Date Received for Clearance Process (MM/YY/DD)
1/14/03

INFORMATION CLEARANCE FORM

A. Information Category

- [ ] Abstract
- [ ] Journal Article
- [ ] Summary
- [ ] Internet
- [ ] Visual Aid
- [ ] Software
- [ ] Full Paper
- [ ] Report
- [x] Other Paper for WM 2003

B. Document Number RPP-14389-FP

C. Title
Accelerated Cleanup Initiatives: Putting the Acceleration Plans Into Action

D. Internet Address

E. Required Information

1. Is document potentially Classified? (●) No ( ) Yes (MANDATORY)
See below for signature
Manager's Signature Required
If Yes _____ ( ) No ( ) Yes Classified
ADC Signature Required
2. References in the Information are Applied Technology (●) No ( ) Yes
Export Controlled Information (●) No ( ) Yes

3. Does Information Contain the Following: (MANDATORY)
a. New or Novel (Patentable) Subject Matter? (●) No ( ) Yes
If "Yes", Disclosure No.: _____
b. Information Received in Confidence, Such as Proprietary and/or Inventions?
(●) No ( ) Yes If "Yes", Affix Appropriate Legends/Notices.
c. Copyrights? (●) No ( ) Yes If "Yes", Attach Permission.
d. Trademarks? (●) No ( ) Yes If "Yes", Identify in Document.
4. Is Information requiring submission to OSTI? (●) No ( ) Yes
5. Release Level? (●) Public ( ) Limited

F. Complete for a Journal Article

1. Title of Journal

G. Complete for a Presentation

1. Title for Conference or Meeting Waste Management 2003
2. Group Sponsoring President's Office
3. Date of Conference February 23-27
4. City/State Tucson, Arizona
5. Will Information be Published in Proceedings? ( ) No (●) Yes
6. Will Material be Handed Out? ( ) No (●) Yes

H. Author/Requestor
Geoff Tyree
(Print and Sign)

Responsible Manager
Bryan Kidder
(Print and Sign)

I. Reviewers

	Yes	Print	Signature	Public Y/N (If N, complete J)
General Counsel	☒	Sandra Kent		(Y) / N
Office of External Affairs	☒	Geoff Tyree		(Y) / N
DOE-RL	☒	Stephen A. Wiegman		(Y) / N
Other	☐			Y / N
Other	☐			Y / N

J. If Information Includes Sensitive Information and is not to be released to the Public indicate category below.

- [ ] Applied Technology
- [ ] Protected CRADA
- [ ] Personal/Private
- [ ] Export Controlled
- [ ] Proprietary
- [ ] Procurement-Sensitive
- [ ] Business-Sensitive
- [ ] Patentable
- [ ] Predecisional
- [ ] Other (Specify) _____
- [ ] UCNI

Information Clearance Approval

APPROVED FOR RELEASE
OFFICIAL DOCUMENT
CW
Date 1/20/03

K. If Additional Comments, Please Attach Separate Sheet

A-6001-401 (12/00)

RPP-14389-FP
Revision 0

Accelerated Cleanup Initiatives: Putting the Acceleration Plans into Action

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

CH2MHILL
Hanford Group, Inc.
Richland, Washington

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-99RL14047

Approved for Public Release
(Upon receipt of Clearance approval)
Further Dissemination Unlimited

RPP-14389-FP
Revision 0

Accelerated Cleanup Initiatives: Putting the Acceleration Plans into Action

G.T. Tyree
CH2M HILL Hanford Group, Inc.

E.S. Aromi
CH2M HILL Hanford Group, Inc.

January 2003

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

CH2MHILL
Hanford Group, Inc.
Richland, Washington

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-99RL14047

Copyright License
By acceptance of this article, the publisher and/or recipient acknowledges the U.S. Government's right to retain a nonexclusive, royalty-free license in and to any copyright covering this paper.

Chris Willingham 1/20/03
Clearance Approval Date

N/A
Release Approval (stamp)

Approved for Public Release
(Upon receipt of Clearance approval)
Further Dissemination Unlimited

RPP-14389-FP
Revision 0

For use with Technical Documents (when appropriate)	
EDC-	FMP-
EDT-	ECN-
Project No.:	Division:
Document Type: RPT	Page Count:

For use with Speeches, Articles, or Presentations (when appropriate)							
Abstract		Summary		Full Paper	X	Visual Aid	
Conference Name:	Waste Management 2003						
Conference Date:	February 23, 2003						
Conference Location:	Tucson, AZ						
Conference Sponsor:	DOE, President's Office						
Published in:							
Publication Date:							

LEGAL DISCLAIMER

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

Scientific or technical information is available to U.S. Government and U.S. Government contractor personnel through the Office of Scientific and Technical Information (OSTI). It is available to others through the National Technical Information Service (NTIS).

This report has been reproduced from the best available copy.

Printed in the United States of America

ACCELERATED CLEANUP INITIATIVES: PUTTING THE ACCELERATION PLANS INTO ACTION

Edward S. Aromi
CH2M HILL Hanford Group, Inc.
PO Box 1500, Richland, WA 99352

Geoffrey T. Tyree
CH2M HILL Hanford Group, Inc.
PO Box 1500, Richland, WA 99352

ABSTRACT

This paper describes project successes during the last year and presents strategies for accomplishing work required to accelerate waste retrieval, treatment and closure of 177 large underground waste tanks at the Hanford Site. The tanks contain approximately 53 million gallons of liquid, sludge, and solid waste resulting from decades of national defense production. The Hanford Site is a 560 square-mile area in southeastern Washington State. One of the nation's largest rivers, the Columbia River, flows through the site and within seven miles of the waste tanks.

The U.S. Department of Energy (DOE) Office of River Protection and CH2M HILL Hanford Group, Inc. (CH2M HILL) drew upon the recommendations in the DOE's Top-To-Bottom Review and the ideas that emerged from the Cleanup Challenges and Constraints Team (C3T) when creating new initiatives last fall in accelerated tank cleanup. The initiatives reflect discussions and planning during the last year by the DOE, regulatory agencies, Hanford stakeholders, and CH2M HILL on how to accelerate tank cleanup and closure. The initiatives focus on near-term risk reduction, deployment of proven cleanup technologies, and completing the feed delivery and waste storage systems needed to support Hanford's Waste Treatment Plant. Working with the Office of River Protection, CH2M HILL is changing the way it does business to align with the new focus on accelerated tank cleanup initiatives.

A key concept of this new approach is to deploy simple, proven technologies whenever possible to accomplish program goals. Finding existing technologies and evaluating whether they can be applied to or adapted to Hanford tank cleanup provide the best chance for success in achieving treatment of all of Hanford's tank waste by 2028.

INTRODUCTION

Hanford's 53 million gallons of liquid, solid, and sludge tank waste is stored underground in 149 single-shell tanks that were built from the 1940s to the 1960s and in 28 double-shell tanks that were built from the 1960s to the 1980s. All of the single-shell tanks were taken out of service in

1980 and are beyond their design service life. Most of the liquid waste has been moved from these older tanks to the newer, safer double-shell tanks. Methods to remove the remaining solid and sludge waste are being deployed in selected tanks to gain information on the best way to retrieve waste from numerous tanks in the next few years. A regulatory pathway for evaluating the success of those retrieval efforts and on defining tank closure is being established through discussions between CH2M HILL and the DOE, the U.S. Environmental Protection Agency (EPA), the State of Washington Department of Ecology, the Washington State Department of Health, and Hanford stakeholders. Critical success factors for accelerating tank closure include strong alignment between these parties, reduction of "footprint" costs, and a clear understanding of the total risk profile of tank cleanup.

ACCELERATED TANK CLEANUP KEY INITIATIVES

In October, 2002, the Office of River Protection and CH2M HILL announced new initiatives for accelerating tank cleanup. The new approach puts into action the results of the DOE's Top-To Bottom Review and the resulting Performance Management Plan for Accelerated Cleanup of the Hanford Site. The approach was also developed within the framework of the Tri-Party Agreement, the legal pact governing Hanford cleanup, and begins the process for achieving two key components of the site's accelerated cleanup plan: Accelerated retrieval of tank wastes, and closure of Hanford tanks 10 years earlier than planned.

Key initiatives during the next four years of Hanford tank cleanup include:

- Demonstrating risk reduction: removing liquid waste from aging single-shell tanks
- Preparing to support tank waste vitrification in the Waste Treatment Plant
- Retrieving waste and closing single-shell tanks
- Removing, treating, and disposing of transuranic or low-level tank waste without vitrification in the Waste Treatment Plant

DEMONSTRATING RISK REDUCTION

Under the first element of the new initiatives, the removal of pumpable liquids from the 149 aging single-shell tanks will be completed by October 2004. The waste is being moved into newer, safer double-shell tanks. In September, the Office of River Protection and CH2M HILL achieved a major milestone by removing 2.5 million gallons of liquid waste from the tanks since pumping operations began in 1998. Since then, more than 200,000 gallons of waste have been removed. Pumping operations on the last single-shell tank, C-103, began in November, five months ahead of schedule. Waste removal operations are now underway on all 16 remaining single-shell tanks, which contain less than 400,000 gallons of pumpable liquid waste (Figure 1).

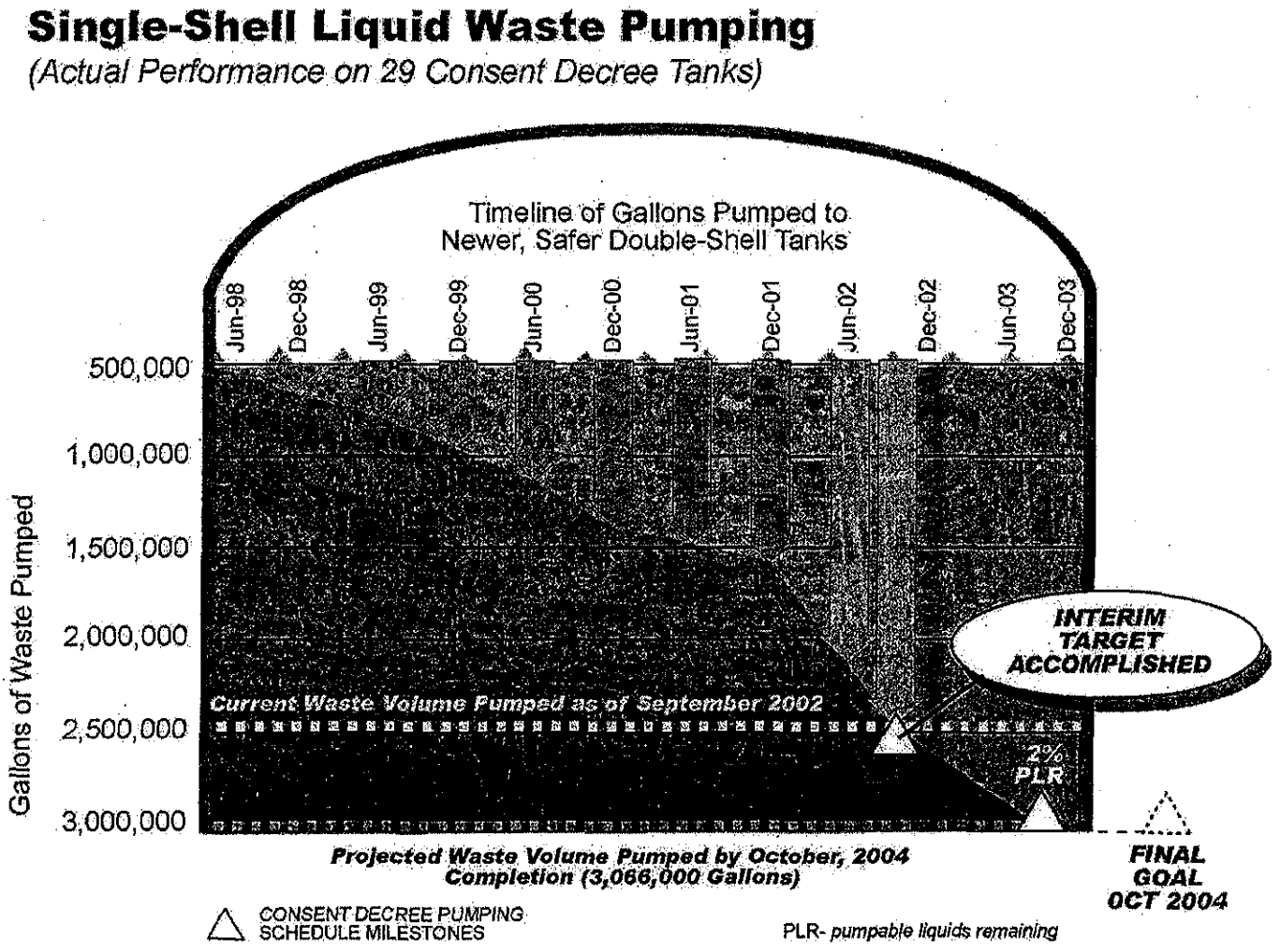

Fig. 1 Single-shell tank liquid waste pumping.

PREPARING TO SUPPORT TANK WASTE VITRIFICATION

The second initiative includes upgrading systems to deliver waste to the Waste Treatment Plant for vitrification and systems to transport, store, and dispose of containers of glassified waste. Preparations to deliver waste include upgrading several of Hanford's double-shell tanks for transferring and "staging" the waste prior to delivery to the Waste Treatment Plant.

Preparations to retrieve and deliver tank waste to the Waste Treatment Plant for vitrification are on track:

- Nearly two miles of waste transfer piping has been installed
- An additional 1.6 miles of waste transfer piping will be installed by 2005 in time for the first Waste Treatment Plant processing
- Several waste transfer stations—process pits—have been constructed and upgraded
- Seven more process pits will be upgraded this fiscal year

- Ten double-shell tanks will be upgraded to serve as staging tanks for waste feed delivery to the Waste Treatment Plant (Figure 2)

Fig. 2 Hanford crew removes 60-foot pump from double-shell Tank AP-101, one of ten double-shell tanks that will serve as staging points for waste as it is retrieved from older single-shell tanks prior to treatment.

RETRIEVING WASTE AND CLOSING TANKS

The third initiative includes closing up to 26 single-shell tanks in the next four years. CH2M HILL will remove waste from and interim close single-shell Tank C-106, the first Hanford tank identified for closure, and complete the retrieval of waste and closure of 25 additional high-risk and low-risk, low-volume single-shell tanks. Pending success with the 26 tanks, CH2M HILL will seek to close an additional 14 tanks to meet the goal of closing 40 tanks as outlined in Hanford's Performance Management Plan.

Tank Closure Commitments and Goals

- The Tri-Party Agreement (1), the legal pact governing Hanford cleanup, calls for:
  - Retrieving the waste from and closing seven single-shell tanks by 2011.
  - Retrieving the waste from all 149 single-shell tanks by 2018 and closing all of the single-shell tanks by 2024.
- DOE's Top-To-Bottom Review and the resulting *Performance Management Plan for Accelerated Cleanup of the Hanford Site* call for closing 40 to 160 tanks by 2018.

- The Office of River Protection and CH2M HILL have set goals of retrieving waste from and closing up to 40 single-shell tanks in the next four years and all 149 single-shell tanks by 2018.

Tank Closure Acceleration Strategy

To participate in the important decisions on closing Hanford tanks, the Department of Energy, regulatory agencies, tribal nations, elected officials, CH2M HILL, and the various Hanford stakeholders need information.

The first step in gathering that information is retrieving the waste from the first single-shell tank selected for closure—Tank C-106. The 1940s-era tank contains approximately 30,000 gallons of liquid waste and approximately 6,000 gallons of sludge waste. Retrieval operations to remove waste from the tank are scheduled to begin this spring. Information from the waste retrieval experience will help guide further decisions on how Hanford tank closure will be accomplished. The discussion will focus on the following questions:

- What retrieval methods have been most successful?
- How will the tank structure be stabilized after the waste is recovered?

SUPPLEMENTAL TREATMENT OF TANK WASTE

The final initiative includes the retrieval and treatment of approximately one million gallons of mixed transuranic and low-level tank waste using non-Waste Treatment Plant techniques. Specifically, CH2M HILL will remove mixed transuranic waste from the single-shell tanks and the double-shell tanks and treat and package the waste for eventual shipment to the Waste Isolation Pilot Plant facility in New Mexico. Removing the mixed transuranic waste from the single-shell tanks directly to packaging avoids the use of the double-shell tanks—saving space. Removing the mixed transuranic waste from the double-shell tanks will create needed space for retrieving waste from other single-shell tanks and provide a cost-effective alternative to immobilizing the waste in glass –potentially saving an estimated $800 million in reduced processing and disposal costs.

CH2M HILL will also identify, retrieve, and treat low-level or low-level mixed waste for disposal on or off of the Hanford Site. The Performance Management Plan for accelerating cleanup at Hanford identifies a strategy based on building the currently scoped Waste Treatment Plant and demonstrating and deploying non-Waste Treatment Plant systems to immobilize tank wastes for disposal. In order to treat all of Hanford's tank waste by the 2028 deadline, the success of these supplemental treatment technologies will be pivotal. Of several potential supplemental technologies that have been considered, CH2M HILL and the Office of River Protection are currently looking at three:

- Containerized Grout involves solidification with grout-forming additives to form immobilized waste suitable for land disposal. Containerized grout would allow acceleration of the tank waste cleanup by reducing the amount of sodium that the Waste Treatment Plant would need to process.

- Bulk Vitrification allows for glassification of the waste inside a disposal container suitable for land disposal. Bulk vitrification would allow accelerated tank waste cleanup by reducing the mass of sodium requiring vitrification in the Waste Treatment Plant.
- Steam Reforming consists of denitration in a high-temperature fluidized bed with additives then or later to make an immobilized waste suitable for land disposal. Steam Reforming would allow acceleration of the cleanup of tank waste by reducing the amount of waste requiring vitrification in the Waste Treatment Plant.

DEPLOYING SIMPLE, PROVEN CLEANUP METHODS

Now that most of the liquid waste has been removed from Hanford's 149 single-shell tanks, the Office of River Protection and CH2M HILL are deploying a variety of methods to remove the remaining solid and sludge waste. Approximately 31 million gallons of solid—or saltcake—and sludge waste remain. Simple, proven methods are being deployed and demonstrations conducted to gain the information needed to match the appropriate retrieval methods with tanks that contain saltcake, sludge, or a combination of both.

Saltcake Dissolution

Saltcake is somewhat like wet beach sand but can dry to an almost rock-like consistency. A proof-of-concept demonstration is being conducted on a sprinkler system that uses gentle sprays of water to dissolve the waste. Single-shell Tank U-107 contained approximately 320,000 gallons of saltcake at the beginning of the demonstration in December. A series of tests are being performed to see which sprinkler nozzles and spray patterns work best to dissolve approximately 100,000 gallons of the saltcake waste. In keeping with the approach of using simple, proven methods, a variety of off-the-shelf sprinkler heads are used—placed in an array around a stainless steel shaft that was lowered to within a few feet of the waste surface. As the waste is dissolved, a saltwell pump—installed in the tank in fall 2001 to remove approximately 90,000 gallons of liquid waste—moves the waste to a newer, safer double-shell tank. In addition to achieving additional risk reduction by removing long-term constituents of concern during pumping operations, the demonstration provides critical information that will guide future single-shell tank waste retrieval projects. Approximately 60 of Hanford's single-shell tanks contain significant amounts of saltcake for which this approach might be practical.

Sludge Retrieval

Sludge looks like fine mud and dries very hard. Unlike saltcake, which can be dissolved with liquid and pumped, the sludge must be pushed around and mobilized with liquid before it can be pumped out of a tank. Demonstration of an in-tank vehicle and pumping system is being conducted in a large, to-scale simulated waste tank. Called the tank crawler, the in-tank vehicle is a sturdy and agile 1,300-pound machine that looks like a small bulldozer with treads and a folding blade. With the push of a button, hydraulics fold the crawler to just 27 inches wide, narrow enough to enter a tank through a 36-inch wide riser. Once inside the tank, the crawler will pump and push its way through thick sludge, moving the waste toward a central pump that will transfer out the contents of the tank. The demonstration is being conducted with mud, which is similar in particle size and viscosity to radioactive and hazardous sludge waste stored in

several of Hanford's large underground tanks. The crawler is designed to be capable of retrieving sludge waste from as many as 60 of Hanford's single-shell waste tanks (Figure 3).

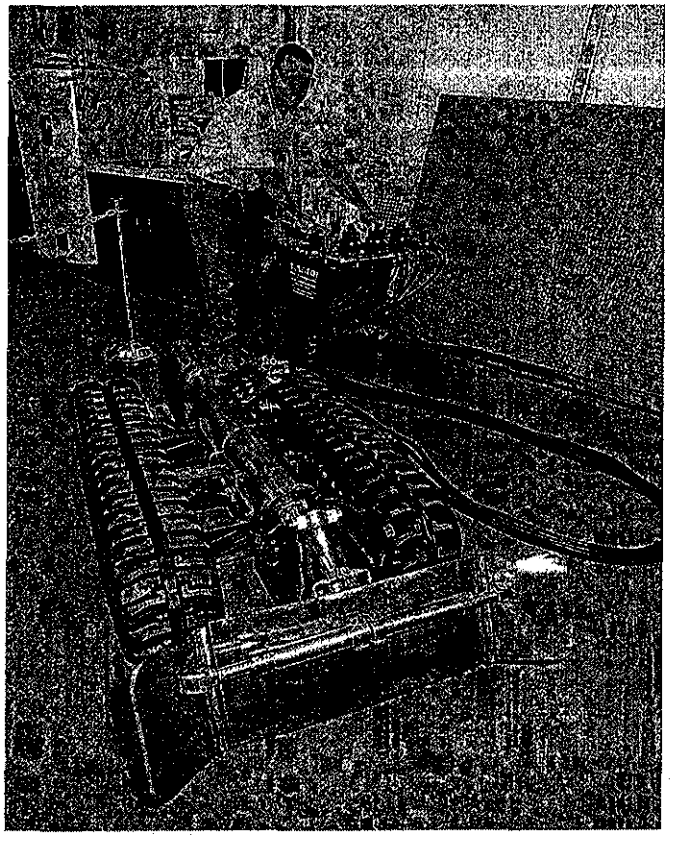

Fig. 3 Tank crawler for sludge waste retrieval.

CONCLUSION

The DOE's Office of River Protection and CH2M HILL Hanford Group are aligning work at the Hanford tank farms with new initiatives on accelerated tank cleanup and closure. In addition to deploying cleanup solutions in the field and gathering information through the tank waste retrieval experience, a key challenge in this endeavor will be partnering, through discussions and planning, between the Department of Energy, the regulatory agencies, Hanford stakeholders, elected officials, and CH2M HILL. The discussion has already begun on how to meet cleanup goals and regulatory commitments, while continuing to protect human health and the environment. A new era in tank cleanup is on the not-too-distant horizon—closure of the first Hanford tank.

REFERENCES

1. "Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement)," as amended, Washington State Department of Ecology, U.S. Department of Energy, and U.S. Environmental Protection Agency, Richland, Washington (1989).