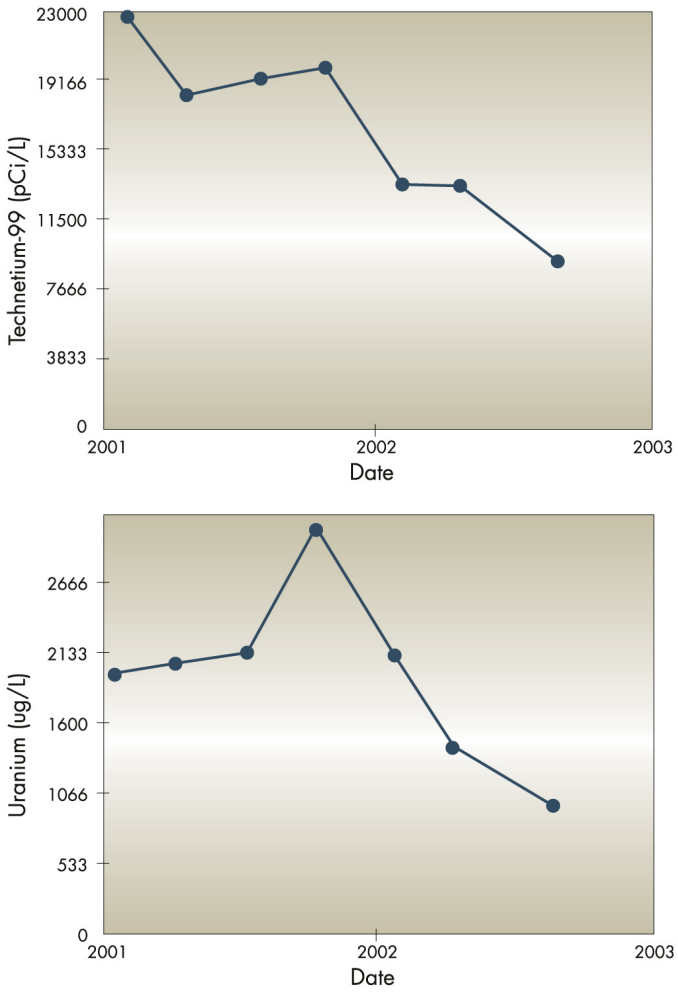


***Figure 2.9**. Concentrations of technetium-99 and uranium in groundwater near U Plant continue to decline; remedial action objectives for technetium-99 most likely can be achieved by 2006.*

Finally, plans to complete source control actions for high-risk waste sites in the U Plant area and measures to eliminate artificial recharge and preferential pathways for contaminant migration by the end of 2006 should preserve the long-term performance of the containment remedy and limit the need for active groundwater remediation in the future.

Source control refers to a process to remove waste, treat as necessary, and dispose the waste on the Central Plateau or Environmental Restoration Disposal Facility.

2.2.2.2 Plutonium Finishing Plant Area

Containment and mass reduction interim actions are underway to recover carbon tetrachloride from both the soil column and the groundwater beneath the Plutonium Finishing Plant. An extensive inventory of carbon tetrachloride still remains unaccounted for in the vadose zone and groundwater, which represents a major unknown in moving to a final remedy for carbon tetrachloride. Extensive characterization efforts have begun to assess the nature and extent of contamination in the soil and groundwater. These coordinated investigations, along with science and technology investigations to better understand the process controlling the migration of carbon tetrachloride in the subsurface environment, provide the best opportunity to develop a remedy to protect human health and the environment.

Even after years of pump-and-treat operations and soil-vapor extraction to recover carbon tetrachloride in the soil column, little change in groundwater concentrations of carbon tetrachloride have been detected. Future beneficial use of groundwater contaminated with carbon tetrachloride beneath 200 West Area is not a realistic goal for the final remedy.

Preventing further degradation of the unconfined aquifer beneath the 200 West Area from the migration of carbon tetrachloride represents a major challenge and depends greatly on the nature of the source control actions and the nature and extent of contamination.

2.3 Monitor Groundwater

As regulatory requirements for monitoring increased in the 1980s, there began to be some overlap between various programs. DOE established a centralized Hanford Groundwater Monitoring Project in 1996 to assure protection of the public and the environment while improving the efficiency of monitoring activities. The project addresses all groundwater monitoring needs at the site, eliminates program redundancy, and allows for more cost-effective groundwater monitoring activities.

DOE has monitored groundwater on the Hanford Site since the 1940s to help determine what chemical and radiological contaminants have made their way to groundwater and how they have migrated in groundwater.

The Hanford Groundwater Monitoring Project provides groundwater monitoring, assessment, and reporting to meet the requirements of RCRA, CERCLA, and the Atomic Energy Act of 1954 as implemented by DOE Orders. The Groundwater Protection Program provides the groundwater monitoring, assessment, and reporting for groundwater operable units where active groundwater remediation is ongoing. The program provides an integrated, site-wide assessment of groundwater quality and identifies any impact from waste-disposal facilities operated by DOE and its contractors. Groundwater monitoring actions are presented in the *Groundwater Monitoring Master Schedule* (see Appendix, Schedule A.8) and are briefly described in the following paragraphs.

Both the unconfined and upper-confined aquifers are monitored and data are maintained and managed in

"Once contamination is detected, monitoring and related activities are undertaken to assess the nature and extent of groundwater contamination so that appropriate action can be taken."

—Draft *Hanford Site Groundwater Strategy*

a centralized database. Monitoring well locations, frequencies, and analytical constituents are documented each year (Figure 2.10). Sampling and analysis is coordinated among all data users, and results are evaluated to describe the areal extent and temporal trends of contamination. Results and conclusions are reported in a quarterly electronic report for RCRA facilities and are described in detail in an annual groundwater monitoring report for the entire site that meets all objectives and regulatory requirements (Hartman et al. 2002). Results are summarized in the Hanford Site environmental report (Poston et al. 2002).

Water-level monitoring is performed to characterize groundwater flow and to determine the impact of Hanford Site operations on the flow system (Figure 2.11). The unconfined aquifer has been characterized in the past

***Figure 2.10**. Fifty-eight new wells were drilled on the Hanford Site in fiscal year 2001. Some of them are monitoring wells to replace dry wells or to gather additional information (shown above). Other wells support groundwater remediation.*

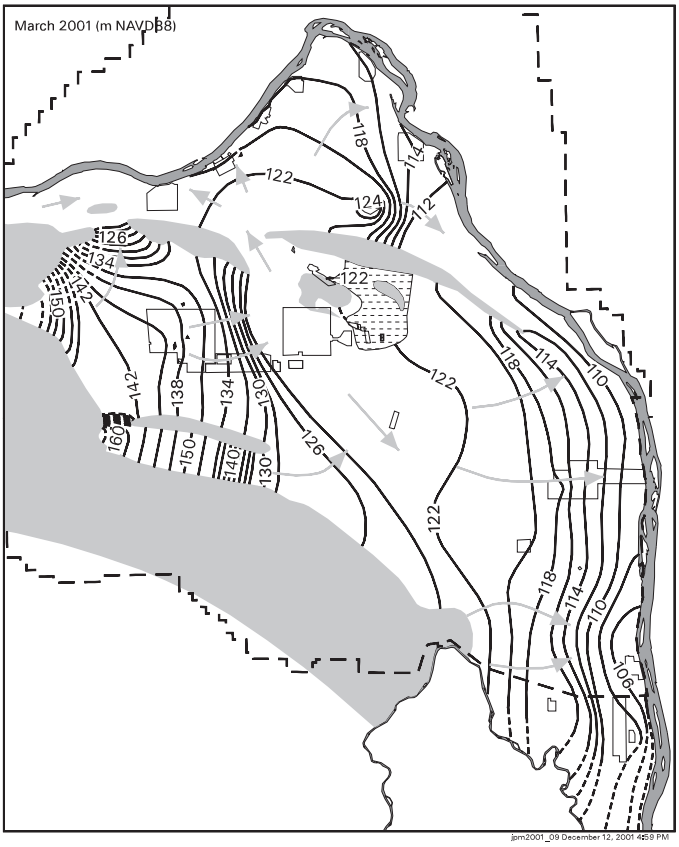


***Figure 2.11**. This map shows the water table and inferred flow directions in March 2001 (North American Vertical Datum of 1988). The water table has declined beneath most of the Hanford Site. Shaded areas and the area filled with dashed lines show where the unconfined aquifer is absent.*

to construct and update a three-dimensional conceptual model for the unconfined aquifer. This conceptual model forms the basis for a numerical flow and transport model that has been constructed and used to predict the impact of site operations on groundwater flow and groundwater quality. These predictions are used to assess the potential impact and offsite migration.

Groundwater monitoring remains a part of the Hanford Site baseline throughout the cleanup mission and will remain a component of long-term stewardship after remediation is completed.

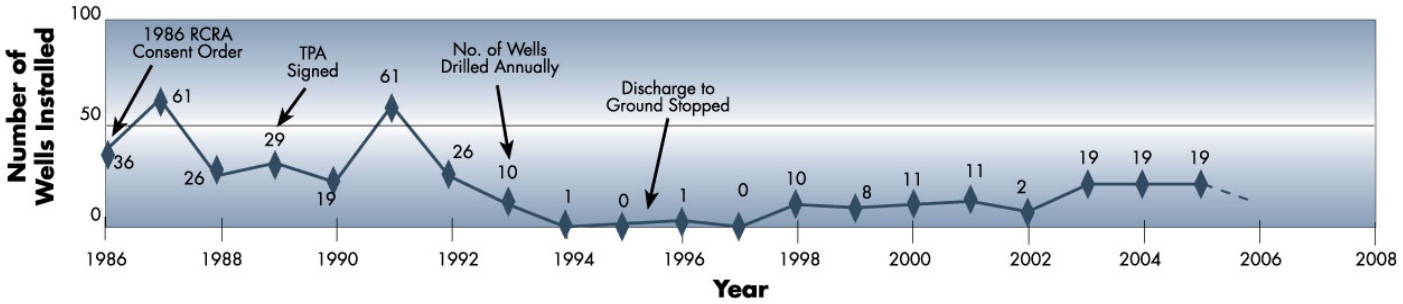


***Figure 2.12**. Well installation to comply with Tri-Party Agreement Milestone M-24.*

One aspect of the groundwater monitoring program included in the performance management plan (DOE/RL-2002-47) is the installation within 3 years of additional wells to create an integrated monitoring well network sufficient to meet program needs (Figure 2.12). During 2002, a team of Ecology, EPA, DOE, and contractor staff participated in a data quality objectives process to identify the additional wells needed to adequately monitor the Central Plateau. That process identified a number of wells that, along with those already in existence, would satisfy the regulatory requirements of the RCRA, CERCLA, and the Atomic Energy Act of 1954. Installation of 200 West Area wells can be completed by October 2003, 200 East Area wells by October 2004, and other needed wells in the Central Plateau by October 2005.

2.4 Completion Strategy

The strategy for completing the remedial and corrective actions for each of the National Priorities List Sites (Figure 2.13) and moving into a long-term stewardship and future use condition relies heavily on groundwater protection. The groundwater pathway represents the primary exposure route for Hanford contaminants to reach human and environmental receptors. Each National Priorities List site is large and complex. Therefore, waste sites have been grouped so that

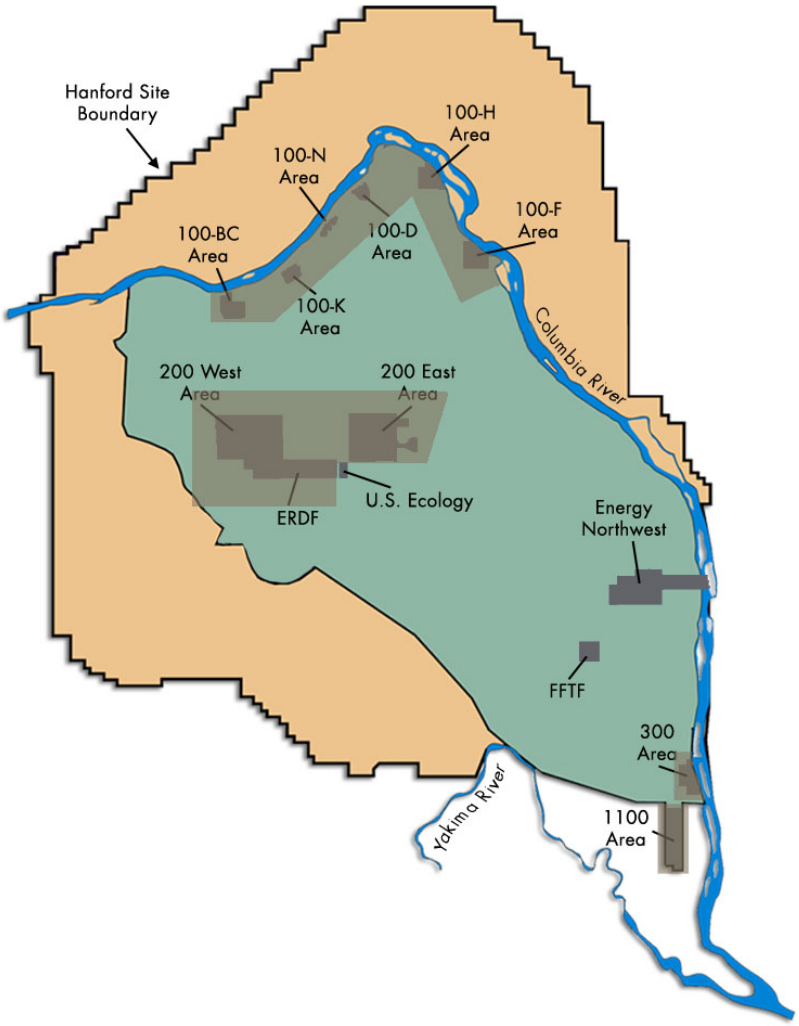


***Figure 2.13**. Areas on the Hanford Site that are on the National Priorities List.*

similar sites can be characterized and remediated efficiently to achieve the goals of groundwater protection and restoration.

The completion strategy for each National Priorities List site, as portrayed in the Master Schedules for the Groundwater Protection Program (see Appendix), is described in the following sections. For the 100 and 300 Areas within the River Corridor, these schedules are more well defined due to the completion of interim records of decision (ROD 1996a; ROD 1996b; ROD 1999a; ROD 1999b) for all source control actions and the establishment of specific Tri-Party Agreement milestones and commitments to arrive at final decisions for these sites. For the sites in the 200 Area, most of the operable units are still early in the remedial investigation/feasibility study and consequently many of the key decisions have not been made. In addition, final decisions for the Central Plateau will greatly depend on the residual risks from tank waste, the long-term contributions from ongoing waste management operations, and the risks to human health and the environment from decontamination and decommissioning of 200 Area nuclear facilities. This accelerated plan provides the basis for actions between now and 2012, and to a lesser extent after 2012, to be taken by the Groundwater Protection Program to complete remediation within regions of the Central Plateau.

2.4.1 River Corridor Completion Strategy

During preparation of the Master Schedules for the Groundwater Protection Program, efforts were taken to assure that the schedules of the River Corridor Project and for groundwater protection activities both support the completion of final records of decision in the 100 and 300 Areas. Recent changes in the Tri-Party Agreement (Ecology et al. 1998) set schedules for the completion of waste site remediation and facility decontamination and decommissioning for the 100 and 300 Areas, which is the primary focus of the River Corridor contractor. Concurrently, the Groundwater Protection Program has responsibility for coordinating groundwater monitoring, assessment, and remediation with ecological monitoring and assessment, and development of the final remedy selection and documentation process for the 100 and 300 Areas. These closely related and highly dependent activities are coordinated to assure compliance with the Tri-Party Agreement. The goal is to complete the activities required to issue final records of decision, develop and implement long-term stewardship, and delete the 100 and 300 Areas from the National Priorities List.

At this time, no formal strategy has been developed to delete any of the 100 Areas from the National Priorities List. However, using an area-by-area approach to develop and prepare data needed to support final remedy decisions provides a sound basis for any deletion strategy.

Final groundwater remedial action decisions were excluded from the River Corridor Contract, but it was acknowledged that ..."Future groundwater decisions shall be required upon completion of source remedial actions and an appropriate period to assess the performance of these actions." Although no specific time frame is given in the contract, the early completion of 100-B/C Area at the end of 2006 should provide a basis to assess each area's compliance with remedial action objectives and help to establish an appropriate schedule for issuing final decisions for the 100 Areas.

The sections that follow describe the completion strategy and commitments for the 100 and 300 Areas contained in the Tri-Party Agreement, the Agreement-in-Principle (Ecology et al. 2001a), and the tentative agreement (Ecology et al. 2001b) for the River Corridor, upon which the Master Schedules for the Groundwater Protection Program (see Appendix) are based.

2.4.1.1 100 Area Completion Strategy and Commitments

The basic strategy in the Tri-Party Agreement cleanup plan for the River Corridor is to pursue source control

measures on an area-by-area basis. The sequence and the timing for completion of source control actions for the individual reactor areas are as follows:

- B/C Area — December 2006
- F Area — December 2008
- H Area — December 2010
- D Area — December 2011
- K Area — December 2012
- N Area — December 2012

Upon completion of these source control actions, DOE is required to submit closeout verification packages for each waste site, pipeline, or unplanned release. Those packages are then consolidated into reports that document these actions achieved the required degree of cleanup. The only requirement is that these reports be submitted in a " timely manner" on an area basis to support the development of a final record of decision for the entire 100 Area. In addition to source control actions, baseline risk assessments will also be developed on an individual reactor basis to support the final 100 Area Proposed Plan and Record of Decision. The commitments to develop a baseline risk assessment for the 100-B/C Area is contained within the River Corridor tentative agreement (Ecology et al. 2001b) and will serve as a template for the other reactor areas.

The schedule for the pilot study of the 100-B/C Area risk assessment is to complete the data quality objectives process in 2002, perform data collection in 2003 and 2004, and submit the 100-B/C Area Risk Assessment Pilot Study Report in July 2005. Based on this schedule, Table 2.2 provides consistent schedules for each of the other areas.

With many of the most significant sources of groundwater contamination already subject to ongoing remedial action, it is anticipated that groundwater plumes for chromium and other mobile contaminants should begin to attenuate. For the 100-B/C Area and the 100-F Area, where no interim actions were taken, chromium concentrations should meet remedial action objectives through monitored natural attenuation, which will protect the Columbia River ecosystem, achieve drinking water standards, and return the area to potential future use status well before 2012.

During the year following completion of the source control actions in each of the areas, groundwater monitoring and well decommissioning activities are scheduled. The goal of these efforts is to upgrade the monitoring networks to meet the requirements for long-term stewardship and issue an approved operations and maintenance plan for each groundwater operable unit. Similar efforts will be needed to develop a long-term environmental monitoring plan to assess the continuing impact of residuals left after source actions are complete.

The last commitment in the River Corridor tentative agreement (Ecology et al. 2001b) is to "Submit a schedule and establish commitments to complete the Remedial Investigation/Feasibility Studies and Proposed Plans in support of the Final Record of Decision for the 100 Area." The 100 Areas study should not represent a major new characterization initiative, but a compilation of data gathered during source control actions, reactor risk assessments, ongoing groundwater monitoring, spring sampling, and Columbia River monitoring as well as the annual groundwater remedial action reports. These data should provide the information required to make the final decision for the 100 Areas.

Table 2.2. Area risk assessment schedules.

Area	Data Quality Objectives	Data Collection	Risk Assessment	Complete Actions
100-B/C	2002	2003-2004	July 2005	December 2006
100-F	2004	2005-2006	July 2007	December 2008
100-H	2006	2007-2008	July 2009	December 2010
100-D	2007	2008-2009	July 2010	December 2011
100-K	2008	2009-2010	July 2011	December 2012
100-N	2008	2009-2010	July 2011	December 2012

The commitments necessary to obtain a final record of decision for the 300 Area are based on the same strategy employed in the 100 Area, including submittal of close-out verification packages in a "timely manner" for each of the three subdivisions within the 300 Area National Priorities List. Development of the final record of decision will again be done after an appropriate period of time to judge the effectiveness of the remedies. The record of decision requires a new milestone be set to establish a date to complete the final remedial investigation/feasibility study for the entire 300 Area. These efforts are likely after 2020.

Other commitments also may influence the scope and the timing of future work. For example, the next CERCLA five-year review could alter the scope and timing of work. The next review may generate additional work if it is determined that remedies are not meeting their remedial action objectives; or, if the remedies are meeting these requirements, it may mean that remedial actions may move to a monitored natural attenuation remedy. The next CERCLA five-year review should be prepared in 2005/2006, and DOE and the Hanford Site contractor will prepare it for submittal to EPA.

Efforts to evaluate alternatives to pump-and-treat systems like those described for N Springs may also provide opportunities to refocus groundwater protection priorities. In these instances, care must be taken to ensure appropriate documentation exists to support a change in the response action. Without appropriate documentation, changes to these actions may create noncompliant conditions when compared to remedial action objectives during the next CERCLA review.

2.4.1.2 300 Area Completion Strategy and Commitments

The strategy for the 300 Area is also built on the early completion of remedial actions on an area-by-area basis. For the purposes of the Tri-Party Agreement, the 300 Area has been subdivided into three parts: the portion of the 300 Area within the industrial complex (inside the fence), the portion outside the industrial area (outside the fence), and the 618-10 and 618-11 burial grounds. Actions to control sources of contamination are to be completed for the portion outside the fence by December 2012. Completing source control actions for the portion inside the fence and the 618-10 and 618-11 burial grounds are not scheduled to be complete until December 2018.

Earlier efforts to complete the outside-the-fence portion of the 300 Area for partial deletion from the National Priorities List would be the primary driver to move this work forward. Any efforts to pursue partial deletion from the National Priorities List for the outside-the-fence portion could not occur before 2014.

In addition to the new milestone commitments contained in the River Corridor change packages, several existing and ongoing activities represent the primary near-term issues between the Groundwater Protection Program and the River Corridor contractor. Several complementary efforts are now underway to evaluate whether the industrial cleanup standard for contaminated soil of 350 pCi/g protects the groundwater and/or ecological receptors. These activities support the ongoing remediation of the 300-FF-1 Operable Unit that contains the primary sources of uranium responsible for the existing groundwater contamination. This re-evaluation of the 350 pCi/g uranium cleanup standard for groundwater is to be complete in early 2003. In addition, it will allow the completed waste site excavations to be backfilled and recontoured, may require the industrial cleanup standard to be lowered to protect the groundwater and ecological receptors, or will seek to modify the existing groundwater remedy to require long-term institutional controls of the groundwater rather than the current remedy of monitored natural attenuation.

Due to the long lead time for completion of the first portion of the 300 Area (after 2012), few other issues exist that cannot be resolved in time to meet the Tri-Party Agreement requirements.

2.4.2 Central Plateau Completion Strategy

Similar to the approach in the 100 Areas, where actions were taken to complete each individual reactor area, each of the parcels selected for early action in the Central Plateau require a group of actions to move to long-term stewardship. Unlike the 100 Areas where the cleanup goals established were predicated on unrestricted future use, the 200 Area cleanup goals would be based on restricted future use, appropriate institutional controls, and effective containment actions to protect human health and the environment. Remedies for the high-risk sites as well as all of the other waste sites located within boundaries of the U Plant Area, the BC cribs and trenches, the Plutonium Finishing Plant cribs, and the PUREX cribs would be based on interim action records of decision.

The closure schedule for the U Plant Area (see Appendix, Schedule A.9) provides an example of the actions needed to proceed through the investigation phase to remedial actions and other measures required to transition to long-term stewardship and to limit the impact of future releases to the 200-UP-1 Operable Unit.

The area closure approach relies on coordinated actions to eliminate septic system discharges, refurbish and relocate water lines, and abandon high-risk wells within the area adjacent to high-risk sites that represent a long-term risk to the 200-UP-1 Operable Unit. Once these actions are complete, remedial actions on the high-risk sites would be implemented and an upgraded monitoring network would be put in place to meet the requirements for long-term stewardship.

Detailed schedules of activities to support each of the other high-risk sites are currently under development. These activities also will be closely coordinated with the decontamination and decommissioning of facilities within the Central Plateau.

For the areas outside the Core Zone described in Section 2.2.1, a much more limited group of actions is envisioned than for areas with high-risk sites. The two parcels addressed in this section contain all of the 200 Area waste sites outside the Core Zone. The 200 North Gable/B Pond complex and the Central Landfill parcels represent only marginal risk to groundwater. However, early action in these areas is expected to preserve the existing groundwater quality and support a final remedy of monitored natural attenuation for much of the 200-PO-1 and 200-BP-5 Operable Units. These parcels also require decommissioning of certain high-risk wells, but no septic systems or waterlines are located in these parcels. Development of institutional controls for these areas are less dependent on the residual contamination left after the remedial action is complete than on the need for restricted access to assure the public is protected from potential air releases from operating facilities.

Once source control actions are complete, the groundwater monitoring networks for these parcels will be upgraded and a long-term operations and maintenance plan for groundwater and environmental monitoring will be completed.

The long-range plan for continued operation of the 200 Area, coupled with the existing inventory of hazardous and radioactive contamination, make it unlikely that the Core Zone of the Central Plateau will be deleted from the National Priorities List. Efforts to pursue partial deletion of lands outside the Core Zone may be possible, but must be made in the context of continuing operations.

The strategy to complete cleanup of the Central Plateau and transition to long-term stewardship focuses on completing actions on land within the Core Zone that contains high-risk waste sites with significant potential to contaminate groundwater and to remediate those lower risk sites that are located outside the Core Zone of the Central Plateau (i.e., shrinking the contaminated area). The four parcels selected as high-risk sites and slated for completion by 2011 do not include tank farms and those high-risk sites immediately adjacent to tank farms. Schedules for completion of those high-risk sites and the adjacent tank farms depend on the timing and strategy for closure of the tank farms.

3.0 Program Management

FHI has an integrated management approach for groundwater protection. The groundwater protection work is organized around key functional areas, allowing major portions of the work to be centralized for the entire Hanford Site. Managing the work in an integrated fashion accelerates cleanup and makes it more efficient by coordinating projects, avoiding duplication, and assuring consistent decisions (see Appendix, Schedule A.13).

3.1 Scope

The sheer expanse of the Hanford Site, the inherent hazards associated with the significant inventory of nuclear material and waste, the large number of aging contaminated facilities, the diverse nature and extent of environmental contamination, and the proximity to the Columbia River make the Hanford Site one of the world's largest and most complex environmental cleanup project. During the cleanup, many key decisions will be made that either directly or indirectly affect the protection of the groundwater and ultimately the Columbia River. To assure these decisions are made in a consistent manner, DOE established a specific, integrated groundwater protection program in 1996. This program is designed to manage all effects from Hanford waste disposal sites (cribs, trenches, tank farms, etc.), from both past and present operations, that directly affect protection of the groundwater and human and environmental receptors.

3.2 Program Organization

To effectively manage the Groundwater Protection Program, FHI created an integrated organization (Figure 3.1). This organization is supported by both

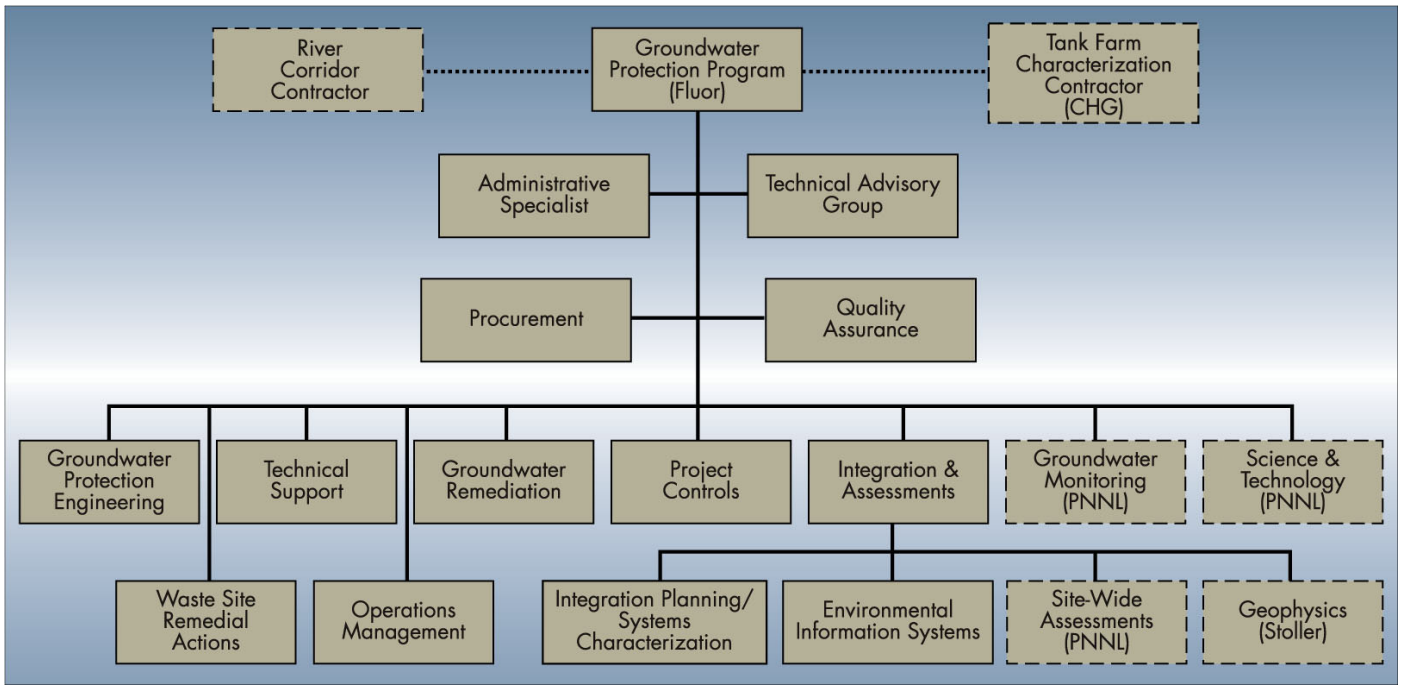


Figure 3.1. *Organization of the Groundwater Protection Program.*

the DOE Office of River Protection and Richland Operations Office and by all four major site contractors. The lead for managing the total effort has been assigned to the Central Plateau contractor, Fluor Hanford, Inc. The Central Plateau contractor has the overall responsibility to assure the work planned and undertaken by each of the major site contractors is done in a consistent and effective manner, which protects human health and the environment.

3.3 Key Functions

Key centralized management functions must be performed in a uniform manner across the site (Figure 3.2).

3.3.1 Characterization of Systems

The Characterization of Systems Task facilitates development of consistent data, parameters, and conceptual models to resolve technical issues and support efforts to estimate contaminant migration and impact (deLamare 2000). In particular, the Characterization of Systems Task: (1) facilitates the development of consistent conceptual models for the Hanford Site; (2) consolidates, maintains, and communicates technical baseline information and data to serve as the basis for organizing technical issues and developing assessment specific data packages, and (3) facilitates the coordination and integration of field characterization work and assessment modeling approaches.

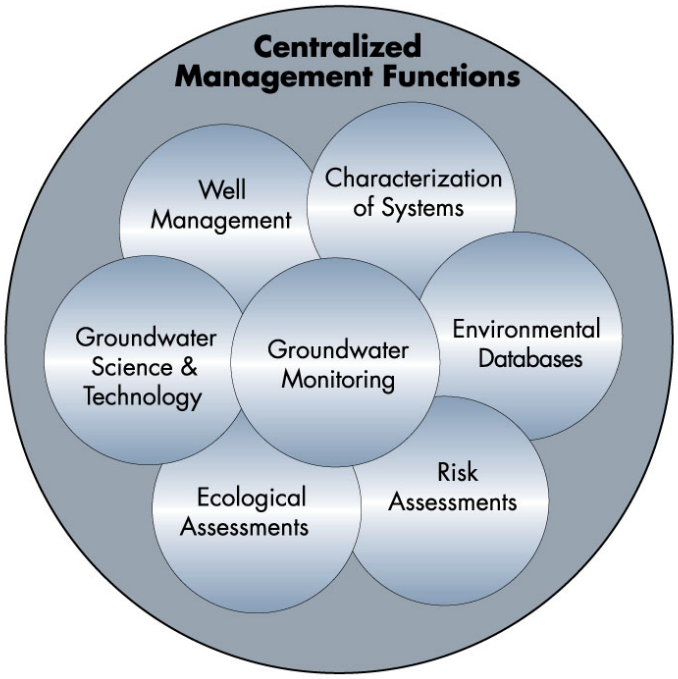


Figure 3.2. *Key centralized management functions.*

3.3.2 Hanford Database Integration

FHI's Groundwater Protection Program has access to sitewide essential services that develop, maintain, and operate Hanford's environmental databases. These databases are used to capture monitoring data, waste site data, well information, sample tracking, and geographic information. The Groundwater Protection Program also has project specific databases (e.g., those associated with remedial projects such as the pump-and-treat systems and in situ redox manipulation). The databases are integrated so they provide staff ready access to information from across the Hanford Site. The Virtual Library provides web access to the most frequently used information in these databases. Table 3.1 describes the databases that are available to the Groundwater Protection Program.

3.3.3 Risk Assessments

The Hanford Cumulative Impact Assessment effort assesses Hanford's impact on the groundwater, the Columbia River, and the users of those resources. An integrated system of computer models and databases enables users to model the movement of contaminants from all waste sites at the Hanford Site through the vadose zone, groundwater, and the Columbia River and estimate the impact of contaminants on human health and the environment. In the future, transport of contaminants through the air will also be available so that contaminant impact through all pathways can be assessed.

Table 3.1. Integration of Hanford databases.

Database Integration	Description
Virtual Library (VL)	The library makes available the information needed to estimate contamination migration and impact across the Hanford Site. This library is now available to DOE/RL personnel, site contractors/ subcontractors, regulators, and others who have access to HLAN, BLAN or P_LAN.
Hanford Features, Events, and Processes (FEP)	This database documents the initial screening of the international suite of FEPs for relevance to the Hanford Site. It is one of the tools used to promote consistency, completeness, and defensibility in conceptual models.
Issues Management (Issues)	The issue management process provides a controlled and documented method to formally track and resolve non-technical and technical issues addressed to the Groundwater Protection Program from regulators, stakeholders, tribal nations, and the public.
Sample and Data Management (SDM)	This system supports the planning, collection and analysis of environmental samples.
Sample Data Tracking (SDT) System	This system is used to prepare forms and container labels and tracks sample progress.
Hanford Environmental Information System (HEIS)	This is a consolidated set of electronic systems that manage data collected during environmental monitoring.
Hanford Well Information System (HWIS)	This is a database that documents information about wells at the Hanford Site.
Waste Information Data System (WIDS)	This is a computerized system that provides source information about waste sites at the Hanford Site. The system is used to track site investigation, remediation, and closure activities under the Tri-Party Agreement.
Hanford Geographic Information System (HGIS)	This system is organized to manage, update, analyze, and display spatial related data at the Hanford Site. It contains detailed maps and site features, such as buildings, roads, piping, topography, geology, wells, and rivers.
Project Specific Databases (PSDB)	This system is made up of two databases that provide quick and easy methods to obtain operational data about pump-and-treat systems and in situ redox manipulation.

Cumulative impact assessments provide a sitewide context for the decisions that must be made on individual waste sites. In addition, this capability allows users to explore the potential impact of remediation alternatives, and, finally, it provides a way to visualize how the impact from various waste types remaining at the Hanford Site will overlap across time.

Analyses to support cleanup decisions are performed at many levels at the Hanford Site. Cumulative impact assessments are performed at the sitewide or area level. Performance assessments for individual waste sites or groups of sites and calculations to support cover design or to examine the detailed chemical and physical interactions between waste and soil may be

performed on the level of a few square meters. A Hanford Site assessment coordination board assures the various programs and projects approach assessments in a consistent and defendable manner. The board is a joint effort by the Office of River Protection and the Richland Operations Office.

To bring consistency to the assessment approach, DOE and the regulators developed a framework for how risk assessments will be performed and used on and around the Central Plateau. The framework has seven tenants and will be applied to assessments that support cleanup decisions (Table 3.2).

3.3.4 Ecological Assessments

Contaminants in fish and wildlife that inhabit the Columbia River and the Hanford Site are routinely monitored. Wildlife may access areas of the site that contain radioactive or chemical contamination, and aquatic organisms can be exposed to contamination entering the Columbia River from groundwater discharges along the shoreline. Fish and some wildlife species exposed to Hanford contaminants have the potential to be harvested for food and contribute to offsite public exposure. In addition, detection of contaminants or changes in contaminant levels in biota over time may indicate that animals are entering contaminated areas (for example, burrowing in waste burial grounds) or materials are moving out of known contaminated areas (for example, through water, blowing dust, or food-chain transport).

Ecological assessments determine the impact of Hanford's past and present operations on the area ecology. These assessments also determine the impact of any specific cleanup, operational, or closure actions. Assessments include determining the concentration of

Table 3.2. Groundwater risk framework per the Tri-Party Agreement.

1. The Core Zone (200 Areas including B Pond [main pond] and S Ponds) will have an industrial scenario for the foreseeable future.
2. The Core Zone will be remediated and closed allowing for other uses consistent with an industrial scenario (environmental industries) that will maintain active human presence in this area, which in turn will enhance the ability to maintain the institutional knowledge of the waste left in place for future generations. Exposure scenarios used for this zone should include a reasonable maximum exposure to a worker/day user, possible Native American users, and intruders.
3. DOE will follow the required regulatory processes for groundwater remediation (including public participation) to establish the points of compliance and remedial action objectives. It is anticipated that groundwater contamination under the Core Zone will preclude beneficial use for the foreseeable future, which is at least the period of waste management and institutional controls (150 years). It is assumed that the tritium and iodine-129 plumes beyond the Core Zone boundary will exceed the drinking water standards for the period of the next 150 to 300 years (less for the tritium plume). It is expected that other groundwater contaminates will remain below, or be restored to drinking water levels outside the Core Zone.
4. No drilling for water use or otherwise will be allowed in the Core Zone. An intruder scenario will be calculated for in assessing the risk to human health and environment.
5. Waste sites outside the Core Zone but within the Central Plateau (200 N, Gable Mountain Pond, BC Crib) will be remediated and closed based on an evaluation of multiple land use scenarios to optimize land use, institutional control cost, and long-term stewardship.
6. An industrial land use scenario will set cleanup levels on the Central Plateau. Other scenarios (for example, residential, recreational) may be used for comparison purposes to support decision making especially for:
   - The post-institutional controls period (more than 150 years).
   - Sites near the Core Zone perimeter to analyze opportunities to shrink the site.
   - Early (precedent-setting) closure/remediation decisions.
7. This framework does not deal with the tank retrieval decision.

contaminants in ecological species, the relative health of indicator species, and other activities required to protect threatened or endangered species.

The data collected to date suggest that maximally exposed individuals of the public are not at risk from consuming game animals. The results also indicate that wildlife populations monitored on the Hanford Site are thriving compared to other reference populations.

A single, integrated biological characterization and impact assessment capability brings better understanding to the potential biological impact associated with the presence of contaminants in the environment. This approach is a cost-effective means to identify those areas and organisms that best represent the most likely receptors of Hanford-derived contamination and areas where both short- and long-term contaminant surveillance and biological impact monitoring should be conducted. Integration of these activities will (1) document the biological resources present, (2) identify biota pathways that contain elevated levels of Hanford-derived contamination, (3) examine measurable biological endpoints that indicate the relative condition of the receptor organisms, and (4) provide the site-specific data necessary to examine, calibrate, or validate contaminant transport and ecological risk assessment models proposed as screening tools for the Hanford Site close-out plans.

> "EPA expects to consider using innovative technology when such technology offers the potential for comparable or superior treatment performance or implementability, fewer or lesser adverse impacts than other available approaches, or lower costs for similar levels of performance than demonstrated technologies."
>
> —40 CFR 300.430 (a)(1)(iii)(E)

3.3.5 Groundwater Science and Technology

The Groundwater Protection Program's Science and Technology Project is providing data, tools, and scientific understanding to fill critical information gaps to support plans for remediation and closure of waste sites at Hanford. For example, the Science and Technology Project has contributed to Office of River Protection milestones. Through funding provided directly to the Science and Technology Project as well as scientific studies by the DOE Environmental Management Science Program, the results of laboratory experiments and advanced modeling were used to predict the future migration of cesium-137, chromium, strontium-90, and uranium beneath leaking single-shell tanks. The Science and Technology Project is transferring results and models from the high-level waste tank investigations to the acceleration work scope identified in the Hanford performance management plan (DOE/RL-2002-47). These general models will be used to develop alternative remediation strategies and set the stage for long-term monitoring. The work required to accomplish this includes the following tasks:

- Estimate waste inventories and measurement of ecological risk assessment data for use in cumulative and site-specific impact assessments to support accelerated remediation and closure decisions.
- Perform laboratory and modeling studies of contaminants in leaking high-level waste tanks and high-risk waste sites to support accelerated remediation and closure plans by resolving issues of future contaminant migration.
- Conduct field studies of flow and reactive transport in Hanford soil to provide modeling parameters for cumulative and site-specific impact assessments.
- Perform laboratory, field, and modeling studies to support development of alternative remediation approaches for the interim groundwater pump-and-treat systems currently operating.

- Develop remediation technologies that may be used at high-risk waste sites or to replace the interim groundwater pump-and-treat systems.

Understanding contaminant release, distribution, and transport are critical to determining interim and final solutions for contaminants on the Hanford Site, their impact to human health and the environment, and the decisions to be made for managing remediation and long-term stewardship. The Science and Technology Project helps provide this critical information.

3.3.6 Groundwater Monitoring

Groundwater is monitored at Hanford to determine the nature and extent of contamination from Hanford operations. Groundwater under the Hanford Site has been contaminated through discharge or storage of liquid waste in cribs, ditches, trenches, ponds, and tanks (Hartman et al. 2002). Currently, approximately 207 square kilometers (80 square miles) of groundwater have contamination levels that exceed drinking water standards. The contaminated groundwater is not in our drinking water system, but portions have reached the Columbia River. The Groundwater Monitoring Project provides an integrated approach for all groundwater monitoring activities at the Hanford Site. The scope of work includes all aspects needed to manage, integrate, and implement the groundwater monitoring requirements for the entire Hanford Site. Specifically, groundwater monitoring includes the following activities:

- Monitor treatment, storage, and disposal units and other site facilities under RCRA regulations to determine if the facility has affected groundwater quality.
- Assess the nature and extent of contamination from RCRA treatment, storage, and disposal units that is known to have affected groundwater quality.
- Assess the groundwater within CERCLA groundwater operable units to determine the type and extent of the contamination, so a record of decision for remediation of the groundwater can be prepared.
- Assess the effectiveness of groundwater remedial actions.
- Deploy, evaluate, and implement innovative techniques (field methods and evaluation processes) to enhance groundwater monitoring.
- Maintain and upgrade the Hanford seismic monitoring network.
- Maintain and upgrade the Hanford Sitewide Groundwater Model.
- Publish an annual report of the results. The report can be accessed at http://groundwater.pnl.gov/

3.3.7 Well Management

Construction and maintenance of wells is an essential but costly element of groundwater protection, remediation, and monitoring. Well management activities provide leadership and a focal point to coordinate the construction, maintenance and decommissioning of wells on the Hanford Site. The vision of the well management strategy is to provide leadership and a focal point for coordinating wells on the Hanford Site. This includes strategic planning and guidance for groundwater protection and support to groundwater/vadose zone remediation. The goals are to prevent duplication of activities and assure information is freely exchanged and more efficiently disseminated to all participants involved in the groundwater protection program. A plan for managing wells will be prepared

and issued in fiscal year 2003. Key elements that will be implemented as part of the plan are:

- Establish a central point of contact for all wells on the Hanford Site.
- Establish roles and responsibilities between site contractors.
- Coordinate well drilling, maintenance, and well decommissioning activities (Figure 3.3).
- Manage and maintain the Hanford Site Well Database.
- Act as focal point for all well management decisions.
- Provide interfaces with regulatory agencies, users, and other databases, such as the Hanford Environmental Information System.

Figure 3.3. *Hanford crews drilled a borehole near tank B-110, one of the first single-shell tanks built in the 1940s. Instruments and sensors were installed to measure soil temperature, soil water pressure, and water content.*

4.0 Communication Plan

Key to the success of cleanup at the Hanford Site is involving and communicating with the public. The public typically most interested in the Hanford Site is a large, passionate, diverse, and geographically dispersed community, united by a common interest to protect the Columbia River and have a voice in Hanford's future. Building the mutual trust and support to move ahead on difficult issues requires an accessible and inclusive program for involving this community.

The *Community Relations Plan for the Hanford Federal Facility Agreement and Consent Order* (DOE/RL 2002, http://www.hanford.gov/crp/toc.htm) gives general guidance for these activities. The Hanford Advisory Board gives additional guidance. 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 range of information resources and public involvement opportunities provided by the Groundwater Protection Program is described in the following sections.

4.1 Public Involvement Opportunities

These opportunities assure that interested people can share information and views, consult and collaborate with DOE, Hanford regulators (EPA and Ecology), and Groundwater Protection Program staff on program activities. Public involvement opportunities are posted on the Internet (http://www.hanford.gov/pubinvolve.html) and include:

- **The Hanford Advisory Board**. DOE and FHI regularly inform the board and its subcommittees of Groundwater Protection Program activities and provides support for meetings, reports, and other activities.
- **Monthly Open Meetings**. These monthly meetings are informal opportunities for the public, tribal governments, stakeholders, regulators, DOE, and FHI program staff to voice opinions, discuss and resolve issues, and identify upcoming events. Meeting minutes are issued to more than 200 individuals and organizations on the Groundwater Protection Program distribution list and are posted on the program's web site. Meetings are held the first Monday of the month.
- **Regulatory Agency Meetings**. The Groundwater Protection Program regularly meets with Hanford regulators to inform them and obtain their input on decisions related to program direction and funding.
- **Information Sessions**. These opportunities bring together program staff and specific groups to inform them about, and seek their input on, selected issues and projects. The meetings may include FHI, DOE, regulators, and others depending on the nature of the discussion.
- **Work Groups**. Work groups provide opportunities for interested parties to meet with program staff to focus on a critical Hanford issue within the project's scope. A typical work group is limited in duration and targets a specific technical or policy issue. Examples of work groups are the Regulatory Path Forward Work Group, the System Assessment Capability Work Group, and the Policy Work Group.
- **Technical and Professional Interactions**. Groundwater Protection Program staff regularly participate in technical and professional conferences, symposia, and other activities to assure these audiences are informed about the program.

In addition, the Groundwater Protection Program is linked to the Hanford Site's emergency preparedness efforts to assure technical action and communication occurs in the event of an off-normal or unusual groundwater event.

4.2 Information Resources

Both technical and public information resources are provided by the Groundwater Protection Program. These resources assure that individuals and groups have timely access to both detailed and general information about the Groundwater Protection Program.

Technical information resources include:

- **Technical Reports**. Numerous technical reports are available that summarize, analyze, and interpret groundwater monitoring and remediation activities at the Hanford Site. The annual Hanford Site Groundwater Monitoring Report (Hartman et al. 2002; http://groundwater.pnl.gov/reports/gwrep01/start.htm) and the annual Hanford Site Environmental Report (Poston et al. 2002; http://hanford-site.pnl.gov/envreport) are examples of these technical reports. Technical reports are available through the Hanford Site Technical Library and via the Internet (http://www.osti.gov/opennet/ or http://www2.hanford.gov/declass/ or http://www.pnl.gov/tech_lib/home.html).
- **Virtual Library**. The electronic library provides easy access and use of critical site data needed by scientific, engineering, and management users at Hanford. Users do not need an understanding of any specialized computer language or database designs to access, retrieve and analyze the data. The Virtual Library is not publicly available.
- **Environmental Databases**. The environmental databases (see Table 3.1) that are available for use by Hanford staff in their work include the Hanford Environmental Information System (HEIS), Hanford Geographic Information System (HGIS), Hanford Well Information System (HWIS), Sample Data Tracking (SDT) System, Waste Information Data System (WIDS), Pump and Treat Project Specific Databases (P&T PSDB), and the In-Situ Redox Manipulation (ISRM) Project Specific Database (PSDB). Several front-end applications are used to interface with the databases as well as more general intranet access via a web browser.
- **Management Reports**. The Groundwater Protection Program regularly provides information and technical progress and related information to a variety of Hanford Site management reports, such as the annual Environmental report (Poston et al. 2002).

Public information resources include:

- **Web Site**. A web site will be maintained to assure that information about the Groundwater Protection Program is easily accessible to interested parties (http://www.hanford.gov/cp/gpp/index.htm).
- **Annual Report**. A report (DOE/RL 2001 most recent issue) is issued each year that summarizes the Groundwater Protection Program's efforts during the past 12 months. The report is distributed widely to government representatives and the public.
- **Information Outreach**. Outreach activities include placement of information in the local and regional newspapers and broadcast outlets, *DOE This Month*, the *Hanford Reach*, Hanford contractor publications, and trade and technical journals.
- **Special Information Products**. Several special information products have been or are in production to provide information about the Groundwater Protection Program, including an interactive CD, brochure, and display and presentation materials.

4.3 Information Sharing Process

General Updates. The status of normal Groundwater Protection Program activities is available to all interested parties on a regular basis through established reports and meetings. Links to reports and information about meetings can be found on the Groundwater Protection Program Website. Meeting reminders and agency-requested copies of reports are also transmitted via email, Hanford plant mail, and U.S. mail.

The Groundwater Protection Program provides regular updates to the general public, tribal nations, regulators, the state of Oregon, and other interested parties during monthly open meetings. These are held the first Monday of every month.

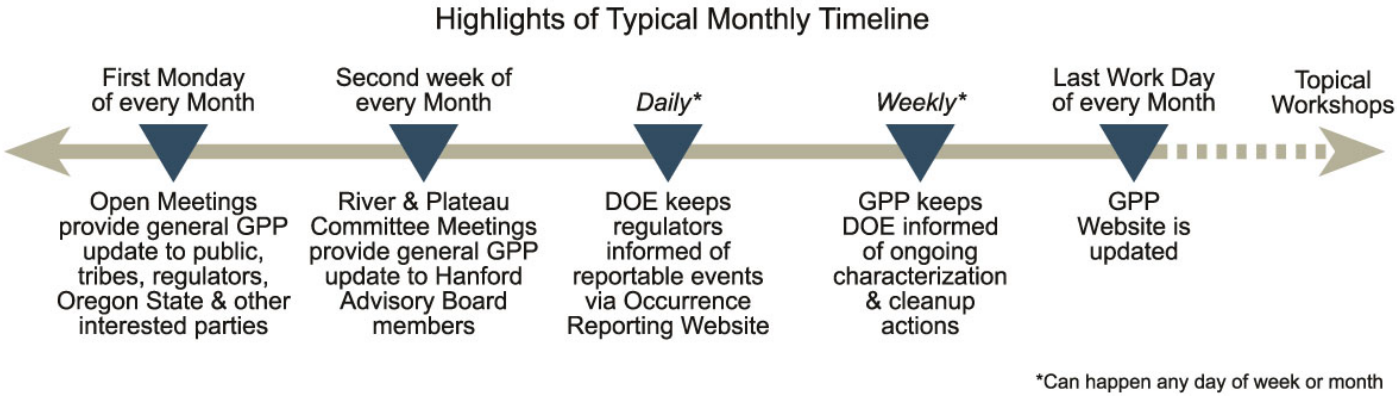
Regular updates are provided by the Groundwater Protection Program to Hanford Advisory Board members through monthly River and Plateau Committee Meetings. Typically, these occur during the second week of each month.

Reportable Events. If a significant adverse condition occurs, Groundwater Protection Program team members follow established procedures detailed in documents such as *Emergency Plan Implementing Procedures* (DOE-0223),[1] *Reporting Occurrences and Processing Operations Information* (HNF-PRO-060),[2] *Environmental Notifications and Reporting* (HNF-PRO-453),[2] and *Central Plateau Remediation Project Occurrence/Emergency Notification* (CP-PRO-005).[2] This process supports compliance with DOE orders and state and federal regulations and assures that the Occurrence Notification Center, the U.S. Department of Energy, regulators, Fluor Hanford senior management, and others are notified, as appropriate.

Emerging Issues. The Groundwater Protection Program keeps stakeholders informed of emerging issues, as necessary. It is important to the Groundwater Protection Program that stakeholders are kept current of organizational issues, since many issues impact stakeholder perceptions about program priorities and directions.

4.4 Topical Workshops

In the future, the Groundwater Protection Program will hold workshops to discuss with interested parties to discuss such things as the N Springs pump-and-treat system, sitewide assessments, specific science and technology topics, and other subjects as needed. These topical workshops will provide a forum to allow the exchange of information and ideas with a broad group of people.



[1] DOE-0223. *Emergency Plan Implementing Procedures*, available from the U.S. Department of Energy, Richland Operations Office, Richland, Washington.

[2] HNF-PRO-060, HNF-PRO-453, and CP-PRO-005 are internal procedure documents of Fluor Hanford, Inc., Richland, Washington.

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Appendix

Master Schedules for the Groundwater Protection Program

Appendix

Under this accelerated plan, the following actions will be completed by the primary management contractor for Hanford (Fluor Hanford, Inc.) by the end of FY 2006:

- Remediate 54 waste sites.
- Decommission high-risk 420 wells.
- Complete four records-of-decision for waste site remediation.
- Complete integrated monitoring system (at least 59 new wells).
- Develop final groundwater remedial actions for 200-UP-1, 100-HR-H, and 100-NR-2 areas.
- Complete water line and infrastructure upgrades to reduce recharge.

This appendix contains the schedule to complete the work. These schedules are updated as work progresses and, therefore, will change regularly. The schedules that are included in this appendix are listed below with a brief description:

Schedule A.1. Master Summary Schedule. This is a master summary schedule and shows the work that will be completed by the Groundwater Protection Program.

Schedule A.2. Waste Site Remedial Action Master Schedule. This schedule contains all the remedial investigations/feasibility studies undertaken.

Schedule A.3. High-Risk Waste Sites Master Schedule. This schedule shows the high priority sites. It shows that groundwater tasks will be completed at the U Plant waste sites by 2006, the BC cribs and trenches by 2006, and the PUREX cribs by 2010.

Schedule A.4. Plutonium Finishing Plant Master Schedule. This schedule shows work that will be completed at the Plutonium Finishing Plant by 2011.

These schedules (Schedule A.2, A.3, and A.4) show waste sites that have been selected for early action to isolate the large, mobile contaminant inventories, including cribs, trenches and other disposal sites near former nuclear materials production facilities. The remedial actions at these sites may be to install surface barriers that meet regulatory specifications. The barriers have shown that they dramatically reduce the rate of release of contaminants to the groundwater over time, especially if installed before waste seeps too deeply into the soil.

Schedule A.5. Shrink the Contaminated Area Master Schedule. This schedule shows the work that will be completed at several waste sites located outside the area in the Central Plateau that are planned for long-term stewardship. Early clean up and closure of these sites would eliminate groundwater contaminant sources outside the Central Plateau by 2009. Schedule A.5 shows that the Central Landfill work will be completed by 2007 and the Gable Mountain/B Pond/200 North work will be completed by 2009. Excavation of contaminated soil and monitored natural attenuation may be viable options for remediation at these sites.

Schedule A.6. Eliminate Recharge Conditions Master Schedule. This schedule shows the work that will be completed to reduce artificial and natural recharge of groundwater. Water moving through contaminated soil transports contaminants to the groundwater. The Groundwater Protection Program is decommissioning unneeded wells, upgrading water and septic systems and installing run-on/runoff controls as part of its work to prevent contaminant movement. Schedule A.6 shows the tasks that will be completed:

- Design and construct surface water run-on and runoff controls - completed by 2004
- Eliminate discharge from the U Plant septic system - completed by 2004
- Decommission high-risk wells – completed by 2006
- Decommission other unnecessary wells – completed by 2012

Schedule A.7. Groundwater Remediation Master Schedule. This schedule shows the work that will be completed to remediate groundwater. Six pump-and-treat systems are used to cleanup contaminated groundwater. These systems are used to remove chromium in the 100-K, 100-D, and 100-H Areas; carbon tetrachloride in the 200 West Area; technetium-99 and uranium in the 200 West Area; and strontium-90 in the 100-N Area. The Groundwater Protection Program is determining if these pump-and-treat systems provide the most effective cleanup alternatives. The efforts planned to move from interim actions to final remedies are shown in Schedule A.7 and include assessments of the following areas:

- U Plant – completed by 2006
- 100-H Area – completed by 2006
- 100-N Area completed by 2006
- 200-UP-1 Operable Unit – completed by 2006
- 200-ZP-1 Operable Unit – completed by 2008
- 100-D Area – completed by 2010
- 100-K Area – completed by 2012

Schedule A.8. Groundwater Monitoring Master Schedule. This schedule shows the activities that will be completed for groundwater monitoring. The need exists to integrate well monitoring and data interpretation provided through the Hanford Site Groundwater Monitoring Project with well drilling performed independently to meet different regulatory requirements. The needs also exists to determine the groundwater monitoring needs for long-term stewardship of the Central Plateau. In addition, the Groundwater Protection Program is evaluating the need for groundwater monitoring, as well as other technologies that would be less expensive and require less maintenance. This schedule identifies the work that will be done.

Schedule A.9. U Plant Closure Master Schedule. This accelerated plan proposed an area-by-area closure concept. This approach will complete clean up of all facilities within a region and the associated waste sites that represent several operable units. A sample of the type of work that would be done at the U Plant under an area closure concept is shown in Schedule A.9.

Schedule A.10. 618-10 and 618-11 Burial Grounds Master Schedule. These burial grounds are considered high-risk sites because of the contaminants found in them and their proximity to the Columbia River. Schedule A.10 shows the work to support current Tri-Party Agreement milestones (Ecology et al. 1998). This schedule shows completion of cleanup in 2018.

Schedule A.11. Assessments Master Schedule. An area-by-area approach to develop and prepare data needed to support final remedy decisions is provided in Schedule A.11. A pilot study for the 100-B/C Area will begin in 2003 and the risk assessment is scheduled to be completed in July 2005. This baseline assessment will provide a template for the other reactor areas.

Schedule A.12. Science and Technology Master Schedule. The Groundwater Protection Program continually evaluates new technologies that may be applied to the cleanup and protection of groundwater. The studies that may be undertaken are shown in Schedule A.12.

Schedule A.13. Integration and Assessment Master Schedule. This schedule provides an overview of how the Groundwater Protection Program will be managed. It demonstrates an integrated management approach for groundwater protection centered around key areas, which allows major portions of the work to be centralized for the entire Hanford Site.

Fluor Hanford

GROUNDWATER PROTECTION PROGRAM

Summary Schedule - Pg 1

Rev. 0

Project Director_____Date_____

FY 1990 | FY 1992 | FY 1994 | FY 1996 | FY 1998 | FY 2000 | FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 | FY 2012 | FY 2013 | FY 2014 | FY 2015 | FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 | FY 2024 | FY 2025 | FY 2026 | FY 2028 | FY 2030 | FY 2032 | FY 2034 | FY 2036 | FY 2037 & Beyond

Eliminate Recharge Condition

Run on
Wells
Water Lines
Septic

Stop Surface Discharge
ETF
M-17
Tank Farms
200 North
200 East
Other 200 Area Waste Sites
D&D 100 RC Wells
D&D 380 Hi Risk Wells
D&D 1774 Non-Compliant Wells
D&D All Other Non Long Term Stewardship Wells
200 West
200 East
Replace Hi Risk Waterline, etc.
Eliminate U Plant Septic System Use

Waste Site Remediation

RI/FS Remediation
Remediate Hi Risk Waste Sites
Shrink the Contaminated Foot-Print
Interface with RCC - WS Closures

Tank Farm Remediation
Final Facility D&D
Start Public Review of 200-CW-1 Proposed Plan
200-TW-1 PP
200-TW-2 PP
200-CW-5 PP
200-PW-4 PP
200-PW-2 PP
200-CS-1 PP
200-LW-1 PP
200-MW-1 PP
200-UR-1 PP
200-IS-1 PP
200-SW-2 PP
A4
A5
A2
Complete all RI/FS - Receive RODs
Waste Site Remediation
U Plant "Regional" (U/Tc-99)
618-10 Burial Ground
618-11 Burial Ground
B1
B2
BC Cribs and Trenches (Tc-99)
PFP "Regional" (Pu/CCL4)
Purex Cribs (I-129)
Gable Mt. Pond / B Pond / 200 North
NRDWL / Central Landfill
Source Control Actions
B / C Area Comp
F Area Comp
H Area Comp
D Area Comp
K Area
N Area
Comp

Groundwater Remediation

River Corridor

Start Pump & Treat Actions
HR-3 Pump and Treat
100 H
100 D
ESD Newspaper Ad
Complete ISRM Installation at 100 D
100 D and 100 H
Implement Final Action
100 K and 100 N
D1
D2
KR-4 Pump and Treat
ECY Agreement for NR-2 ROD Amendment
NR-2 Pump and Treat
Evaluate Passive System (Phyto Remediation, Apatite)
Implement Final Action as Necessary for N Area

Central Plateau

U Plant (U, Tc-99)
PFP (CCl_4)

UP-1 Pump and Treat (U, Tc-99)
Implement U-Plant Final Action as Necessary
ZP-1 Pump and Treat
Implement PFP Final Action as Necessary

Assessments

Site Wide Assessments
Risk - B / C, F, H, D, K & N Area
Ecological Assessments

Draft Composite Analysis
Finalize Composite Analysis
Submit Composite Analysis
Continue Until Site Closure
DQO - Data Collection - Risk Assessment - Completion Actions
B/C Area
F Area
H Area
D Area
N Area
K Area
NEPA Characterization
NEPA Characterization
5 Year Review
NEPA Char
NEPA Char
NEPA Char
NEPA Char
NEPA Char
5 Year Rev
NEPA
NEPA
NEPA

Legend
Key Event (Start / Completion)
Decision Point
Activity
Progress
Logic
Float
Reference Project
Initiative S/E Work Scope
EM 50 Funded Work Scope
Unfunded Work Scope
Documented Interface
Intra-Schedule Logic (Page to Page)
FLUOR Performance Baseline Incentive
FLUOR Performance Stretch Goal
FLUOR Performance Super Stretch Goal
TRI-PARTY AGREEMENT MILESTONE
Public Involvement

GROUNDWATER PROTECTION PROGRAM

Schedule A.1. *Master Summary Schedule*

Fluor Hanford

GROUNDWATER PROTECTION PROGRAM

Summary Schedule - Pg 2

Rev. 0

Project Director_____ Date_____

FY 1990 | FY 1992 | FY 1994 | FY 1996 | FY 1998 | FY 2000 | FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 | FY 2012 | FY 2013 | FY 2014 | FY 2015 | FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 | FY 2024 | FY 2025 | FY 2026 | FY 2028 | FY 2030 | FY 2032 | FY 2034 | FY 2036 | FY 2037 & Beyond

Science & Technology

Soil Waste Inventory

Soil Inventory Model — SIM App to Remaining Sites (A2) — Soil Waste Inventory Field Confirm & Update (B1)

Subsurface Transport

S-SX, & T-TX-TY Tank Farms

U-Plant Regional Closure (A3) — 200 Area Remaining Waste Sites

Vadose Zone Field Study (A1) — Uranium Reactive Transport Model (A4)

Columbia River

Biological Uptake Sr90 by Aquatic Species (D1) — Uranium, Iodine-129 Uptake by Aquatic Species

Remediation - N Springs

100N Phytoremediation & Apatite Sequestration Feasibility Studies (D2)

- CCl4

Insitu Carbon Tetrachloride Remediation (EMSP) (B2)

Tank Farms

Science & Technology - Geophysics

B, BY, BX FIR

Site Characterization - Tank Farm Waste

T, TY, TX Field Investigation Report (FIR)

Site Analysis & Coordination

C, A, AX Field Investigation Report (FIR)

U Farm FIR

Monitoring

Groundwater Monitoring

Long Term Stewardship Plan — S&T Long Term Monitoring Alternative

SAmpling & Analysis, Data Mgmt

Groundwater Sampling and Analysis

Sitewide Surveillance Monitoring

1997 Transfered ALE, North Slope, & McGee Ranch Management Control to US Fish & Wildlife Management

Transfer the River Corridor Unit to US Fish & Wildlife Management

Long Term Stewardship

River Corridor — Balance Outside Core Zone — Long Term Stewardship — Core Zone

Integration (Management)

Legend

- Key Event (Start / Completion)
- Decision Point
- Activity
- Progress
- Logic
- Float
- Reference Project
- Initiative 5/6 Work Scope
- EM 50 Funded Work Scope
- Unfunded Work Scope
- Documented Interface
- Intra Schedule Logic (Page to Page)
- FLUOR Performance Baseline Incentive
- FLUOR Performance Stretch Goal
- FLUOR Performance Super Stretch Goal
- TRI-PARTY AGREEMENT MILESTONE
- Public Involvement

GROUNDWATER PROTECTION PROGRAM

Schedule A.1. *(contd).*

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GROUNDWATER PROTECTION PROGRAM

Waste Site Remedial Actions

Rev. 0


Project Director
Date
FY 2002
FY 2003
FY 2004
FY 2005
FY 2006
FY 2007
FY 2008
FY 2009
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
FY 2019
FY 2020
FY 2021
FY 2022 & Beyond
200 Waste Site Remediation
200-CW-1 Operable Unit
200-CW-1 / 200 North Assessment
M-015-38A FS/PP/PPM
200-CW-1 ROD
M-015-00C
200-CS-1 Operable Unit
200-CS-1 Assessment
M-015-39B
R I Report
M-015-39C
FS/PP/PPM
ROD
200-CW-5 Operable Unit
200-CW-2 Operable Unit
200-CW-4 Operable Unit
200-SC-1 Operable Unit
200-CW-2, -4, -5, & 200-SC-1 Assessment
M-015-40B
RI Report
M-015-40C
FS/PP
ROD
Post-ROD Waste Site Remediation Schedule Will Be Developed to Support the Central Plateau Regional Closure Plan (09/03)
200-TW-1 Operable Unit
200-TW-2 Operable Unit
200-PW-5 Operable Unit
200-TW-1, -2, & 200-PW-5 Assessment
M-015-41B RI Report
M-015-41C FS/PP/PPM
ROD
200 Waste Site Remediation
200-PW-2 Operable Unit
200-PW-4 Operable Unit
200-PW-2, -4, Assessment
M-015-43B RI Report
M-020-33 Closure Plan
M-015-43C FS/PP/PPM
ROD
200-PW-1 Operable Unit
200-PW-3 Operable Unit
200-PW-6 Operable Unit
200-PW-1, -3, -6 Assessment
RIR
FS/PP
ROD
200-LW-1 Operable Unit
200-LW-2 Operable Unit
200-LW-1, -2 Assessment
M-015-46A
RIR
M-015-46B
FS/PP
ROD
200-MW-1 Operable Unit
200-MW-1 Assessment
M-015-44A
RIR
M-015-44B
FS/PP/PM
ROD
200 Waste Site Remediation
200-IS-1 Operable Unit
200-ST-1 Operable Unit
200-IS-1 & 200-ST-1 Assessment
M-013-00M RI/FS Work Plan
RIR
FS/PP
M-020-54 Closure Plan
ROD
200-UR-1 Operable Unit
200-UR-1 Assessment
M-013-00N RI/FS Work Plan
FS/PP
ROD
200-SW-1 Operable Unit
200-SW-2 Operable Unit
200-SW-1, -2 Assessment
M-013-00O RI/FS Work Plan
FS/PP
ROD

Acronyms

RI - Remedial Investigation
FS - Feasibility Study
PP - Proposed Plan
ROD - Record of Decision
PPM - Proposed Permit Modification

Key Assumptions

Summary

1. Schedule reflects standard CERCLA activities following the 200 area remedial Investigation/ Feasibility Study Implementation Plan - Environmental Restoration Program (DOE/RL-98-28, Rev. 0).
2. Schedule matches the current commitments and will be re-evaluated during the Spring of 2003.
3. This is a summary of 200 Area Baseline Assumptions from ERC FY01 Long Range Baseline Report. More detailed assumptions can be found in the ERC FY01 Long Range Baseline Report.
4. Assume a delayed inititation of remedial activities beyond the required 15-Months after the issuance of the ROD for some Operable units is acceptable to all parties.

Assessment

1. RI/FS Work Plan
2. Remedial Investigation
3. RI Report
4. Feasibility Study/Proposed Plan/ Proposed Permit Modification
5. Record of Decision
6. Closure Plan

Confirmatory/ Remedial Design Sampling

1. Confirmatory sampling will be performed on waste sites that have not been previously characterized to confirm the prescribed remedy as appropriate.
2. Design sampling will also be performed as part or the Comfirmatory Sampling task for all sites with Containment (barriers) as the remedial alternative.
3. Assumes no design sampling will be required for removal and disposal sites; these sites will be remediated using the observational approach with verification sampling done as part of the remedial action.
4. Includes DQO, SAP, planning, fieldwork, and reporting.

Remedial Design/ Remedial Design Report/ Remedial Action Work Plan

1. The surface barrier remedial design assumes a three-step design process including preliminary intermediate, and final design.
2. Materials for construction of the barriers are available when needed (i.e., McGee Ranch silt).
3. Assumes use of alternative surface barriers designed for Hanford's environmental conditions and for appropriate RCRA equivalency that will be addressed in the FS.
4. Assumes a 9-month remedial design period with 110 days for preliminary, 44 days for intermediate, and 44 days for final design.
5. Assumes the RDR/RAWP will be combined into one document with a 10-month duration with no public review.

Remedial Design/ Remedial Design Report/ Remedial Action Work Plan - Cont

6. Includes separate DQOs and SAP for confirmatory sampling and verification sampling.

Procurement

1. Procurement package will be assembled for construction with an procurement duration of 4 to 6 months.

Remediation

1. Redemption, if needed, assume use of engineered surface barriers or waste removal and disposal at ERDF. Sites inside the 200 Area land use boundary will generally have a surface barrier. Sites outside the 200 Area fences will generally be removal actions. Assumes no action required for the 200-SW-1 Nonradioactive Landfill (NRDWL), the Solid Waste Landfill (SWL) and the Old Central Landfill (OCL), which will be remediated with a surface barrier. 50% of 200-Ur-1 OU unplanned release sites area not addressed based on the assumption that unplanned releases can be fully addressed (i.e. no action) through waste site reclassification. Assumes UPR's associated with each OU will be addressed by remediation of the waste sites associated with the UPR. Assumes that septic tanks will be removed but the tile field left in place with no further action.

Remediation - Cont

2. For removal sites, excavation volumes are based on site dimensions from WIDS. Volume calculations assumed removal of existing structure(s) and does not include the remediation of soils left following D&D activities.

O&M

1. Assumes approximate 9-month effort to prepare O&M plan. Scope will address long-term hydrologic performance monitoring, barrier stability/settlement, inspection, and maintenance.
2. Assumes 5 years of O&M monitoring.

Cleanup Verification / Closeout

1. Site specific cleanup verification packages will be prepared for each removal waste site. A 12-month duration for cleanup verification packages is assumed.
2. The closeout report/certification of completion process is assumed to take approximately 12 months for RCRA TSDs.

Key Interfaces

TPA / DNFSB Milestones

M-013-00M Submit 1 200 Npl RI/FS (RFI/CMS) work plans for the 200-IS-1, Tanks/Lines/Pits Diversion Boxes Ou. Includes waste sites in the 200-St-1, Septic Tank and Drain Fields OU.	12/31/2002
M-013-00N Submit 1 200 NPL RI/FS (RFI/CMS) Work Plans for the 200-UR-1, Unplanned Releases.	12/31/2003
M-013-00O Submit 1 200 NPL RI/FS (RFI/CMS) Work Plans for the 2--SW-2, Radioactive Landfills and Dumps OU. Includes waste sites in the 200-SW-1, Non-Radioactive Landfills and Dumps OU.	12/31/2004
M-015-00C Complete all 200 Area Non-Tank Farm Operable Unit Pre-ROD site investigations under Approved Work Plan Schedules.	12/31/2008
M-015-38A Submit 200-CW-1 Gable Moutain Pond/B Pond and Ditch Cooling Water Group Feasibility Study.	03/31/2003
M-015-39B Submit 200-CS-1 Chemical Sewer Group RI Report.	05/31/2004
M-015-39C Submit 200-CS-1 Chemical Sewer Group FS, 200-CS-1 Chemical Sewer Proposed Plan/ Proposed RCRA Permit Modification	11/30/2005
M-015-40B Submit 200-CW-5 U-Pond/Z-Ditches Cooling Water Group RI Report.	05/31/2003
M-015-40C Submit 200-CW-5 U-Pond/Z-Ditches Cooling Water Group FS, and Proposed Plan.	10/31/2004
M-015-41B Submit 200-TW-1 OU & 200-TW-2 OU RI Report to EPA and Ecology.	10/30/2002
M-015-41C Submit 200-TW-1 OU & 200-TW-2 OU FS & Proposed Plant to EPA and Ecology	03/31/2004
M-015-43B Submit 200-PW-2 OU RI Report	06/30/2004
M-015-43C Submit 200-PW-2 OU Feasibility Study and Proposed Plan/Proposed RCRA Permit Modification.	12/31/2005
M-015-44A Submit 200-MW-1 OU Remedial Investigation Report	12/31/2005
M-015-44B Submit 200-MW-1 OU Feasibility Study and Proposed Plan	12/31/2006
M-015-46A Submit 200A Chemical lab Waste OUs RI Report, include the Past Practice Waste Sites in 200-LW-1 & 200-LW-2 ACL Groups	10/31/2005
M-015-46B Submit 200A Chemical lab Waste OUs FS/PP mod, include the Past Practice Waste Sites in 200-LW-1 & 200-LW-2 ACL Groups	09/30/2006
M-015-47 Submit Proposed Plan to EPA and/or Ecology to conduct remedail action(s) for source control at high-risk waste site(s).	06/30/2003
M-016-00 Complete Remedial Actions for all 200 Non-Tank Rarm Operable Units	09/30/2024
M-020-00A Submit Closure/Postclosure Plans for all RCRA TSD Units except 216-A-10, 216-A-36B, 216-A-37-1, South Retention Basins, 216-S-10 Pond, 2160S-10 Ditch, 241-CX-70, 241-CX-71, and 241-CX-72.	02/28/2004
M-020-00B Submit Closure/Post-Closure Plans for 216-A-10, 216-A-36B, 216-A-37-1, 207-A South Retention Basin, 216-S-10 Pond, 216-S-10 Ditch, 241-CX-70, 241-CX-71, and 241-CX-72.	12/31/2008
M-20-33 Submit 216-A-10 Crib, 216-A-36B Crib, 216-A-37-1 Crib, and 207-A South Retention Basin Closure/ Post Closure to Ecology.	12/31 2005
M-20-39 Submit 216-S-10 Pond and Ditch Closure/Post Closure Plans to Ecology	11/30/2005
M-20-54 Submit 241-CX-70 Storage Tank, 241-CX-71 Neutralization Tank, 241-CX-72 Storage Tank Closure/Post Closure to Ecology	12/31/2008

Legend


Key Event (Start / Completion)
Decision Point
TIP
Technology Insertion Point
Activity
Logic
Float
Reference Project
Initiative 5/6 Work Scope
EM 50 Funded Work Scope
Unfunded Work Scope
3
Documented Interface
P
FLUOR Performace Baseline Incentive
Stretch
FLUOR Performace Stretch Goal
Super Stretch
FLUOR Performace Super Stretch Goal
TRI-PARTY AGREEMENT MILESTONE
2
Intra Schedule Logic (Page to Page)
Inter Schedule Logic (Sch to Sch)
TO
FROM
11
S&T
12
S&T

Schedule A.2. *Waste Site Remedial Action Master Schedule.*

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GROUNDWATER PROTECTION PROGRAM

High Risk Waste Sites

Rev. 0

Updated: February 11, 2005 09:25 AM
File: GPP High Risk WS.dgn

Project Director _____ Date _____

FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 | FY 2012 | FY 2013 | FY 2014 | FY 2015 | FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 & Beyond

B/C Cribs & B/C Control Area

Decision Making Documents

- FS /Proposed Plan (TW-1, TW-2)
- M-015-41C — 6/21/2004
- ROD

Remediation

- BC Crib Characterization
- BC Control Area Voluntary Cleanup Planning
- BC Control Area Radiation survey
- BC CA Cleanup
- Confirmation Sampling(200-TW-1)
- Pipeline Remedial Design(200-TW-1)
- Barrier Remedial Design (200-TW-1)
- Procurement
- Procurement
- Pipeline Excavation
- Barrier Construction
- Verify Closeout
- Backfill
- Operation & Maintenance

PUREX Cribs

Decision Making Documents

- M-020-33, M-015-43C — 12/31/2005
- FS / Proposed Plan (PW-2 & PW-4)
- ROD

Remediation

- Confirmation Sampling
- Pipeline Remedial Design
- Procurement
- Barrier Remedial Design
- Procurement
- Pipeline Excavation
- Barrier Construction
- Verify Sampling / Backfill
- Operation & Maintenance

PFP CCL4 / Plutonium Rich Waste Sites

Decision Making Documents

- FS / Proposed Plan
- ROD

Remediation

- Confirmation Sampling
- Pipeline Remedial Design
- Procurement
- Barrier Remedial Design
- Procurement
- Pipeline Excavation
- Barrier Construction
- Verify Sampling / Backfill
- Operation & Maintenance

Acronyms

Key Assumptions

1. The four 200-LW-1 BC cribs/trenches will be incorporated into the 200-TW-1/2 FS/PP/ROD.
2. Surface barriers assumed preferred remedial alternative for cribs/trenches.
   - a - Five surface barriers for five PUREX cribs; 216-A-5, 216-A-10, 216-A-36B, 216-A-37-1, 216-A-45. Issue draft A FS/PP 6 months ahead (by 6-30-05) of TPA milestone M-15-43C (12/31/05) to support ROD by 6/30/06.
   - b - Four surface barriers for 22 200-TW-1 BC cribs/trenches Issue Draft A FS/PP 3 months ahead (by 12/31/03) to TPA milestone M-15-41C (3/31/04) to support ROD by 12/31/04.
   - c - One surface barrier for four 200-LW-1 BC cribs/trenches 200-TW-1 ROD amended to incorporate 200-LW-1 (BC) sites; Single RDR/RAWP modified to incorporate 200-LW-1 (BC) sites. Integrate barrier construction with 200-TW-1 BC cribs.
   - d - Five surface barriers for seven PFP Carbon Tetrachloride (CCl4)/Plutonium (Pu) cribs: 216-Z-1&2, 216-Z-1A, 216-Z-3, 216-Z-9, 216-Z-12, 216-Z-18, 216-Z-19.
3. Excavation with waste disposal to ERDF assumed preferred remedial alternative for pipelines ponds/ditches, and surface contamination.
   - a - Pipelines to cribs/trenches
   - b - BC control area
4. BC Control Area Cleanup as voluntary action.
   - a. Minor surface contamination over BC Control area.
   - b. RadRover or equivalent equipment will be used to survey the area burned in 2000 and hand surveys conducted in remaining controlled area.
   - c. Work in the BC control area will consist of a single phase cleanup from the outside in towards the cribs and trenches.
   - d. Assumes shallow soil survey and removal of contamination areas greater than the action levels to a maximum depth of 1'.
   - e. Verification monitoring using hand held equipment will be conducted immediately following the removal action.
5. One new BC characterization borehole will be required to support characterization needs for other site projects.
   - a. Assume streamlined DQO process for the other site projects characterization requirements.
   - b. Only SAP will need to be prepared.
6. One borehole will be accelerated from the 200-LW-1 Work Plan.
7. The above waste sites are associated with several OUs. It is assumed that FS will address all waste sites within an OU consistent with existing TPA M-15 interim milestones to complete FSs. Following the remedial decision (ROD), only the above waste sites (#1 & #2) will be accelerated for remediation. None of the waste sites identified for accelerated remediation are adjacent to tank farms.
8. Confirmatory/remedial design sampling can be initiated prior to issuance of ROD or approved Closure Plan, and needed only for waste sites with surface barriers. Remove and dispose (excavation) waste sites are not assumed to require confirmatory/remedial design sampling as sampling will be performed during remediation applying the observational approach.
9. Soil borrow sources for surface barrier construction available on the Hanford Site.
10. Remediation milestone 09/2030 for BC Cribs and BC CA met by completion of excavation/barrier construction and submittal of verification/closeout package and does not include final regulatory approval of verification/closeout, backfilling, or O&M.
11. Other remediation milestones met by completion of excavation/barrier construction (does not include verification/closeout, backfilling, or O&M)
12. Barrier construction and excavation performed under subcontract. BC Control Area cleanup performed by Hanford workforce.
13. Assumes use of alternative surface barriers designed for Hanford's environmental conditions and for appropriate RCRA equivalency that will be addressed in the FS.
14. FS/PP/ROD required for surface barriers and waste site excavations; EE/CA/AM for pipeline removal.
15. Early regulator buy-in/acceptance.
16. RCRA TSD Closure Plans not required for RCRS TSD sites in OUs with and FS/PP/ROD; assumes WAC 173-303-645 (1)(e) provision can be applied.
17. Sufficient characterization data available from past characterization activities and/or planned activities under existing work plans to support regulatory decisions.
18. Assumes minimal additional ecological assessment for BC Cribs and BC control area. No additional ecological assessment for others. Ecological DQO's may be needed, but assume DQO results would require no additional ecological sampling.
19. Assume minimum of 5 years to barrier monitoring and inspection (O&M period).
20. Key document driver is the *Performance Management Plan for Accelerated Cleanup of the Hanford Site*, DOE/RL-2002-47, Predecisional Draft B, and July 17, 2002.
21. Issues:
    - a - The accelerated plan does not account for the possibility that some sites may contain TRU levels of contamination, which would introduce additional complexities and likely require additional scope, schedule, and budget to address.
    - b - FH/ORP waste site ownership.

TPA / DNFSB Milestones

M-15-00C	Complete all 200 Area non-tank farm operable unit pre-ROD site investigations under approved work plan schedules	12/31/2008
M-015-41B	Submit 200-TW-1 OU & 200-TW-2 OU RI report to EPA and Ecology and includes the Past Practice Waste Sites in the 200-PW-5 Fission Product-Rich Process Waste Group.	10/30/2002
M-015-41C	Submit 200-TW-1 OU & 200-TW-2 OU FS and Proposed Plan to EPA and Ecology and includes the Past Practice Waste Sites in the 200-PW-5 Fission Product-Rich Process Waste Group. The waste site associated with the Hanford prototype barrier will be addressed by the TW-1/TW-2 Proposed Plan.	03/31/2004
M-015-43B	Submit 200-PW-4 OU RI Report including the Past Practice Waste Sites in the 200-PW-4 General Process Waste Group.	06/30/2004
M-015-43C	Submit 200-PW-4 OU Feasibility Study and Proposed Plan/Proposed RCRA Permit Modification including the Past Practice Waste Site in the 200-PW-4 General Process Waste Group.	12/31/2005
M-016-00	Complete Remedial Actions for all 200 Area Non-Tank Farm Operable Units.	09/30/2024
M-020-00B	Submit Closure/Post-closure Plans for 216-A-10, 216-A-36B, 216-A-37-1, 207-A South Retention Basin, 216-S-10 Pond, 216-S-10 Ditch, 241-CX-70, 241-CX-71, and 241-CX-72.	12/31/2008
M-20-33	Submit 216-A-10 Crib, 216-A-36B Crib, 216-A-37-1 Crib, and 207-A South Retention Basin Closure/Post Closure Plans to Ecology in corrridination with Feasibility Study for the 200-PW-2 Uranium-Rich Process Waste Group Operable Unit (to be coordinated under M-15-43C).	12/31/2005

Legend

- Key Event (Start / Completion)
- Decision Point
- Technology Insertion Point
- Activity
- Logic
- Float
- Reference Project
- Initiative 5/6 Work Scope
- EM 50 Funded Work Scope
- Unfunded Work Scope
- Documented Interface
- FLUOR Performance Baseline Incentive
- FLUOR Performance Stretch Goal
- FLUOR Performance Super Stretch Goal
- TRI-PARTY AGREEMENT MILESTONE

Schedule A.3. *High-Risk Waste Sites Master Schedule.*

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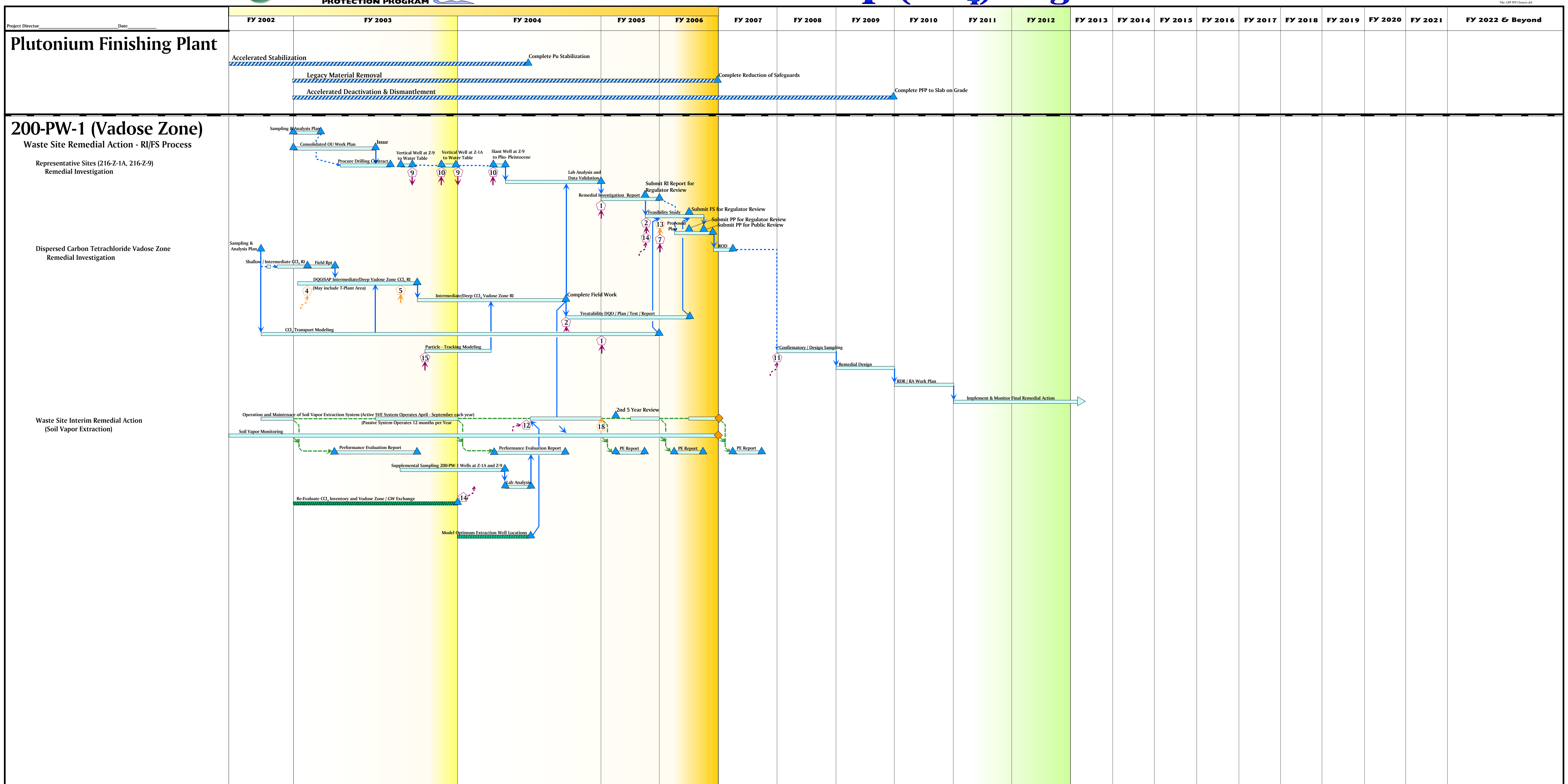
GROUNDWATER PROTECTION PROGRAM

PFP Area Cleanup (CCl_4) - Pg1

Rev. 0



Acronyms	
CCl_4	Carbon Tetrachloride
DNAPL	Dense Non-Aqueous Phase Liquid
DQO	Data Qualilty Objective (Process)
EAPS	Enhanced Access Penetration system
FS	Feasibility Study
PFP	Plutonium Finishing Plant
Pu	Plutonium
RA	Remedial Action
RDR	Remedial Design Report
RI	Remedial Investigation
ROD	Record Of Decision
SAP	Sampling and Analysis Plan
TRU	Transuranic

Key Assumptions

1. Active soil vapor extraction system operates 6 months (April - September) each year until ROD is issued. Passive soil vapor extraction systems operate 12 months each year.
2. Groundwater pump-and-treat operates continuously until ROD is issued.
3. No other waste sites in the consolidated PW-1/PW-3/PW-6 Operable Unit work plan need to be characterized during the remedial Investigation.
4. The 200-PW-1 Remedial Investigation report, Feasibility Study, and Proposed Plan will be issued for 30 day regulator review periods.
5. The 200-PW-1 Proposed Plan will be issued for a 45 day public review and comment period.
6. The 200-PW-1 ROD process is assumed to last 4.5 Months.

1. PNNL residual DNAPL study supports CCl_4 transport model development and PW-1 RI report.
2. PNNL evaluation of Vadose Zone remedial alternatives supports PW-1 Feasibility Study and Dispersed CCl_4 Treatability study.
3. PNNL evaluation of groundwater remedial alternatives supports ZP-1 Feasibility Study.
4. EAPs (drilling) demo supports PW-1 dispersed deep CCl_4 DQO and ZP-1 DQO.
5. EAPs (laser) demo supports PW-1 dispersed deep CCl_4 DQO and ZP-1 DQO.
6. CCl_4 acceleration project feeds ZP-1 RI report.
7. PNNL TRU speciation / mobility study supports PW-1 Feasibility Study.
8. ZP-1 deepening of Z-9 well supports P&T operations as an extraction well.
9. PW-1 drilling at representative sites supports ZP-1 DNAPL investigation drilling.
10. ZP-1 DNAPL investigaiton drilling affects PW-1 drilling schedule.
11. 218-W-4C TRU retrieval links to PW-1 CCl_4 remedial design.
12. GW project converts original ZP-1 extraction well to PW-1 SVE well.
13. EMSP studies support PW-1, ZP-1 feasibility studies.
14. GW project CCl_4 studies supports PW-1 feasibility study.
15. Assessments support particle tracking.
16. Site wide integration supports DQO / Work plan.
17. TX -TY field investigation links to ZP-1 P&T evaluation.
18. Horizontal drilling demonstration supports SVE operations.

Key Interfaces

TPA / DNFSB Milestones

M-015-00C	Complete all 200 Area non-Tank Farm Operable Unit pre-ROD site investigations under approved work plan schedules.	12/31/2008
PROPOSED - [M-015-45A]	Submit 200-PW-1 OU Remedial Investigation Report including the Past Practice Waste Sites in the 200-PW-3 Organic-Rich Process Waste Group and 200-PW-6 Plutonium-Rich Process Waste Group.	TBD
PROPOSED - [M-015-45B]	Submit 200-PW-1 OU Feasibility Study and Proposed Plan including the Past Practice Waste Sites in the 200-PW-3 Organic-Rich Process Waste Group and 200-PW-6 Plutonium-Rich Process Waste Group.	03/31/06

Legend

- Key Event (Start / Completion)
- Decision Point
- TIP Technology Insertion Point
- Activity
- Logic
- Float
- Reference Project
- Initiative 5/6 Work Scope
- EM 50 Funded Work Scope
- Unfunded Work Scope
- Documented Interface
- FLUOR Performace Baseline Incentive
- FLUOR Performace Stretch Goal
- FLUOR Performace Super Stretch Goal
- TRI-PARTY AGREEMENT MILESTONE
- Intra Schedule Logic (Page to Page)
- Inter Schedule Logic (Sch to Sch) TO FROM S&T S&T

Schedule A.4. *Plutonium Finishing Plant Master Schedule.*

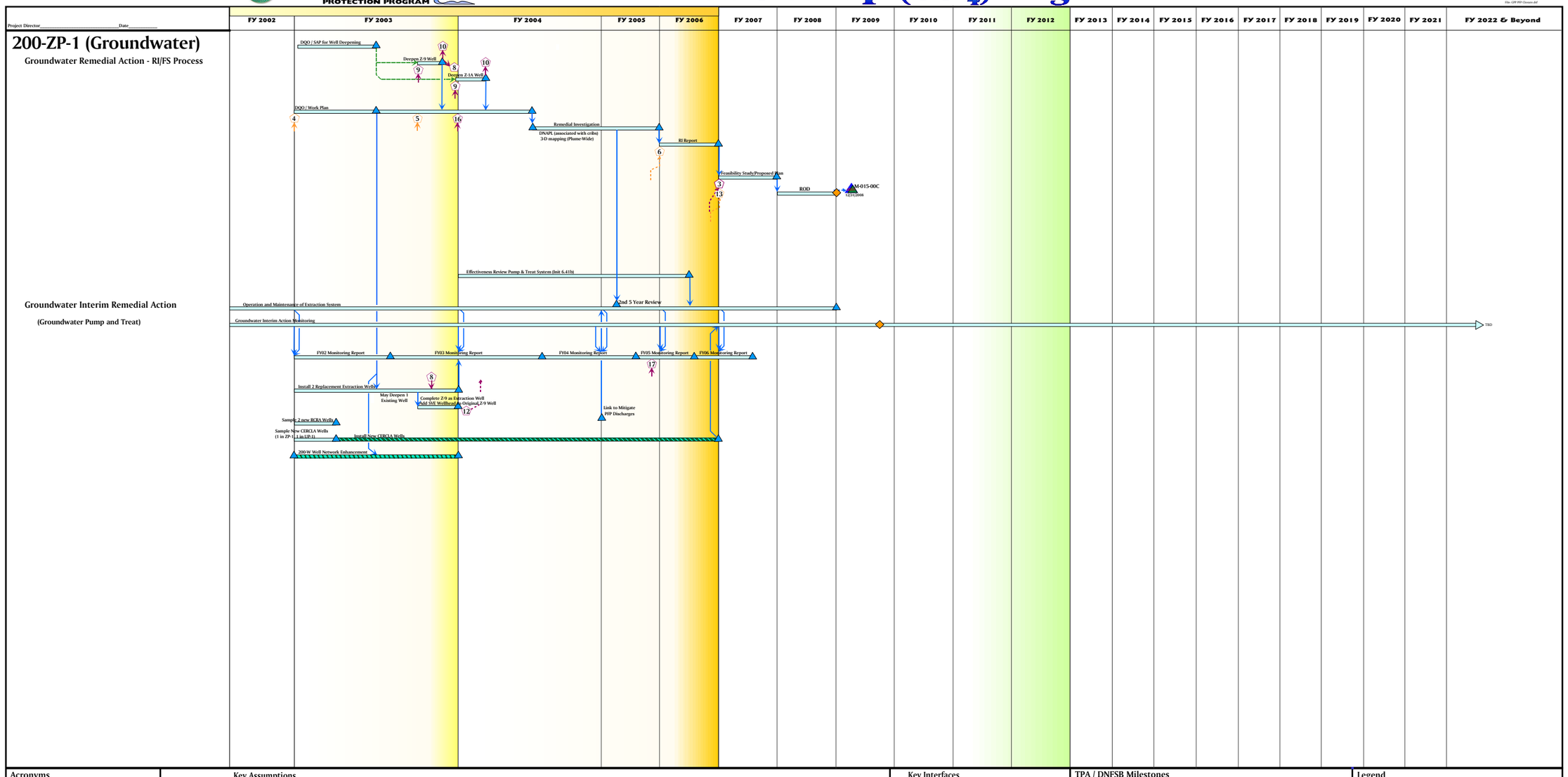
Fluor Hanford

GROUNDWATER PROTECTION PROGRAM

PFP Area Cleanup (CCl_4) - Pg2

Rev. U
Updated: February 15 2005 09:46 AM
File: GPP PFP Closure.fpf

Project Director_____Date_____



Acronyms

See - Page 1

Key Assumptions

See - Page 1

Key Interfaces

TPA / DNFSB Milestones

See - Page 1

Legend

- Key Event (Start / Completion)
- Decision Point
- TIP — Technology Insertion Point
- Activity
- Logic
- Float
- Reference Project
- Initiative 5/6 Work Scope
- EM 50 Funded Work Scope
- Unfunded Work Scope
- Documented Interface
- FLUOR Performance Baseline Incentive
- FLUOR Performance Stretch Goal
- FLUOR Performance Super Stretch Goal
- TRI-PARTY AGREEMENT MILESTONE
- Intra Schedule Logic (Page to Page)
- Inter Schedule Logic (Out to Sch) TO / FROM

Schedule A.4. *(contd).*

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GROUNDWATER PROTECTION PROGRAM

PFP Area Cleanup (CCl_4) - Pg3

Rev. 0

Updated: February 13, 2003 09:40 AM
File: GPP PFP Closure.dgn

Project Director_____Date_____

	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022 & Beyond
Science & Technology Groundwater Protection Program			Evaluation of Carbon Tetrachloride Remedial Alternatives (2) Vadose; (3) Groundwater PNNL Residual DNAPL Measurement and Transport Model Update (1) PNNL Speciation and Mobility of TRU Contaminants (Supporting PW-1 Remedial Design) (7)																		
DOE - HQ National Energy Technology Laboratory		(4) EAPS Demo #1 Uncontaminated (Drilling) Phase I (5) EAPS Demo #2 Offsite Uncontaminated (Laser) Phase I Go / No Go Decision EAPS Phase II Horizontal Drilling Demonstration (18)																			
Office of Science and Technology		Carbon Tetrachloride Acceleration Project (6)																			
Environmental Management Science Program		Mechanisms of Carbon Tetrachloride Retention and Slow Release in Model Porous Solids and Sediments (13) Transport, Targeting, and Application of Functional Nanoparticles for Degradation of Chlorinated Organic Solvents (13) Overcoming Barriers to the Remediation of Carbon Tetrachloride through Manipulation of Competing Reaction Mechanisms (13) Engineered Natural Geosorbents for In-Situ Immobilization of DNAPLs and Heavy Metals (13) Resolving the Impact of Biological Processes on DNAPL Transport in Unsaturated Porous Media (13)																			
Assessments		Site-Wide Groundwater Model Support to Waste Sites (15)																			
Site-Wide Integration		Hanford Groundwater Remediation Strategy (16)																			
T and TX-TY Tank Farm (Phase I)		Field Activity Analysis (17) Field Investigation Report																			
218-W-4C Burial Ground		TRU Waste Retrieval (11)																			

Acronyms

Key Assumptions

Key Interfaces

TPA / DNFSB Milestones

Legend

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- Intra Schedule Logic (Page to Page)
- Inter Schedule Logic (Go to Sub) FROM / TO

Schedule A.4. *(contd).*

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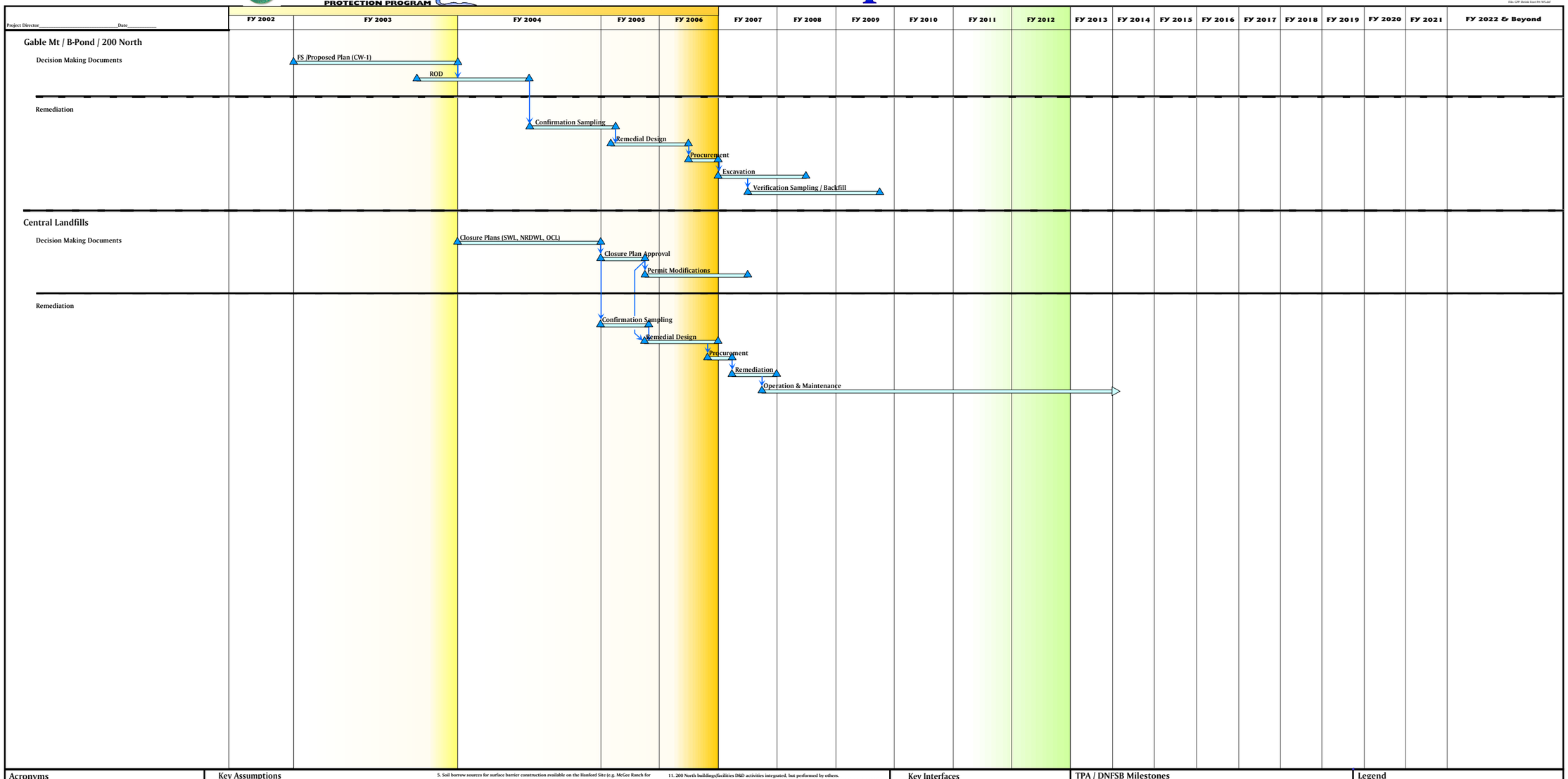
GROUNDWATER PROTECTION PROGRAM

Shrink the Footprint

Rev. 0

Updated: February 13, 2003 09:50 AM
File: GPP Shrink Foot Pri WA.dsf

Project Director_____Date_____



Acronyms

Key Assumptions

1. Surface barriers assumed preferred remedial alternative for landfills.
   a - Three surface barriers for three land fills: SWL, NRDWL, OCL.
   SWL and NRDWL (Central Landfill) closed under RCRA D and C Closure Plans respectively.
   Old Central Landfill (OCL) closed as voluntary action.
2. Excavation with waste disposal to ERDF assumed preferred remedial alternative for pipelines, ponds/ditches, and surface contamination.
   a - Gable Mountain Pond and B Pond (200-CW-1) and associated pipelines.
   b - Fourteen 200 North waste sites (200-CW-3) and associated pipelines.
3. It is assumed that the 200 Northend and 200-CW-1 FS will address all waste sites consistent with existing TPA M-15-38A interim milestones.
   Following the remedial decision (ROD), only the above waste sites will be accelerated for remediation. None of the waste sites identified for accelerated remediation are adjacent to tank farms.
4. Confirmatory/remedial design sampling can be initiated prior to issuance of ROD or approved Closure Plan, and needed only for waste sites with surface barriers. Remove and dispose (excavation) waste sites are not assumed to require confirmatory/remedial design sampling as sampling will be performed during remediation applying the observational approach.
5. Soil borrow sources for surface barrier construction available on the Hanford Site (e.g. McGee Ranch for silt loam).
6. Remediation milestones met by completion of excavation/barrier construction (does not include verification/closeout, backfilling, or O&M).
7. Barrier construction and excavation performed under subcontract.
8. Assumes use of alternative surface barriers designed for Hanford's environmental conditions and for appropriate RCRA equivalency that will be addressed in the FS.
9. FS/PP/ROD required for surface barriers and waste site excavations; EE/CA/AM will be performed concurrently with the FS/PP/ROD for D&D of 200 North facilities/buildings. Assumes D&D Completed prior to completion of waste site remediation.
10. Early regulator buy-in/acceptance.
11. 200 North buildings/facilities D&D activities integrated, but performed by others.
12. Sufficient characterization data available from past characterization activities and/or planned activities under existing work plans to support regulatory decisions.
13. No additional ecological assessment. Ecological DQO's may be needed, but assume DQO results would require no additional ecological sampling.
14. Assume minimum of 5 years to barrier monitoring and inspection (O&M period).
15. Key document driver is the *Performance Management Plan for Accelerated Cleanup of the Hanford Site*, DOE/RL-2002-47, Predecisional Draft B, and July 17, 2002.

Key Interfaces

1. PFP D&D
2. 200 North D&D

TPA / DNFSB Milestones

M-15-00C	Complete all 200 Area non-tank farm operable unit pre-ROD site investigations under approved work plan schedules	12/31/2008
M-015-38A	Submit 200-CW-1 Gable Mountain Pond/B Pond and Ditch Cooling Water Group Feasibility Study. Including 216-N-1, 216-N-2, 216-N-3, 216-N-4, 216-N-5, 216-N-6, 216-N-7, UPR-200-E-34, 600-118, 200-N-3, 600-254, 2607-N, UPR-200-N-2, Past Practice Waste Sites, and submit 200-CW-1 Gable Mountain Pond/B Pond and Ditch Cooling Water Group Proposed Plan/Proposed RCRA Permit Modification.	03/31/2003
M-016-00	Complete Remedial Actions for all 200 Area Non-Tank Farm Operable Units.	09/30/2024

Legend

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- FLUOR Performance Stretch Goal
- FLUOR Performance Super Stretch Goal
- TRI-PARTY AGREEMENT MILESTONE
- Intra Schedule Logic (Page to Page)
- Inter Schedule Logic (Other Schedules)

TO	FROM
11 5&1	12 5&1

Schedule A.5. *Shrink the Contaminated Area Master Schedule.*

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GROUNDWATER PROTECTION PROGRAM

Eliminate Recharge Conditions

Rev. 0

Updated: February 13, 2003 09:35 AM
File: GPP Elim Recharg Cond.dsf

Project Director_____Date_____

FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 | FY 2012 | FY 2013 | FY 2014 | FY 2015 | FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 & Beyond

Decommission Non-Tank Farm Wells

- U-Plant Area: Identify Wells / Decommissioning Profiles (02/21/2003) → Place Contract → Decommission ~40 Wells → Decommission Remaining U-Plant Area Wells (09/30/2005) — 2 U-P
- Other Areas Containing High-Risk Wells: Identify Wells / Decommissioning Profiles (09/30/2002) → Decommission ~120 Wells → Decommission ~120 Wells → Decomm ~140 Wells → Decomm ~140 Wells (09/30/2007)
- All Other Non-Compliant (~1774): Identify Wells / Decommissioning Profiles (09/30/2006)
- All Remaining Non-LTS: Identify Wells / Decommissioning Profiles (10/01/2008) → Decommission Wells → (09/30/2018)

Water Utility Modifications

100 Area

- Master Plan Update — 2 U-P
- 182-B, D Area Export Water Pumps (L-327): Replace / Automate Pumps to Reduce System Pressure & Reduce Response Time — 3 HSO

600 Area

- Export Lines & Isolation Valves (L-334): Install Remote Operated Shut-Off Valves — 3 HSO

200E

- Reservoir (L-317): Rehabilitate Leaky Reservoir — 3 HSO
- Facility Supply Lines & Isolation Valves:
  - Disconnect Inactive Water Lines — 3 HSO
  - Refurbish 20" South "A" Farm Raw Water Supply Line — 3 HSO
  - Refurbish 8" North "A" Farm Raw Water Supply Line — 3 HSO
  - Refurbish 10" B-Plant Potable Water Supply Line — 3 HSO
  - Refurbish "24" Raw Water Line to PUREX(L-342) — 3 HSO

200 W

- Reservoir (L-311): Rehabilitate Leaky Reservoir — 3 HSO
- Facility Supply Lines & Isolation Valves:
  - Refurbish Northern Segment of "20" Raw Water Line to U-Plant/S-Lab — 3 HSO
  - Refurbish "12" Potable Water Line to T-Plant — 3 HSO
  - Disconnect Inactive 200 West Water Lines — 3 HSO
- U-Plant Regional Closure: Relocate / Reline / Disconnect U-Plant Water Lines (09/30/2005) — 2 U-P

Septic System Modifications

U-Plant Discharges / Mitigate Other Discharges

- Eliminate U-Plant Area Septic System Discharges (03/31/2005) — 2 U-P
- Accomplish Regional Tie-Ins and Personnel Relocations — 2 U-P, 3 HSO
- Issue Work Plan (Master Plan Update) (02/21/2005) — 2 U-P

Run-On / Run-Off Water Control

Identify Needs / Remedies

- Field Investigation — 2 U-P, 3 HSO

Implement Actions

- Regrade / Berm / Curbs & Gutters — 2 U-P, 3 HSO

Acronyms

LTS - Long Term Stewardship
D & D - Decontamination / Decommissioning / Closure

Key Assumptions

1. Single, multi-year competitive bid contract is the most cost effective means to decommission wells
2. High-risk wells for decommissioning will be identified by 06/30/2002
3. Schedule bassis is 2,154 non-tank farm wells to be decommissioned, of which, 380 are in high-risk areas, and 314 are in the 200 Area.
4. Average well decommissioning cost is $11,000. $15,000 for high-risk wells. Basis is BHI data.
5. Approximately 42 U-Plant regional area wells will require decommisioning in conjunction with accelerated facility closure.
6. No significant soil contamination will affect water utility system modification work.
7. PFP septic system can be designed / relocated to mitigate deleterious effects on vadose zone / groundwater contaminates.

Key Project Interfaces

2 U-plant Area Accelerated Closure
3 Hanford Site Operations

TPA / DNFSB Milestones

Legend

Key Event (Start / Completion)
Decision Point
TIP Technology Insertion Point
Activity
Logic
Float
Reference Project
Initiative SIS Work Scope
EM 50 Funded Work Scope
Unfunded Work Scope
Documented Interface
TRI-PARTY AGREEMENT MILESTONE
Intra Schedule Logic (Flags to Page)
Inter Schedule Logic (Sub to Sub) TO / FROM — 11 S&T / 12 S&T

Schedule A.6. *Eliminate Recharge Conditions Master Schedule.*

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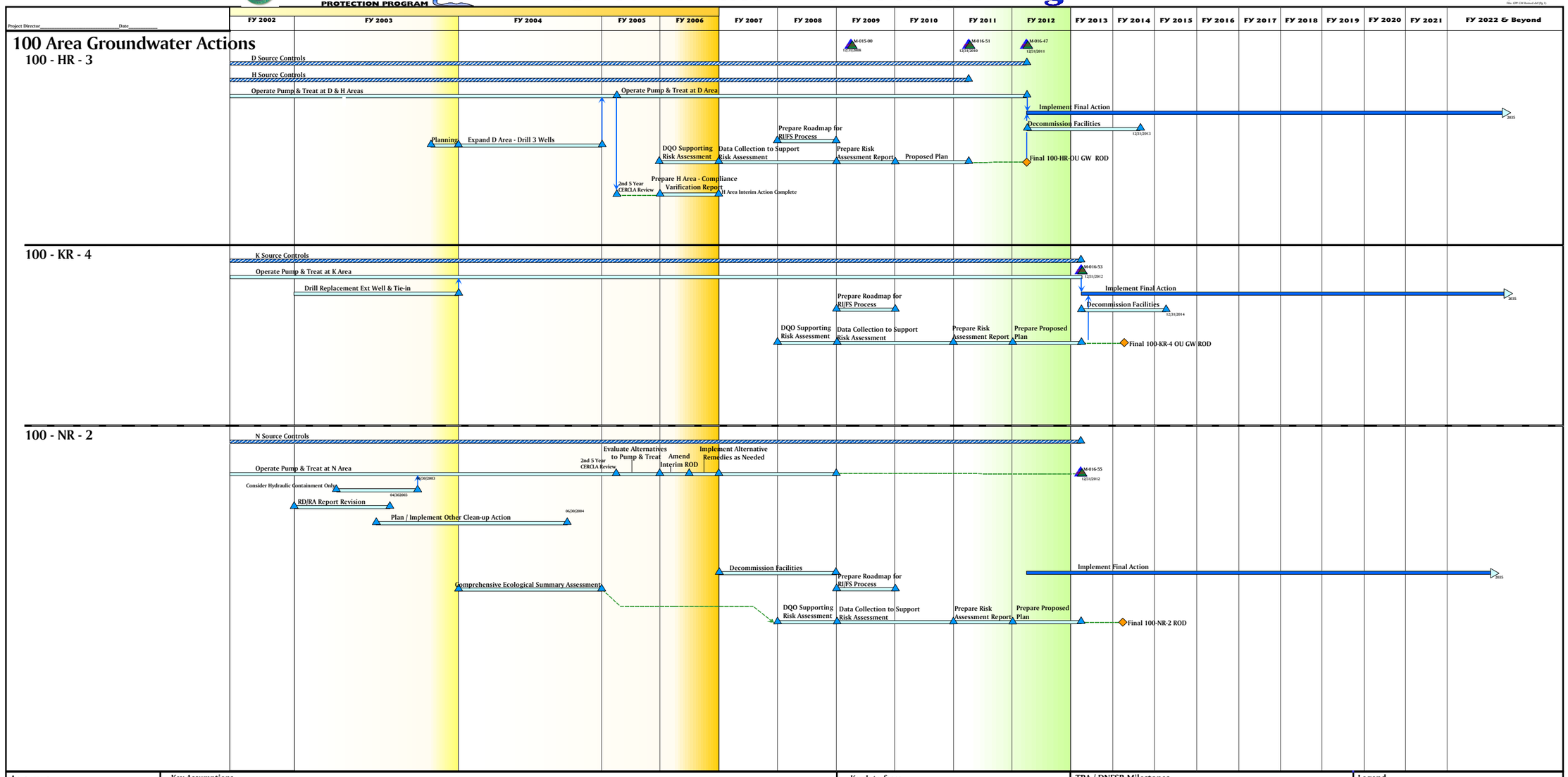
GROUNDWATER PROTECTION PROGRAM

Groundwater Remediation Pg 1

Rev. 0

Updated: February 21, 2003 03:00 PM
File: GPP GW Revised.dsf (Pg 1)

Project Director_____ Date_____



Acronyms

Key Assumptions

1. H, K and N RI / FS Work Done in Parallel
2. ISRM Monitoring under HR-3 IAM
3. Minimum Number of Injections required throughtout life of Barrier
4. Wells at D will be built for possible use as extraction wells
5. Continue base operations with ROD ammendements 02/31/04 and 06/30/06 for HR-3 and KR-4, no change in operations assumed
6. Hydraulic containment approved with issuance of revised RD/RA.

Key Interfaces

TPA / DNFSB Milestones

M-15-00	Complete the RI/FS (or RFI/CMS) for all Operable Units	12/31/2008	Page 1
M-015-00C	Complete all 200 Area Non-Tank Fram OU Pre-RODs	12.31.2008	Page 3
M-16-27C	Complete 100-HR-3 Phase III ISRM Barrier Emplacement	06/30/2003	Page 2
M-16-45	Complete Interim Remedial Action for 100 B/C Area	12/31/2006	Page 2
M-16-47	Complete Interim Remedial Actions for 100 D Area	12/31/2011	Page 1
M-16-49	Complete Interim Remedial Actions for 100 F Area	12/31/2008	Page 2
M-16-51	Complete Interim Remedial Actions for 100 H Area	12/31/2010	Page 1
M-16-53	Complete Interim Remedial Actions for 100 K Area	12/31/2012	Page 1
M-16-55	Complete Interim Response Actions for 100 N area	12/31/2012	Page 1
M-024-00D	Install RCRA GW Monitoring Wells at Rate up to 50 in CY03	12/31/2003	Page 3
M-024-00P	Install RCRA GW Monitoring Wells up to 50 in CY04 if Req'd	12/31/2004	Page 3
M-024-56	Install 2 Additional Wells at SST WM Area TX-TY	12/31/2002	Page 4 (Comp 12/09/2002)

Legend

Key Event (Start / Completion)
Decision Point
TIP Technology Insertion Point
Activity
Logic
Float
Reference Project
Initiative 5/6 Work Scope
EM 50 Funded Work Scope
Unfunded Work Scope
Documented Interface
FLUOR Performance Baseline Incentive
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TRI-PARTY AGREEMENT MILESTONE
Intra Schedule Logic (Page to Page)
Inter Schedule Logic (Sch to Sch)
TO
FROM
11 S&T
12 S&T

Schedule A.7. *Groundwater Remediation Master Schedule.*

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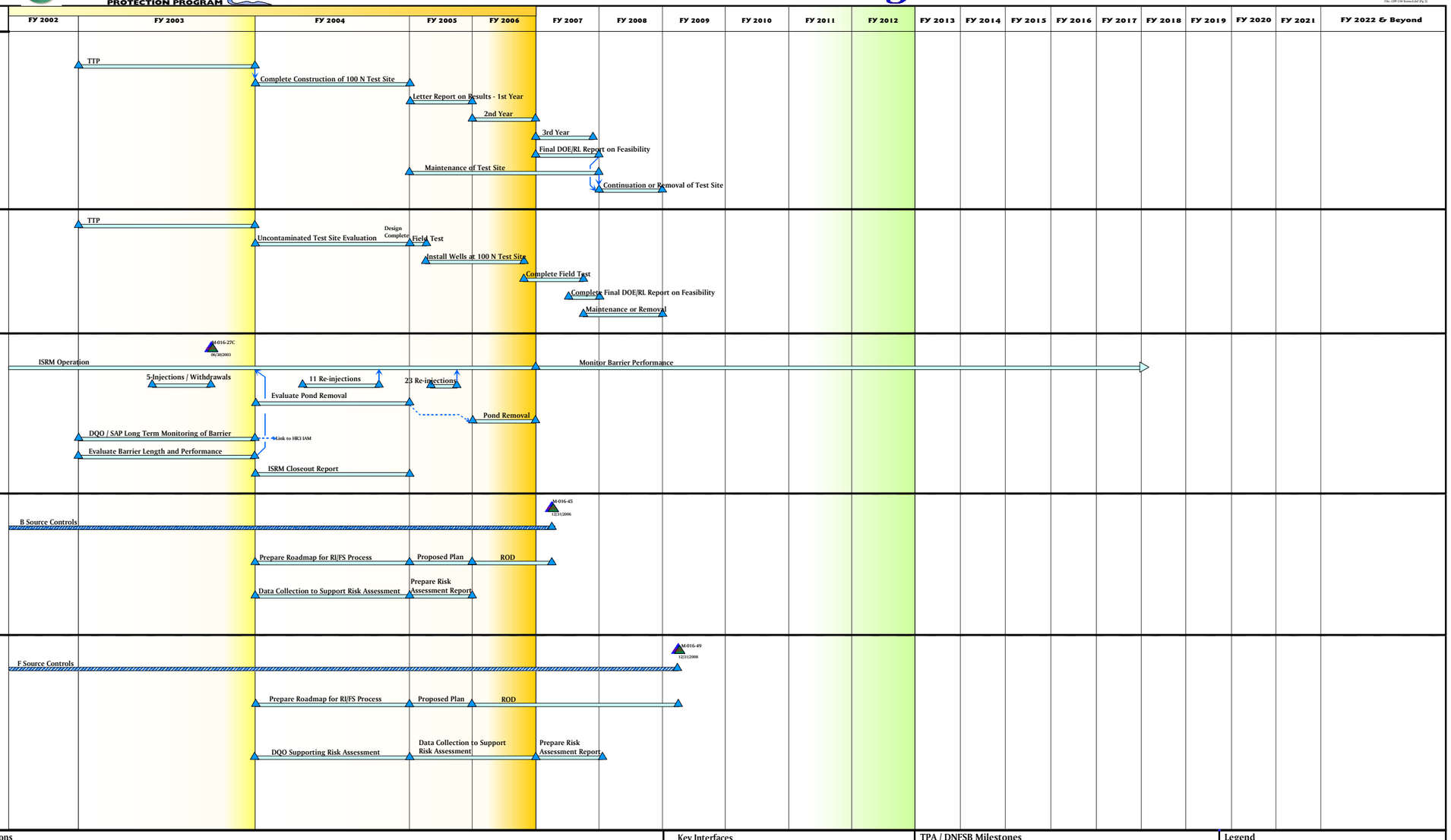
GROUNDWATER PROTECTION PROGRAM

Groundwater Remediation Pg 2

Rev. 0

Updated: February 13, 2003 09:22 AM
File: GPP GW Remed Fnl Pg 2

Project Director_____Date_____



Acronyms	Key Assumptions	Key Interfaces	TPA / DNFSB Milestones	Legend

Schedule A.7. *(contd).*

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GROUNDWATER PROTECTION PROGRAM

Groundwater Remediation Pg 3

Rev. U

Updated: February 21, 2003 02:30 PM
File: GPP GW Remed.dsf (Pg 3)

Project Director_____Date_____

200 Area GW Actions

FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 | FY 2012 | FY 2013 | FY 2014 | FY 2015 | FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 & Beyond

UP - 1

- Operation & Maintenance of Extraction System → 2035
- Complete U Plant Waste Sites Remediation St. Initiative 5.Ig
- DQO / Work Plan to Support RI/FS Process
- RI (LFI)
- RI Report
- Issue RI Report Rev 0
- Risk Assessment (PNNL Performance Assessment)
- Feasibility Study
- Proposed Plan
- ROD
- M-15-00C 12/31/2008
- Implement Final Remediation
- Update 200-UP-1 O&M Facility Procedures
- Well 299-W19-43 Tie-in
- ~~Design & Implementation~~
- D&D 200-UP-1 Chemical Treatment
- Treatment Sys Life-Cycle Expectancy Evaluations
- M-24-00P
- Install 1 New CERCLA Well
- CERCLA Wells - Install 3 New Monitoring Wells → 2035
- CERCLA 5 Year Review

ZP - 1

- Operations & Maintenance of Extraction System → 2035
- D&D Physical Treatment
- CERCLA Well
- CERCLA Wells - Install 3 New Monitoring Wells → 2035
- Effectiveness Review P & T System
- DQO / Work Plan to Support RI/FS
- RI (LFI)
- Z1A & Z9 (Well #4)DNAPL Investigation Drilling
- RI Report
- Issue RI Report Rev 0
- St. Initiative 6.4la
- M-24-00O
- FS / PP
- ROD
- DNAPL Investigation DOW
- M-15-00C 12/31/2008
- Implement Final Remediation
- Update 200-ZP-1 O&M Facility Procedures
- Treatment System Life-Cycle Expectancy Evaluations
- Replacement Extraction Well (Well #1)
- CERCLA 5 Year Review
- CERCLA 5 Year Review
- CERCLA 5 Year Review

PW - 1

- Operations & Maintenance of Extraction System → 2035
- D&D VES
- Re-Evaluate CCl4 Inventory & Vadose Zone / GW Exchange
- Modeling Optium Ext. Well Locations
- Treatment System Life-Cycle Expectancy Evaluations
- Update 200-PW-1 O&M Facility Procedure
- Construct New Z1A Well as Vapor Extraction
- CERCLA 5 Year Review
- CERCLA 5 Year Review
- CERCLA 5 Year Review

Acronyms

Kd	Distribution Coefficient
PP	Proposed Plan
RI	Remedial Investigation
ROD	Record of Decision

Key Assumptions

UP-1 RI/FS process has been set on a very aggressive schedule in order to have the final ROD issued by the end of FY06, which is the date the Vitrification Project will begin sending waste water to ETF for treatment. While the approval of the final proposed plan and issuance of the final ROD typically requires one full year for each document. The proposed schedule allows only 6 months for writing, reviewing, revising and issuing the final proposed plan. and only 9 months for the final ROD to be issued.
The UP-1 RI/FS schedule also assumes that the conclusions from the DQO process will show that the vast majority of the data exists and that sufficent funding is available in the first two quarters of FY04 to collect any missing data. If any of these assumptions are not accurate, then the proposed schedule will not likely be achievable

200 Area Groundwater Remediation:
- UP-1 - TPA Milestone M-15-00C : 200 Area RI / FS Fincal
- One CERCLA well to be installed by 12/02
- UP-1/ZP-1 - Assumes that new well installation priority list to be established by DOE / EPA / Ecology in C2T process puts 200 West wells in higher priority over 200 East wells.
- Assumes current extraction system remains operational until final remedy is implemented.
- Assumes the majority of data needed to support RI / FS process has already been collected.
- ZP-1 - One CERCLA well to be installed by 12/02

PSTF (Modutank)
- Purgewater / IDW Strategy approved by 12/31/2002.
- IH will issue existing closure plan for approval and plan will be approved by 7/03.
- ETF upgrades to accept purge water project funded by GPP.
- Closure waste to ERDF.
- Purge water trucks stay with Groundwater Protection Program.
- Trucks upgraded to meet ETF req by 10/01/2004.

Footnotes:

(a) Tied to interim action monitoring plan.
(b) Includes new injection and extraction wells.
(c) Decision point regarding whether or not to continue expand, or discontinue pump & treat system.
(d) Active system only operating 6 months out of the year, while passive system operating 12 months out of the year.
(e) Addresses only CERCLA wells.
(f) When investigation - Devived Waste Plan is signed, all waste will go to ERDF.

Key Interfaces

1	Links to U-Plant Regional O & M Monitoring	Jackson
2	Links to PNNL laboratory experiment / modeling (uranium) T, TX, TY Tank Farm	
3	Links to MSE Kd Study	
4	Links to DNAPL / 3-D CCL4 DQO / Investigation	Rohay
5	Links to PW-1 RI/FS process	
6	Links to PNNL's RCRA GW Monitoring program	
7	Links to PNNL well deepening evaluation	
8	Output to SAC and other models	
9	Links to PW-1 RI/FS process	
10	See "Eliminate Recharge Conditions", "U Plant Regional WS Remediation" schedules for well decommissioning activities.	

TPA / DNFSB Milestones

See Page 1

Legend

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- Intra Schedule Logic (Page to Page)
- Inter Schedule Logic (Sch to Sch) TO / FROM

Schedule A.7. *(contd).*

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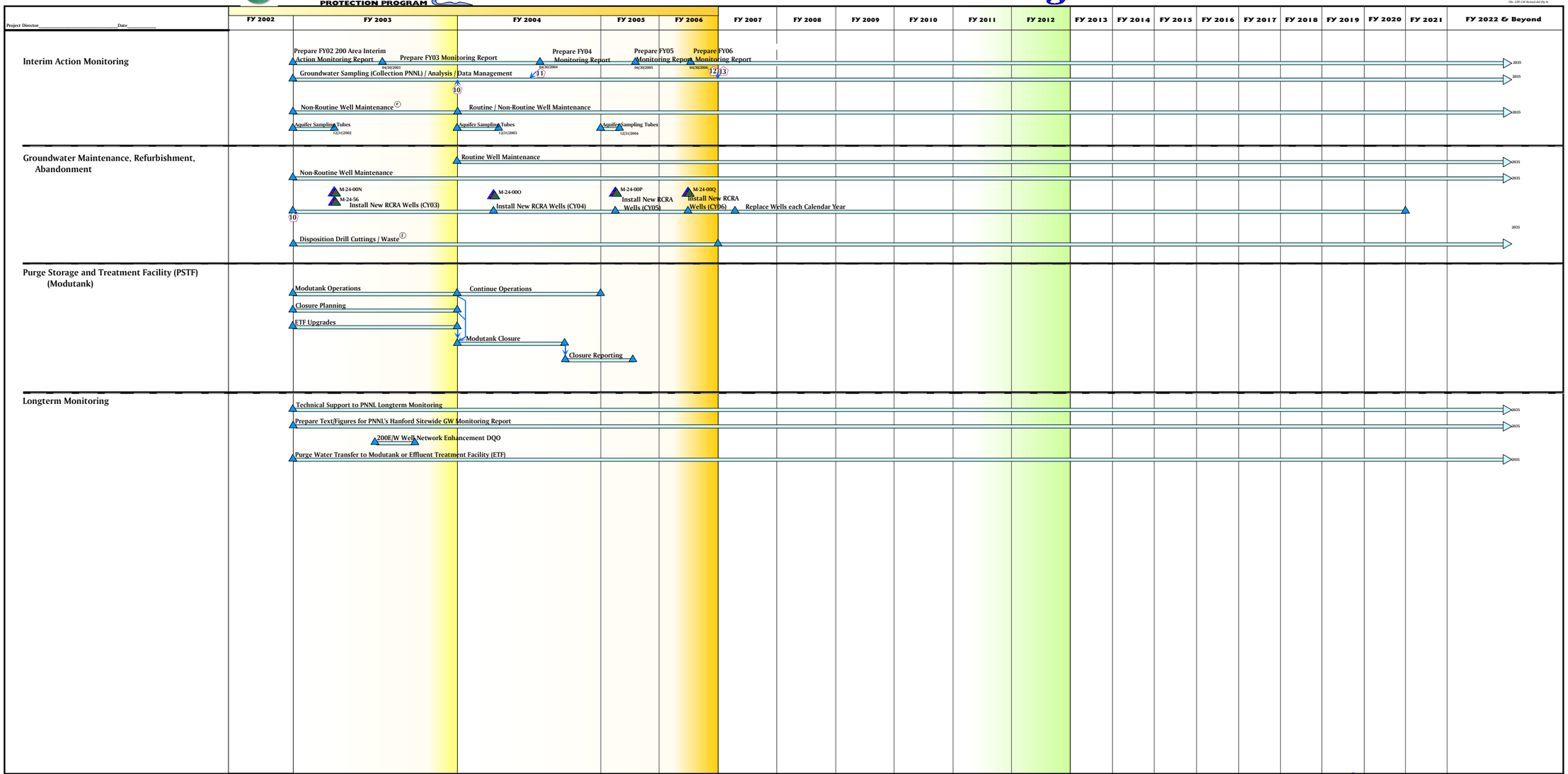
GROUNDWATER PROTECTION PROGRAM

Groundwater Remediation Pg 4

Rev. U

Updated: February 21, 2003 03:28 PM
File: GPP CM Revised.def (Pg 4)

Project Director_____Date_____



Acronyms

Key Assumptions

Key Interfaces

1	Links to U-Plant Regional O & M Monitoring	Jackson
2	Links to PNNL laboratory experiment / modelling (uranium) T, TX, TY Tank Farm	
3	Links to MSE Kd Study	
4	Links to DNAPL / 3-D CCLA DQO / Investigation	Rohay
5	Links to PW-1 RI/FS process	
6	Links to PNNL's RCRA GW Monitoring program	
7	Links to PNNL well deepening evaluation	
8	Output to SAC and other models	
9	Links to PW-1 RI/FS process	
10	See "Eliminate Recharge Conditions", "U Plant Regional WS Remediation" schedules for well decommissioning activities.	

TPA / DNFSB Milestones

See Page 1

Legend

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TRI-PARTY AGREEMENT MILESTONE
Intra Schedule Logic (Page to Page)
Inter Schedule Logic (Sch to Sch)
TX / PRIOd
11 S&T
12 S&T

Schedule A.7. *(contd).*

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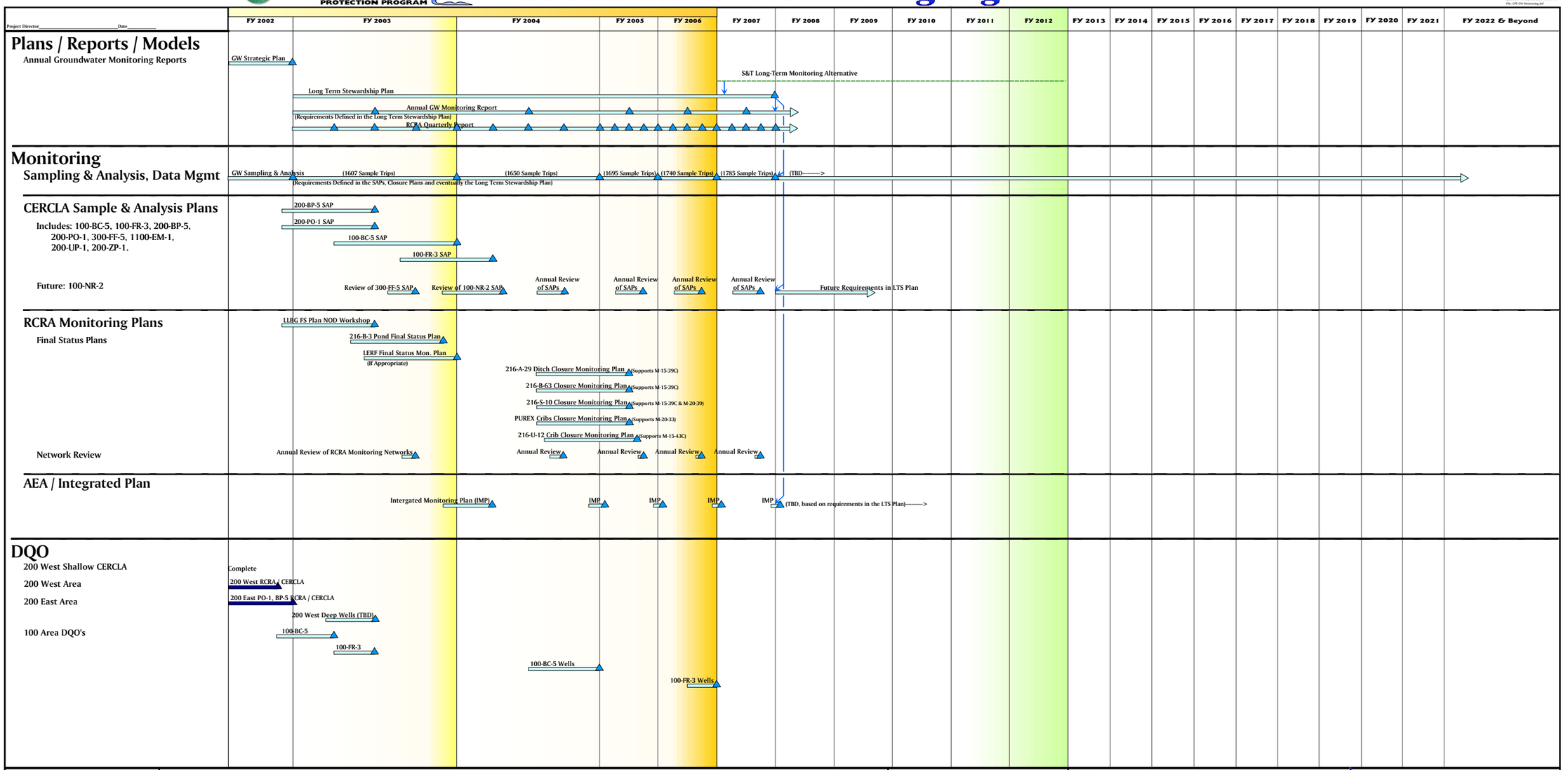
GROUNDWATER PROTECTION PROGRAM

Groundwater Monitoring Pg 1

Rev. 0

Updated: February 15, 2005 10:20 AM
File: GPP GW Monitoring.mpp

Project Director_____Date_____



Acronyms

Key Assumptions

1. Funding for 2 of the 4 (Dec 02) CERCLA wells in PNNL FY02 Budget.
2. 2 Wells at 618-10 (PNNL), 2 wells near PFP for UP-1 and ZP-1.
3. CERCLA well in the FY03 budget. One AEA well at 100K Area.
4. Acceptable monitoring network in place by 09/2005.

Done with detection and assessment wells by 09/2005. Wells after that are associated with post-closure monitoring.

Need basis for costs estimates of the noted number of wells.

RCRA quarterly T/SO reports not shown

Interim action monitoring requirements shown / budgeted on the groundwater master schedule

Includes monitoring of > 1000 wells. Annual requirements are identified / budgeted in the detailed work plan.

Implement number of wells and analysis logging $2M total.

SEISMIC

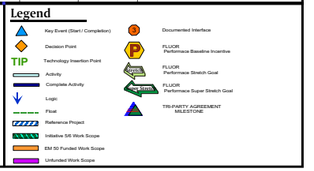
5. $80K per year to University of Washington for seismic monitoring network support.
6. Baseline assumes no dollars for strong motion Accelerometer upgrade.
7. Baseline assumes no dollars for seismic network upgrade.

Key Interfaces

TPA / DNFSB Milestones

M-24-00N	Install RCRA Groundwater Monitoring Wells at the rate of up to 50 in CY02	12/31/2002
M-24-00O	Install RCRA Groundwater Monitoring Wells at the rate of up to 50 in CY03	12/31/2003
M-24-00P	Install RCRA Groundwater Monitoring Wells at the rate of up to 50 in CY04	12/31/2004
M-24-00Q	Install RCRA Groundwater Monitoring Wells at the rate of up to 50 in CY05	12/31/2005
M-24-00R	Install RCRA Groundwater Monitoring Wells at the rate of up to 50 in CY06	12/31/2006 (If required)

Legend



Schedule A.8. *Groundwater Monitoring Master Schedule.*

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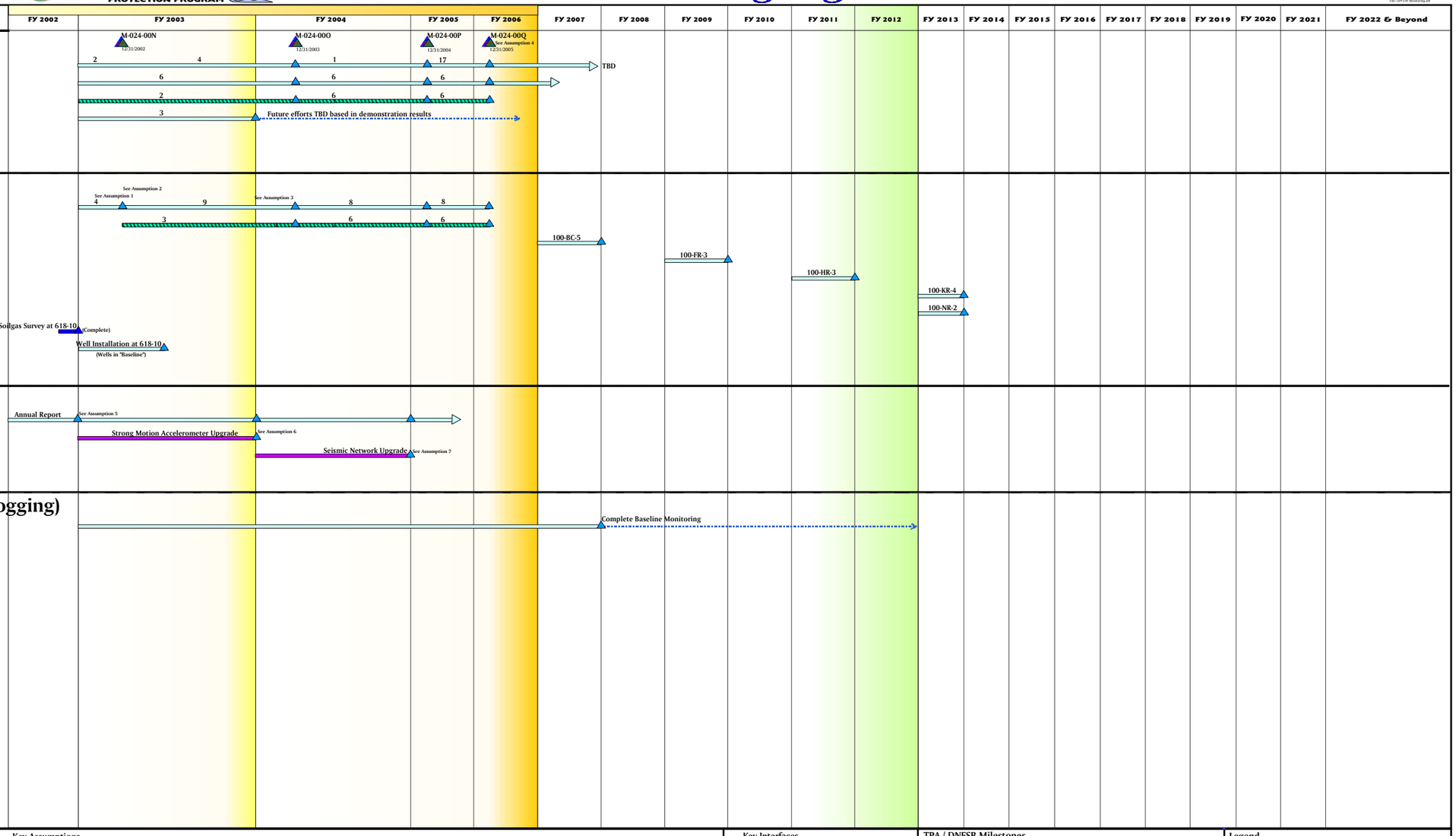
GROUNDWATER PROTECTION PROGRAM

Groundwater Monitoring Pg 2

Rev. 0

Updated: February 13, 2003 09:21 AM
File: GPP-IW Monitoring.ppt

Project Director_____Date_____



Acronyms	Key Assumptions	Key Interfaces	TPA / DNFSB Milestones	Legend

Legend

- Key Event (Start / Completion)
- Decision Point
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- Initiative 5/6 Work Scope
- EM 50 Funded Work Scope
- Unfunded Work Scope
- Documented Interface
- FLUOR Performace Baseline Incentive
- FLUOR Performace Stretch Goal
- FLUOR Performace Super Stretch Goal
- TRI-PARTY AGREEMENT MILESTONE

Schedule A.8. *(contd).*

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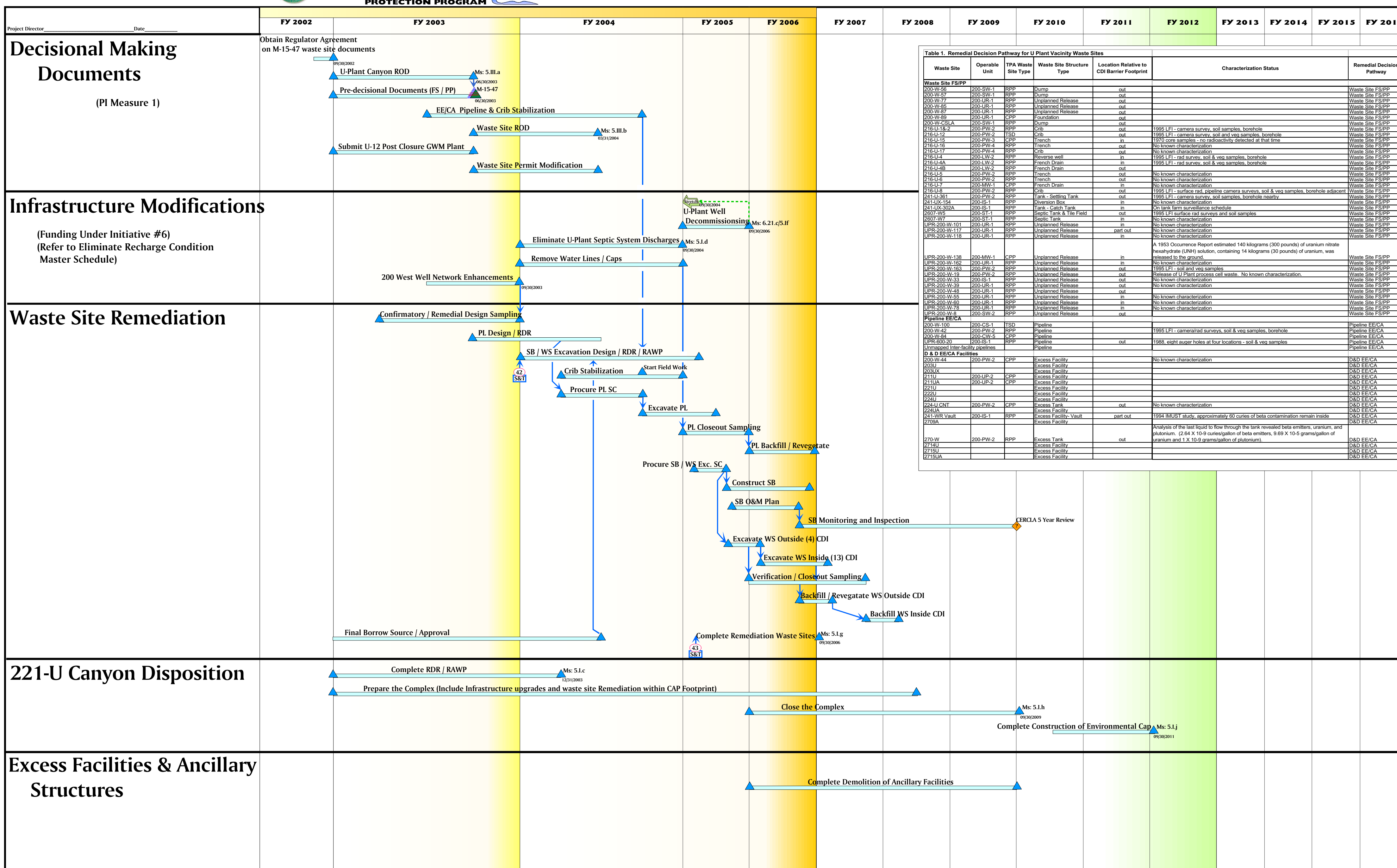
GROUNDWATER PROTECTION PROGRAM

U-Plant Area WS Remediation

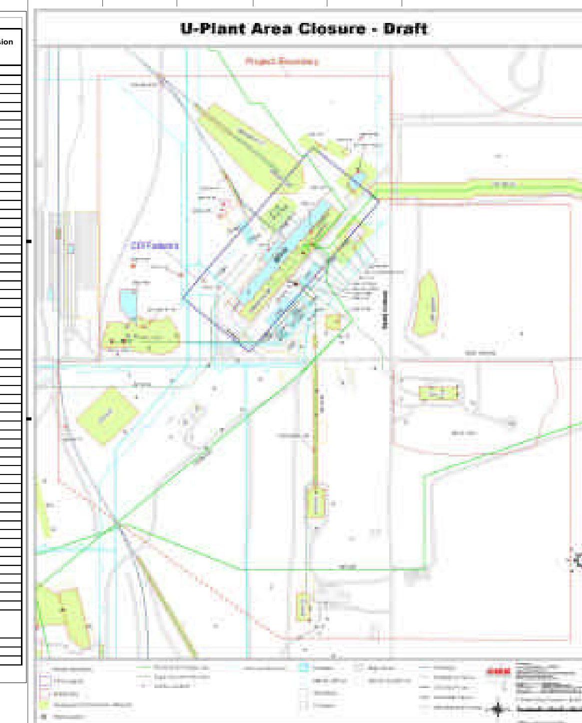
Rev. 0



Project Director
Date
FY 2002
FY 2003
FY 2004
FY 2005
FY 2006
FY 2007
FY 2008
FY 2009
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
FY 2019
FY 2020
FY 2021
FY 2022 & Beyond
Decisional Making Documents
(PI Measure 1)
Obtain Regulator Agreement on M-15-47 waste site documents
U-Plant Canyon ROD
Ms: 5.III.a
Pre-decisional Documents (FS / PP)
M-15-47
EE/CA Pipeline & Crib Stabilization
Waste Site ROD
Ms: 5.III.b
Submit U-12 Post Closure GWM Plant
Waste Site Permit Modification
Infrastructure Modifications
(Funding Under Initiative #6)
(Refer to Eliminate Recharge Condition Master Schedule)
U-Plant Well Decommissioning
Ms: 6.21.c/5.If
Eliminate U-Plant Septic System Discharges
Ms: 5.I.d
Remove Water Lines / Caps
200 West Well Network Enhancements
Waste Site Remediation
Confirmatory / Remedial Design Sampling
PL Design / RDR
SB / WS Excavation Design / RDR / RAWP
42
S&T
Crib Stabilization
Start Field Work
Procure PL SC
Excavate PL
PL Closeout Sampling
PL Backfill / Revegetate
Procure SB / WS Exc. SC
Construct SB
SB O&M Plan
SB Monitoring and Inspection
CERCLA 5 Year Review
Excavate WS Outside (4) CDI
Excavate WS Inside (13) CDI
Verification / Closeout Sampling
Backfill / Revegetate WS Outside CDI
Backfill WS Inside CDI
Final Borrow Source / Approval
Complete Remediation Waste Sites
Ms: 5.I.g
43
S&T
221-U Canyon Disposition
Complete RDR / RAWP
Ms: 5.I.c
Prepare the Complex (Include Infrastructure upgrades and waste site Remediation within CAP Footprint)
Close the Complex
Ms: 5.I.h
Complete Construction of Environmental Cap
Ms: 5.I.j
Excess Facilities & Ancillary Structures
Complete Demolition of Ancillary Facilities

Table 1. Remedial Decision Pathway for U Plant Vacinity Waste Sites

Waste Site	Operable Unit	TPA Waste Site Type	Waste Site Structure Type	Location Relative to CDI Barrier Footprint	Characterization Status	Remedial Decision Pathway
Waste Site FS/PP						
200-W-56	200-SW-1	RPP	Dump	out		Waste Site FS/PP
200-W-57	200-SW-1	RPP	Dump	out		Waste Site FS/PP
200-W-77	200-UR-1	RPP	Unplanned Release	out		Waste Site FS/PP
200-W-85	200-UR-1	RPP	Unplanned Release	out		Waste Site FS/PP
200-W-87	200-UR-1	RPP	Unplanned Release	out		Waste Site FS/PP
200-W-89	200-UR-1	CPP	Foundation	out		Waste Site FS/PP
200-W-CSLA	200-SW-1	RPP	Dump	out		Waste Site FS/PP
216-U-1&-2	200-PW-2	RPP	Crib	out	1995 LFI - camera survey, soil samples, borehole	Waste Site FS/PP
216-U-12	200-PW-2	TSD	Crib	out	1995 LFI - camera survey, soil and veg samples, borehole	Waste Site FS/PP
216-U-15	200-PW-3	CPP	Trench	in	1970 core samples - no radioactivity detected at that time	Waste Site FS/PP
216-U-16	200-PW-4	RPP	Trench	out	No known characterization	Waste Site FS/PP
216-U-17	200-PW-4	RPP	Crib	out	No known characterization	Waste Site FS/PP
216-U-4	200-LW-2	RPP	Reverse well	in	1995 LFI - rad survey, soil & veg samples, borehole	Waste Site FS/PP
216-U-4A	200-LW-2	RPP	French Drain	in	1995 LFI - rad survey, soil & veg samples, borehole	Waste Site FS/PP
216-U-4B	200-LW-2	RPP	French Drain	out		Waste Site FS/PP
216-U-5	200-PW-2	RPP	Trench	out	No known characterization	Waste Site FS/PP
216-U-6	200-PW-2	RPP	Trench	out	No known characterization	Waste Site FS/PP
216-U-7	200-MW-1	CPP	French Drain	in	No known characterization	Waste Site FS/PP
216-U-8	200-PW-2	RPP	Crib	out	1995 LFI - surface rad, pipeline camera surveys, soil & veg samples, borehole adjacent	Waste Site FS/PP
241-U-361	200-PW-2	RPP	Tank - Settling Tank	out	1995 LFI - camera survey, soil samples, borehole nearby	Waste Site FS/PP
241-UX-154	200-IS-1	RPP	Diversion Box	in	No known characterization	Waste Site FS/PP
241-UX-302A	200-IS-1	RPP	Tank - Catch Tank	in	On tank farm surveillance schedule	Waste Site FS/PP
2607-W5	200-ST-1	RPP	Septic Tank & Tile Field	out	1995 LFI surface rad surveys and soil samples	Waste Site FS/PP
2607-W7	200-ST-1	RPP	Septic Tank	in	No known characterization	Waste Site FS/PP
UPR-200-W-101	200-UR-1	RPP	Unplanned Release	in	No known characterization	Waste Site FS/PP
UPR-200-W-117	200-UR-1	RPP	Unplanned Release	part out	No known characterization	Waste Site FS/PP
UPR-200-W-118	200-UR-1	RPP	Unplanned Release	in	No known characterization	Waste Site FS/PP
UPR-200-W-138	200-MW-1	CPP	Unplanned Release	in	A 1953 Occurrence Report estimated 140 kilograms (300 pounds) of uranium nitrate hexahydrate (UNH) solution, containing 14 kilograms (30 pounds) of uranium, was released to the ground.	Waste Site FS/PP
UPR-200-W-162	200-UR-1	RPP	Unplanned Release	in	No known characterization	Waste Site FS/PP
UPR-200-W-163	200-PW-2	RPP	Unplanned Release	out	1995 LFI - soil and veg samples	Waste Site FS/PP
UPR-200-W-19	200-PW-2	RPP	Unplanned Release	out	Release of U Plant process cell waste. No known characterization.	Waste Site FS/PP
UPR-200-W-33	200-IS-1	RPP	Unplanned Release	out	No known characterization	Waste Site FS/PP
UPR-200-W-39	200-UR-1	RPP	Unplanned Release	out	No known characterization	Waste Site FS/PP
UPR-200-W-48	200-UR-1	RPP	Unplanned Release	out		Waste Site FS/PP
UPR-200-W-55	200-UR-1	RPP	Unplanned Release	in	No known characterization	Waste Site FS/PP
UPR-200-W-60	200-UR-1	RPP	Unplanned Release	in	No known characterization	Waste Site FS/PP
UPR-200-W-78	200-UR-1	RPP	Unplanned Release	in	No known characterization	Waste Site FS/PP
UPR-200-W-8	200-SW-2	RPP	Unplanned Release	out		Waste Site FS/PP
Pipeline EE/CA						
200-W-100	200-CS-1	TSD	Pipeline			Pipeline EE/CA
200-W-42	200-PW-2	RPP	Pipeline		1995 LFI - camera/rad surveys, soil & veg samples, borehole	Pipeline EE/CA
200-W-84	200-CW-5	CPP	Pipeline			Pipeline EE/CA
UPR-600-20	200-IS-1	RPP	Pipeline	out	1988, eight auger holes at four locations - soil & veg samples	Pipeline EE/CA
Unmapped Inter-facility pipelines			Pipeline			Pipeline EE/CA
D & D EE/CA Facilities						
200-W-44	200-PW-2	CPP	Excess Facility		No known characterization	D&D EE/CA
203U			Excess Facility			D&D EE/CA
203UX			Excess Facility			D&D EE/CA
211U	200-UP-2	CPP	Excess Facility			D&D EE/CA
211UA	200-UP-2	CPP	Excess Facility			D&D EE/CA
221U			Excess Facility			D&D EE/CA
222U			Excess Facility			D&D EE/CA
224U			Excess Facility			D&D EE/CA
224-U CNT	200-PW-2	CPP	Excess Tank	out	No known characterization	D&D EE/CA
224UA			Excess Facility			D&D EE/CA
241-WR Vault	200-IS-1	RPP	Excess Facility- Vault	part out	1994 IMUST study, approximately 60 curies of beta contamination remain inside	D&D EE/CA
2709A			Excess Facility			D&D EE/CA
270-W	200-PW-2	RPP	Excess Tank	out	Analysis of the last liquid to flow through the tank revealed beta emitters, uranium, and plutonium. (2.64 X 10-9 curies/gallon of beta emitters, 9.69 X 10-5 grams/gallon of uranium and 1 X 10-9 grams/gallon of plutonium).	D&D EE/CA
2714U			Excess Facility			D&D EE/CA
2715U			Excess Facility			D&D EE/CA
2715UA			Excess Facility			D&D EE/CA



Acronyms

AM	Action Memorandum	RAWP	Remedial Action Work Plan
CERCLA	Comprehensive Environmental Respnose, Compensation, and Liability Act	S&T	Science & Technology
CDI	Canyon Disposition Initiative	SB	Surface Buried
EE/CA	Engineering Evaluation / Cost Analysis	SC	Subcontract
EXC	Excavation	TPA	Tri-Party Agreement
FS	Feasibility Study	TRU	Transuranic
GWM	Groundwater Monitoring Plan	TSD	Treatment, Storage, & Disposal
MS	Milestone	WS	Waste Site
O&M	Operation and Maintenance		
OU	Operable Unit		
PL	Pipe Line		
PP	Proposed Plan		
RCRA	Resource Conservation & Recovery Act		
RDR	Remedial Design Report		
RI/FS	Remedial Investigation / Feaasability Study		
ROD	Record of Decision		

Key Assumptions

1. Key document driver is the Performance Management Plan for Accelerated Cleanup of the Hanford Site, DOE/RL-2002-47, Predecisional Draft B, and July 17, 2002.
2. RCRA TSD (216-U-12) closure requirements are satisfied by CERCLA documentation and decisions reached in satisfying PI#5 milestone, 09/30/02.
3. 33 wastes assigned to multiple OUs will be addressed by a single ROD under M-15-47 Milestone. Focus Feasibility/ Proposed Plan / ROD for surface barriers and waste site evacuation; EE/CA and AM for Pipe removal.
4. Willing to proceed at risk with confirmatory design sampling and remedial design activities before ROD is in place.
5. Schedule based on experience using typical ERC protocols, procedures and processes.
6. Surface barriers will be an alternative regulated aproved landfill cover for cribs and trenches. Borrow soils for surface barriers available on Hanford Site.
7. Eight surface barriers for ten U-Plant cribs. Seventeen waste sites will be remediated by excavation. Six pipelines may be remediated by removal.
8. Excavation with ERDF disposal assumed for crib pipelines. No TRU waste encountered during excavation.
9. Sufficient characterization data available from past and planned RI / FS work plan activities to support regulatory decisions.
10. The Rough Order of Magnitude (ROM) construction costs based on ERC cost estimates in FY 2000 dollars.
11. Two of the eight barriers intensively monitored for performance. The remaining barriers will have minimal maintenance inspection.
12. Unresolved issues: Remediation of CDI facilities (e.g cross site pipeline, interfacility pipeline, diversion box and catch tank). These sites contain TRU waste.
13. Failure to fund Initiative 6 may jeopardize completion of some waste site remediations.
14. Assumes that Ecology complete ROD within 9 months.
15. TPA M-15-47 milestone will address waste sites in multiple operable units, which will require reassignment of waste sites per TPA requirements.
16. DOE action to resolve GFS/Information regarding approval of using McGee Ranch Silt as barrier material for alternative approved landfil cover.
17. Establish a decision point for U-Plant re: Application of 435.1.
18. Assumptions to meet high risk waste sites P.I. date of 09/30/2006:
    a. Remediate all waste sites in the U Plant Area that are outside the proposed environmental cap to be over the 221-U facility and ancillary facility debris (DOE-RL 2001-11, Final Feasibility Study for the Canyon Disposition Initiative, 221-U Facility).
    b. Activities include high-risk waste sites 216-U1, -U2, U8, -U16, and -U17. 216-U12 is also included assuming it can be closed in accordance with HFFACO provisions for RCRA/CERCLA integration and coordination. Identify and manager interfaces with River Protection Project to ensure appropriate final closure.

18. c. Remediaiton of waste sites meaans completion of all protective measures (e.g., Installation of engineered barriers, waste site stabilization and / or removal) in accordance with the U Plant Area Waste Sites Record of Decision.
    d. This does not include demolition of U Plant, completion of the environmental cap over the facilities, or remediation of Office of River Protection structures, systems, or components.
    e. Pipeline remediation will be implemented immediately adjacent to underground structures, e.g. pipelines, systems and components are excluded from the waste sites.

TPA / DNFSB Milestones

M-15-47 Submit A Proposed Plan to EPA and/or Ecology to conduct remedial action(s) for source control at high-risk waste site(s) which includes an engineering evaluation of an engineered surface barrier.

Key Interfaces

42 Surface barrier monitoring technology design from S&T input to U-Plant waste site surface barrier.

43 Surface barrier side slope from S&T input to canyon cover design and waste site cover design.

Legend

TIP

Schedule A.9. *U Plant Closure Master Schedule.*

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GROUNDWATER PROTECTION PROGRAM

618-10 / 11

Rev. 0

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Project Director _____ Date _____

FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 | FY 2012 | FY 2013 | FY 2014 | FY 2015 | FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 & Beyond

Preliminary Remediation Strategy

TIP

- Conceptual Design
- Negotiations with Energy NW
- Intermediate Design
  - M-16-66 09/30/2004
  - M-16-67 03/31/2007
- Treatability Tests
  - at 618-10: 618-10 Vertical Drum
  - at 618-11: 618-11 Caissons
- Safety Basis Documentation
- Final Design
  - PROPOSED M-91-?? 09/30/2011
  - 618-10 & 11 Update Safety Analysis, Approach, & Infrastructure Requirements
- Procurement
  - PROPOSED M-91-?? 09/28/2012
  - Procurement
- Remedial Action 618-10
  - Waste Volumes
    - 130,000 yd³ mixed
    - 0 contact waste
    - 11 yd³ remote
- Remedial Action 618-11
  - Waste Volumes
    - 120,000 yd³ mixed
    - 13,300 yd³ contact handled
    - 123 yd³ remote
  - M-16-00B 09/30/2018


618-11 Burial Ground


618-10 Geoprobe

Acronyms

Key Assumptions

Technology Insertion Points (TIP)

1. **Characterization / Remote Handling for:**
   - **Caissons**
   - **Vertical Pipes**

Key Interfaces

TPA / DNFSB Milestones

M-16-00B	Complete all interim 300 Area remedial actions	09/30/2018
M-16-66	Initiate Intermediate design & authorization Safety Analysis for Remedial Actions at the 618-10 & 618-11 Burial Grounds	09/30/2004
M-16-67	Submit an intermediate design report, a remediation schedule and a treatability investigation work plan for Remedial Actions at the 618-10 and 618-11 Burial Grounds	03/31/2007
M-91-??	M-91 Facility functional design criteria available	09/29/2006
M-91-??	Initiate M-91 Facility construction	01/04/2010
M-91-??	Complete M-91 Facility construction	09/30/2011
M-91-??	M-91 Remote Handling Facility On-line	09/28/2012

Legend

Key Event (Start / Completion)
Decision Point
TIP Technology Insertion Point
Activity
Logic
Float
Reference Project
Initiative SR Work Scope
EM 50 Funded Work Scope
Unfunded Work Scope
Documented Interface
FLUOR Performance Baseline Incentive
FLUOR Performance Stretch Goal
FLUOR Performance Super Stretch Goal
TRI-PARTY AGREEMENT MILESTONE
Inter Schedule Logic (Page to Page)
Inter Schedule Logic (Sch. to Sch)
TO FROM
11 S&I
12 S&I

Schedule A.10. *618-10 and 618-11 Burial Grounds Master Schedule.*

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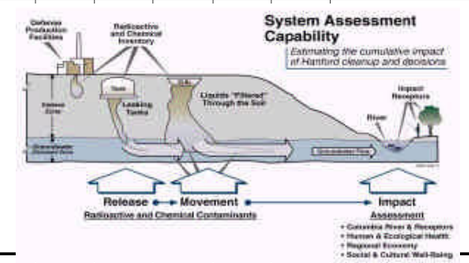
Risk Assessment Schedules

- B/C Area: DQO; Data Collection; Risk Assessment; Complete Actions
- F Area: DQO; Data Collection; Risk Assessment; Complete Actions
- H Area: DQO; Data Collection; Risk Assessment; Complete Actions
- D Area: DQO; Data Collection; Risk Assessment; Complete Actions
- K Area: DQO; Data Collection; Risk Assessment; Complete Actions
- N Area: DQO; Data Collection; Risk Assessment; Complete Actions



Site Wide Assessments

Perform Assessments

Demonstration; Revise / Test; Perform / Document; Annual Reviews; Continue Until Site Closure

Assessment Coordination Group Review of CA Approach

Assessment Coordination Group Review of CA Intermediate Results/Approach

Submit Composite Analysis

Disposal Authorization

Composite Analysis

Disposal Authorization

Complete Final RC Cleanup

Special Assessments

Develop Requirements for CA & Other Assessments (1)

5 Year Review; 5 Year Review

River Closure Risk Assessment

River Closure Decision Start

Complete Final ROD

Requirements / Revise / Test; Support Closure of Tanks

Requirements; Revise / Test; 200 Area Regional Assessment Support

Determine Final Groundwater Remedies

Develop Capability

Calibrate GW Model to Hydraulic Head Data (1)

200 Area Monitoring Results

Calibrate GW Model to H_2 Data

Develop Air Transport Capabilities

UP 1 Mods to Remedial Approach

ZP 1 Decide on Path Forward

Conceptual Models

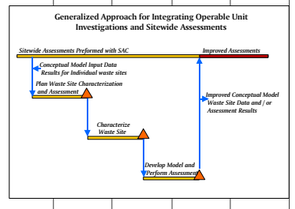
Requirements; Conceptual Models; 7 Tank Closure; 200 Area; CA; River Closure; Continue to Support Assessments

- Inventory: Id COCs
- Release: Class (Link to ILAW Program); Tank Waste (Saltcake & Sludge & Hardheal) Input from Tank Closure Program); 77 - 10 S&T
- Vadose: KD; ZI Templates
- Groundwater: Review GW Geology 600 Area
- River
- Risk: Atmospheric Paths; Initial Contaminant Set

Assessments Data

Data Packages; Revised Inventory; Revised Transport Parameters; Factory Matching Data; Data for Additional CA Contaminants; Data to Support Tank Closure; Data Package to Support 200 Regional Assessment; 200 Area Assessment; CA; Data to Support River Closure; Continue to Support Assessments

- Inventory: Review Inventory of Current COCs; Inventory for Additional Contaminants; 25 S&T; 37 S&T
- Release
- Vadose: Review KD DST; Review Trans Parameters; Review Trans Parameters New COCs; 27 S&T; 79 S&T; 77 B&A
- Groundwater: Review Plume Mass & Geometry
- River: Ecology Characterization of 300 Area; Ecology Characterization of 100 Area; 77 ???; 77 ???
- Risk: 35 S&T



Acronyms

CMS - Corrective Measures Study
FS - Feasibility Study
OU - Operable Unit
PP - Proposed Plan
RFI - RCRA Facility Investigation
RI - Remedial Investigation
ROD - Record of Decision

Key Assumptions

1. CA annual review does not result in update to CA more often than every 5 years
2. Improvements needed for System Assessment capability will be enhancements to existing capabilities - Not complete redesign
3. 200-CW-1 remedial action is to remove and dispose
4. Incremental funding is provided if interim actions are deemed necessary
5. TPA Milestones are successfully renegotiated to extend beyond 2018
6. First 12 OUs will provide sufficient data to support RA decisions for all remaining OUs
7. Need for interim actions is revaluated annually.

Foot Notes

(1) Provide to COS Core Projects S&T to identify needs to support.

Key Interfaces

1. Groundwater monitoring results from GW Project
2. Environmental data from Public Safety & Resource Protection
3. Tank inventory from ORP
4. Waste site data from Tank Farm Vadose Zone & 200 Area Waste Site Characterization

TPA / DNFSB Milestones

Defense Nuclear Facility Safety Board (DNFSB) Milestones
DNFSB 94-2 DOE order 435.1 - Composite analysis required for continued disposal authorization

Tri-Party Agreement (TPA) Milestones
M-13-00 Submit RIFS work plan(s) for for 200 NPL Areas
M-13-00 Complete the RIFS (RFI/CMS) process for all OUs
(-00c, -39a, -39b, -39c, -40a, -40b, -40c)
M-16-00 Complete RA for all non-tank farm OUs
M-20-00 Submit permit application or closure plans for RCRA TSD Units
(-33, -39, -52, -53, -54)

Legend

Key Event (Start / Completion); Decision Point; Technology Insertion Point; Activity; Logic; Float; Reference Project; Initiative 5/6 Work Scope; EM 50 Funded Work Scope; Unfunded Work Scope

Documented Interface; FLUOR Performance Baseline Incentive; FLUOR Performance Stretch Goal; FLUOR Performance Super Stretch Goal; TRI-PARTY AGREEMENT MILESTONE

Intra Schedule Logic (Page to Page); Inter Schedule Logic (SUA to SUA): TO / FROM; 11 S&T; 12 S&T

Schedule A.11. *Assessments Master Schedule.*

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Project Director_____Date_____

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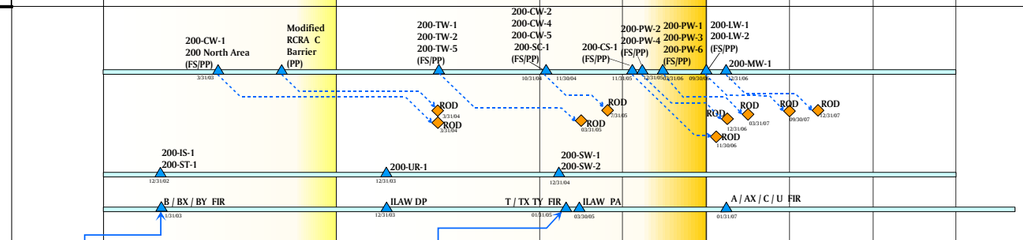
Waste Site Assessments

RI /FF
ROD

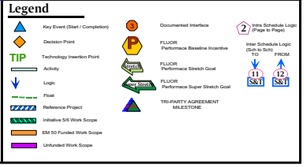
Work Plans
(RI / FS / PP; ROD TBD)
Accelerated Actions
CHG RCAP ILAW



Solid Waste PA

Sitewide Groundwater Model
Support to Waste Sites

Acronyms	Key Assumptions	Foot Notes	Key Interfaces	TPA / DNFSB Milestones	Legend



Schedule A.11. *(contd).*

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Project Director_____Date_____

	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022 & Beyond
Ecological Assessments																					
Public Safety Resource Protection Program	EMP Update; NEPA Characterization	NEPA Characterization	EMP Update; NEPA Characterization	5 Year Review; NEPA Char.	NEPA Char.	EMP Update; NEPA Char.	NEPA Char.	NEPA Char.	EMP Update; 5 Year Review; NEPA Char.	NEPA Char.	NEPA Char.	EMP Update									
Surface Environmental Surveillance Project	Site Air Emission Permit; 100N P&T; GWM Summary; VZ Summary	SAC & COS Requirements; COS Data Packages	SAC 04 Comp Analysis	5 Year Review Data Update			SAC & COS Req.; COS Data Pack.	SAC 09 Comp Analysis	5 Year Review Data Update		River Corridor Final Risk Assessment										
Baseline Contaminant Monitoring																					
SESP / EM / DOH	300 Area Shoreline Assessment; Recieve Data	300 Area O&M Sampling Plan; Input to 5 Year Review; 100 BC Pilot Study		5 Year Review River ROD & SAC Rev 2			100 F ROD, 5 Year Review, SAC Rev 3				River Final ROD Report										
Integrated Biological / Ecological Characterization	Integrated Methodology, Development		100 D Ecological Characterization; 100 F Ecological Characterization		100 H Ecological Char																
HRTC / SESP / EM	COS Tech Issue; Hanford Cr TOX / Uptake Effects; Cr Salmon Integration Report; Cr in Salmon Smolt																				
DOH / SESP / EM	100 N Pump & Treat																				
Ecosystem Monitoring	SER Input; Baseline Surveys				SAC 5 Year Reviews River Corridor ROD																
Ecological Compliance Assessment Project	NEPA Triggers; Pre-Activity Ecological Reviews & Mitigation; Baseline Surveys; NEPA Input		NEPA Input	NEPA Input	NEPA Input	NEPA Input	NEPA Input	NEPA Input	NEPA Input	NEPA Input	NEPA Input										
Cultural Resources	NEPA Rqmts; CR Annual Report; Pre-Activity Ecological Reviews & Mitigation; Baseline Surveys; CR Annual Report		CR Annual Report	CR Annual Report	CR Annual Report	CR Annual Report	CR Annual Report	CR Annual Report	CR Annual Report	CR Annual Report	CR Annual Report										
GWP Science & Technology	99 TC TOX / Uptake Study	SAC / CA 5 Yr Review 200 Interim ROD 100 BC Pilot Study River Corridor ROD COS Issues; I_{50} TOX / Uptake Parameters	SAC / CA 5 Yr Review 200 N P&T (Interim ROD) River Corridor ROD COS Issues; I_{25} I/U (tbd) TOX / Uptake	SAC Rev 2 5 Yr Review 200 Interim ROD COS Issues																	
GWP COS	White Paper	Aquatic Ecosystem Baseline Characterization	SAC Comp Analysis	5 Yr Review																	
Site Land Release (FH)	HRNM Historic Site Assessment	Site ?? Surveys; Release ALE		Release McGee, Riverlands, & North Slope																	

Acronyms

- CR - Cultural Resources
- DOH - Washington Department of Health
- ECAP - Ecological Compliance Assessment Project
- EM - Ecosystem Monitoring
- EMP - Environmental Monitoring Plan
- HRNM - Hanford Reach National Monument
- HRTC - Hanford Resource Transfer Council
- NEPA - National Environmental Policy Act
- PSRPP - Public Safety and Resource Protection
- SER - Site Environmental Report
- SESP - Surface Environmental Surveillance Project

Key Assumptions

Foot Notes

Key Interfaces

Department of Ecology
Department of Health
Environmental Protection Agency

TPA / DNFSB Milestones

CA
5 Year Review
River Corridor RODs

Legend

Key Event (Start / Completion)
Decision Point
TIP Technology Insertion Point
Activity
Logic
Float
Reference Project
Initiative 5/6 Work Scope
EM 50 Funded Work Scope
Unfunded Work Scope
Documented Interface
FLUOR Performance Baseline Incentive
FLUOR Performance Stretch Goal
FLUOR Performance Super Stretch Goal
TRI-PARTY AGREEMENT MILESTONE
Intra Schedule Logic (Page to Page)
Inter Schedule Logic (Activity to Activity)
FROM 11 Sc1
TO 12 Sc1

Schedule A.11. *(contd).*

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FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 | FY 2012 | FY 2013 | FY 2014 | FY 2015 | FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 & Beyond

Roadmap Planning & Implementation

Roadmap Planning and Implementation
Rev. 3 (03/2004)
Rev. 4 (03/2006)
Rev. 5 (03/2008)
Further S&T workscope TBD
(03/2010)
(03/2012)
2035

Soil Waste Inventory

25 AST — Soil Inventory Model Dev & Appl for Site Wide Assessment
26 AST — Complete SIM Application to Remaining Soil Waste Sites
Soil Waste Inventory Field Confirmation and Update

Subsurface Transport

Moisture, Water and Contaminant Flux Measurements at S-SX, & T-TX-TY Tank Farms
29 ILP — U-Plant Regional Acceleration & Closure Vadose Zone Moisture & Flux Measurements
30 WSE — Vadose Zone Moisture, Water & Contaminant Flux Measurements 200 Area Remaining Waste Sites
MSE Uranium Study
27 WSE — Vadose Zone Transport Field Study Uranium Reactive Transport Experiment
28 ILP — Uranium Transport Model of Field Experiment
Scaling Uranium Reactive Transport to Assessments Models
S&T Investigation at B-BX-BY (Uranium and Strontium-90)
31 RPP — Laboratory Experiments & Modeling for T-TX-TY Tank Farm (Cesium-137, Uranium, Strontium-90, Technetium-99 & Chromium)
32 RPP — Quantative Conceptual Model for A/AX, C and U Tank Farms
33 WSE — Speciation & Mobility of Transuranics Supporting TW-2, CW-5, PW-1 Remedial Design
34 WSE — Carbon Tetrachloride Residual Measurements & Model Update
Office of S&T Carbon Tetrachloride Acceleration Project
Carbon Tetrachloride Retention and Release (EMSP)
Heterogeneity Scaling Study (EMSP)
Uranium Mobility Studies (EMSP)
Radionuclide In-situ Sensors (EMSP)

Acronyms

EMSP - Environmental Management Science Program
MSE -
S&T - Science And Technology
SIM -

Key Assumptions

1. Other national laboratories will continue to provide resources to the Integration Project as needed.
2. Work planned by core projects (RPP Tank Farm Vadose Zone and ILAW, 200 Area Characterization, Groundwater Project, Surface Environmental Surveillance Project), where interfaces with S&T have been identified, will be funded and proceed as scheduled.
3. Other core projects will pay for coring, sample retrieval with ES&H, basic characterization, and sample waste disposal. S&T will provide funding for incremental costs: S&T will recieve at least 500 g of each contaminated sample for "wrap-around" science.
4. EMSP projects will provide select contributions to "wrap-around" science and vadose zone transport field studies.
5. ES&H and waste management issues will not limit the distribution of "reasonable" samples to EMSP investigators or the multi-laboratory S&T team.

Key Interfaces

TPA / DNFSB Milestones

Legend

Key Event (Start / Completion)
Decision Point
TIP Technology Insertion Point
Activity
Logic
Float
Reference Project
Initiative S/S Work Scope
EM-50 Funded Work Scope
Unfunded Work Scope
Documented Interface
FLUOR Performance Baseline Incentive
FLUOR Performance Stretch Goal
FLUOR Performance Super Stretch Goal
TRI-PARTY AGREEMENT MILESTONE
Inter Schedule Logic (Page to Page) TO / FROM
Schedule Specific legend
EMSP - DOE Office of Science Funded
Natural & Accelerated Bioremediation Research Program (NABIR) Funded

Schedule A.12. *Science and Technology Master Schedule.*

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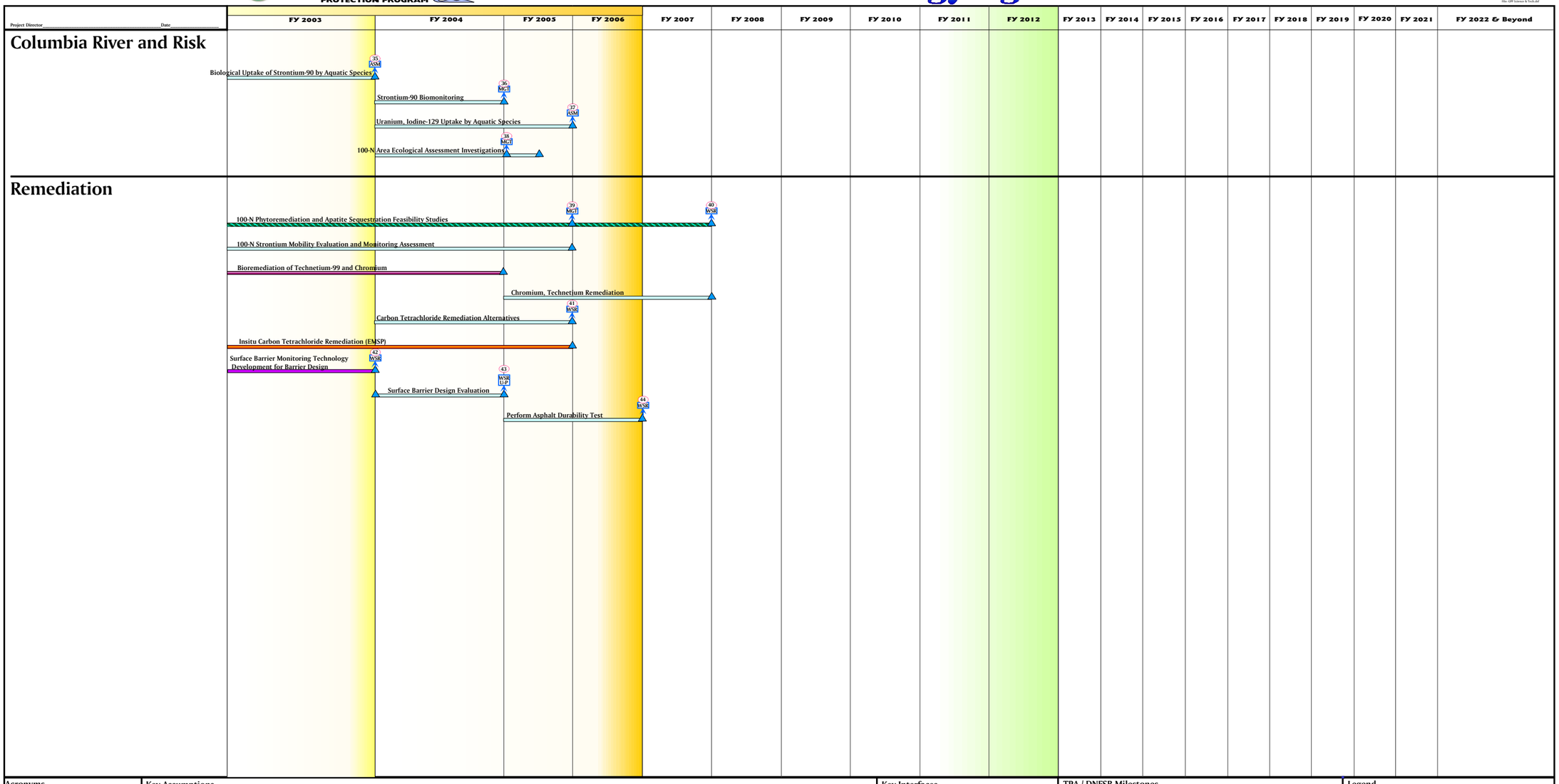
Updated: February 19, 2003 09:45 AM
File: GPP Science & Tech.dsf

Project Director _____ Date _____



Acronyms	Key Assumptions	Key Interfaces	TPA / DNFSB Milestones	Legend
				Key Event (Start / Completion) Decision Point TIP Technology Insertion Point Activity Logic Float Reference Project Initiative S/S Work Scope EM 50 Funded Work Scope Unfunded Work Scope Documented Interface FLUOR Performance Baseline Incentive FLUOR Performance Stretch Goal FLUOR Performance Super Stretch Goal TRI-PARTY AGREEMENT MILESTONE *Schedule Specific legend* EMSP - DOE Office of Science Funded Natural & Accelerated Bioremediation Reasearch Program (NABIR) Funded Intra Schedule Logic (Page to Page) Inter Schedule Logic (Other Project S/S) FROM 11 S&T TO 12 S&T

Schedule A.12. *(contd).*

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Integration & Assessment

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File: GPP Int & Assess.dgf

Project Director_____Date_____

Acronyms

Key Assumptions

Reference:
Document - 0204055A/02-AMCP-0025
Title: Vadose zone monitoring study in conjunction with design of Cell 5 & 6 of ERDF expansion & evaluation of vadose zone monitoring for Central Plateau.

Key Interfaces

TPA / DNFSB Milestones

Legend

Schedule A.13. *Integration and Assessment Master Schedule.*