Tank Waste

Retrieval, Processing, and On-Site Disposal at Three Department of Energy Sites

Final Report

Frank L. Parker
Vanderbilt University
Chair

Micah Lowenthal
Nuclear and Radiation Studies Board

National Research Council Committee on the Management of Certain Tank Wastes

Presentation to WM'07
February 28, 2007

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

Outline

- Task
- Background
- Major Findings and Recommendations
- Site-specific Findings and Recommendations
- Watch list
- Committee
- Acknowledgements

Task (I)

Congressional Request §3146 FY05 National Defense Authorization Act

- Evaluate DOE's plans for retrieval and on-site disposal of tank wastes from reprocessed spent fuel at Savannah River, Hanford, and Idaho. Specifically,
  1. the state of the Department's understanding of the physical, chemical, and radiological characteristics of the waste referred to above, including an assessment of data uncertainties;
  2. any actions additional to those contained in current plans that the Department should consider to ensure that its plans to manage its radioactive waste streams will comply with the performance objectives of Part 61 of Title 10, Code of Federal Regulations;
  3. the adequacy of the Department's plans for monitoring disposal sites and the surrounding environment to verify compliance with those performance objectives;
  4. existing technology alternatives to the current management plan for the waste streams mentioned above and, for each such alternative, an assessment of the cost, consequences for worker safety, and long-term consequences for environmental and human health;

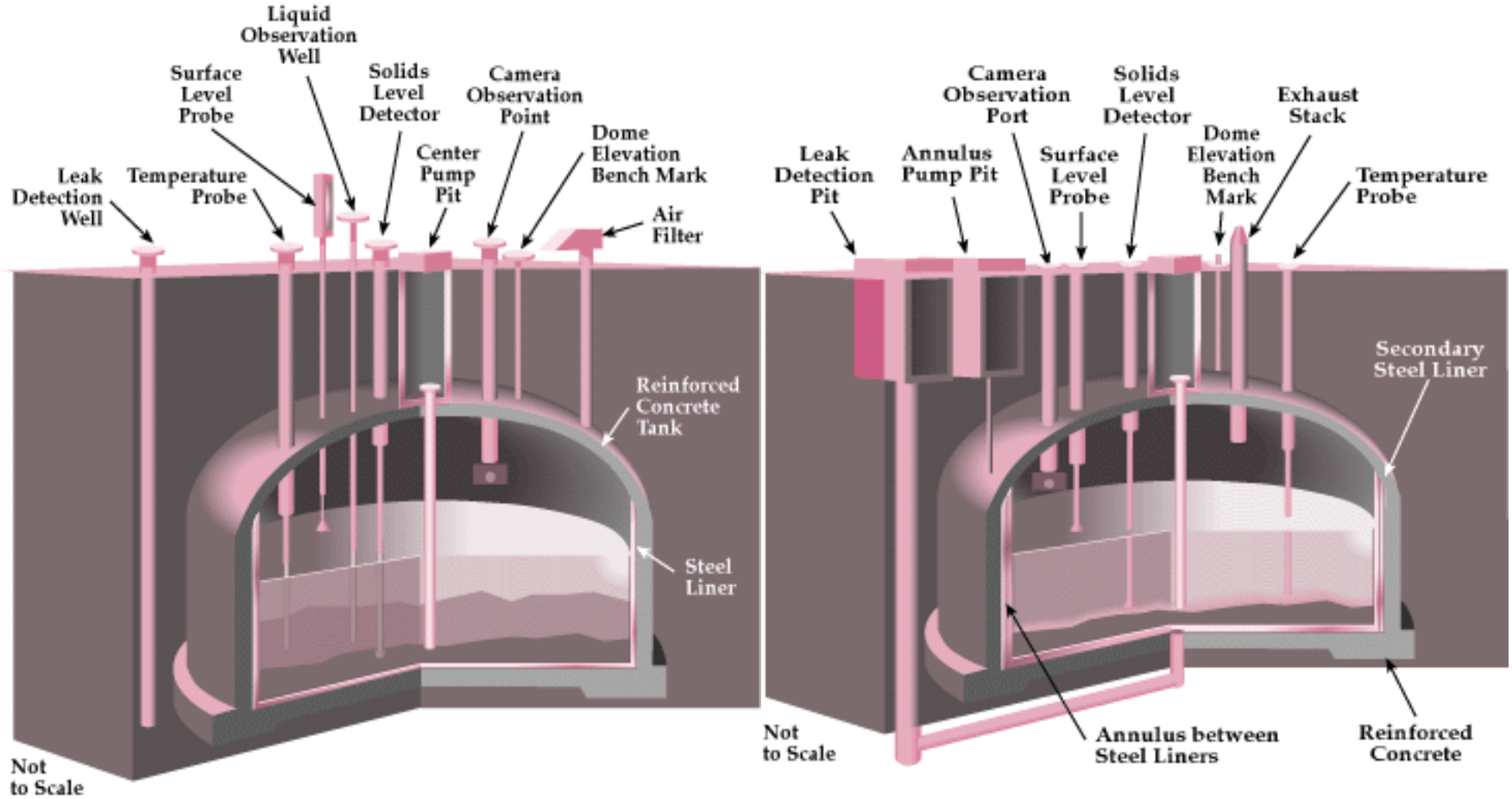
Task (II)

5. any technology gaps that exist to effect improved efficiency in removal and treatment of waste from the tanks at the Hanford, Savannah River, and Idaho sites; and
6. any other matters that the committee considers appropriate and directly related to the subject matter of the study.

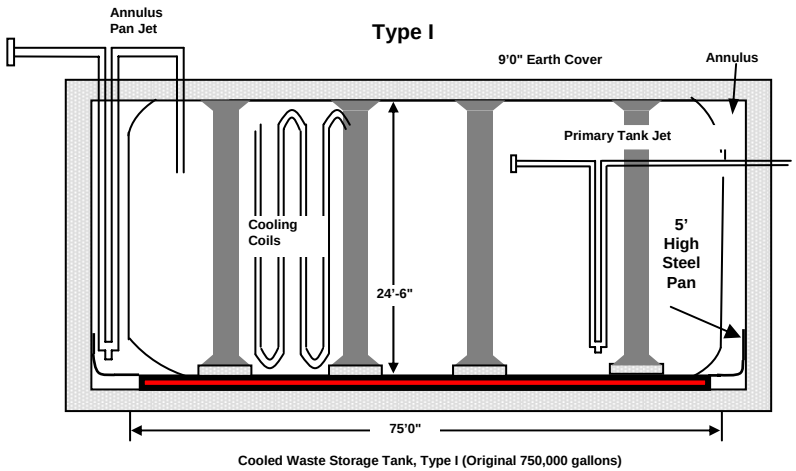
The committee may develop recommendations it considers appropriate and directly related to the subject matter of the study, including:

1. improvements to the scientific and technical basis for managing the waste covered by the study, including the identification of technology alternatives and mitigation of technology gaps; and
2. the best means of monitoring any on-site disposal sites from the waste streams referred to above to include soil, groundwater, and surface water monitoring.

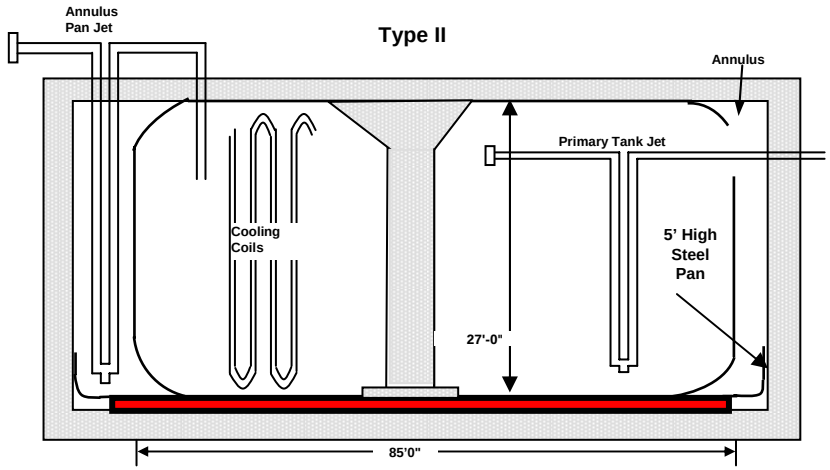
Hanford Single-Shell and Double-Shell Tanks



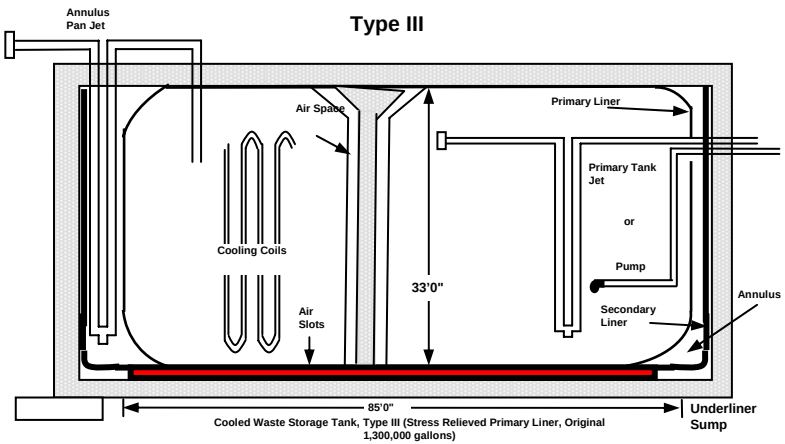
Savannah River Site Tanks



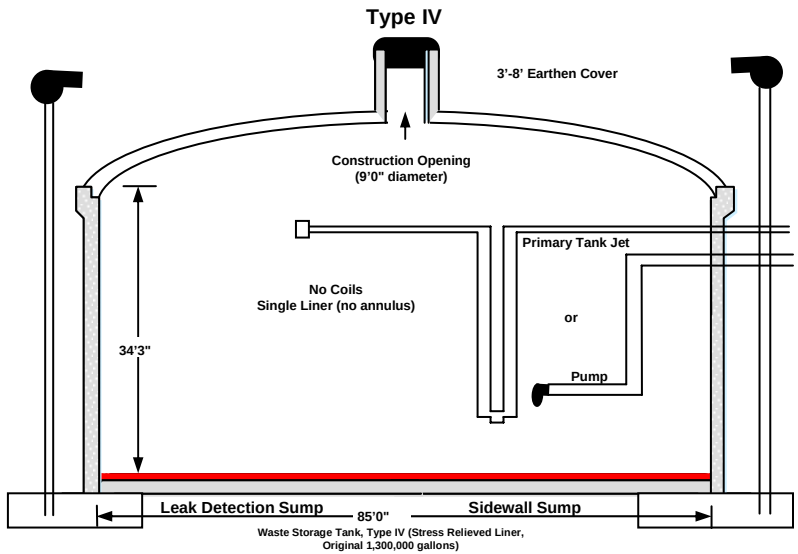
Cooled Waste Storage Tank, Type I (Original 750,000 gallons)



Cooled Waste Storage Tank, Type II (Original 1,030,000)gallons)

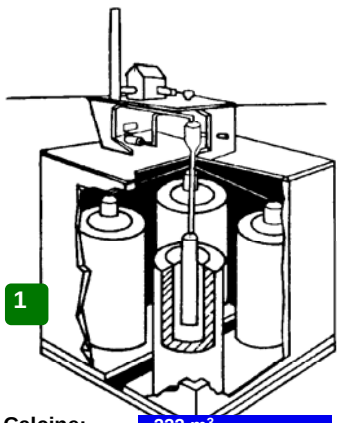


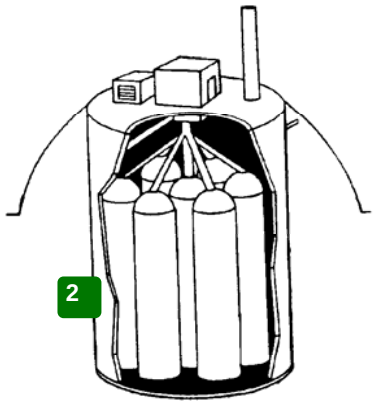
Cooled Waste Storage Tank, Type III (Stress Relieved Primary Liner, Original 1,300,000 gallons)

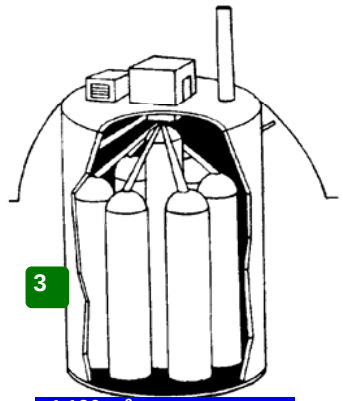


Waste Storage Tank, Type IV (Stress Relieved Liner, Original 1,300,000 gallons)

Idaho's Calcine Bins

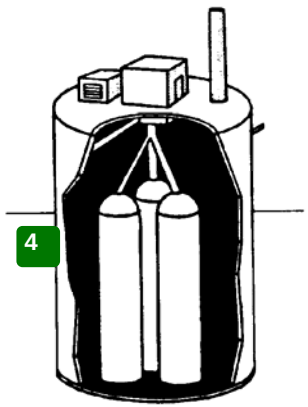


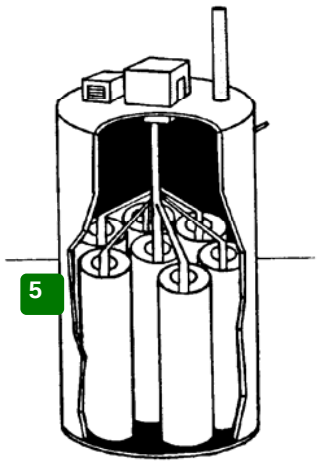


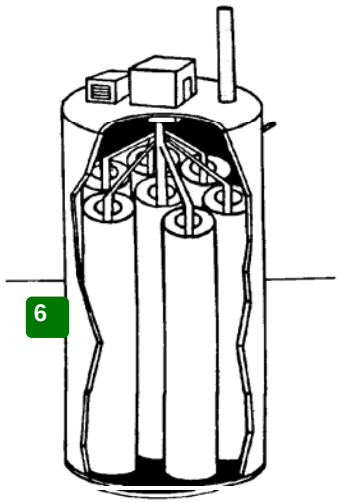


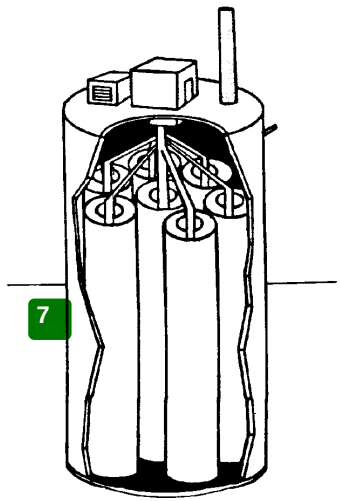
	1	2	3
Calcine:	222 m^3	851 m^3	1,120 m^3
Capacity:	227 m^3	851 m^3	1,130 m^3

Total:
4411 m^3
Calcine Waste
(INEEL/EXT-98-00455 Rev.2 Jan-2005)







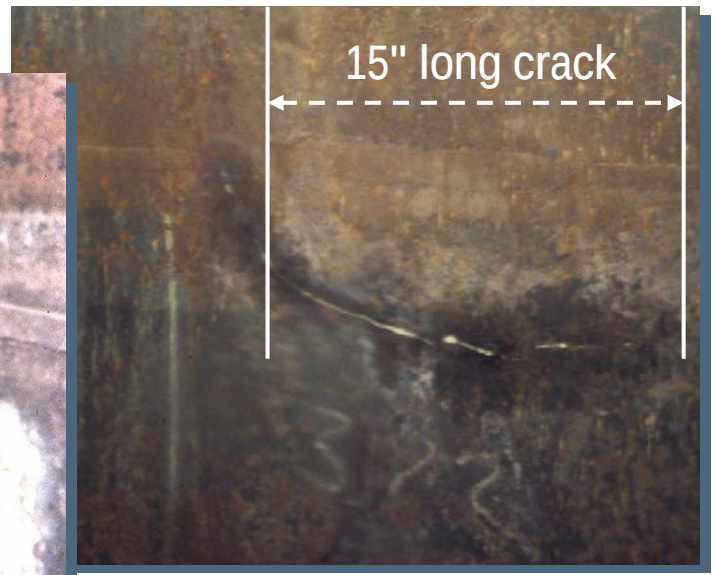


	4	5	6	7
Calcine:	484 m^3	1,010 m^3	724 m^3 (48%)	0m^3 (00%)
Capacity:	484 m^3	1,010 m^3	1,506 m^3	1,784 m^3

Cooling Coils in SRS Tank

Salt Waste in Tank Annulus at SRS

Tank 14

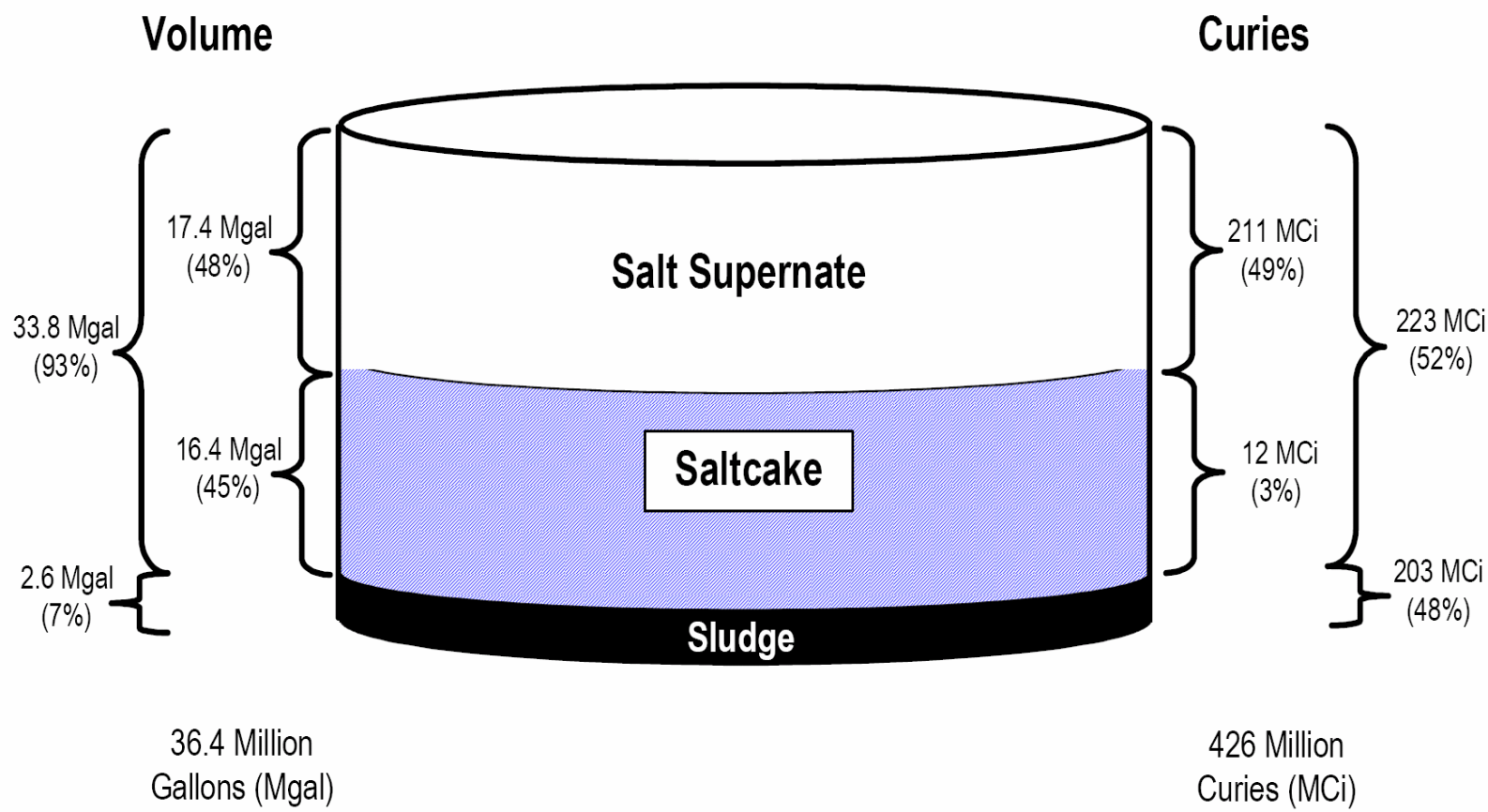


Tank 15

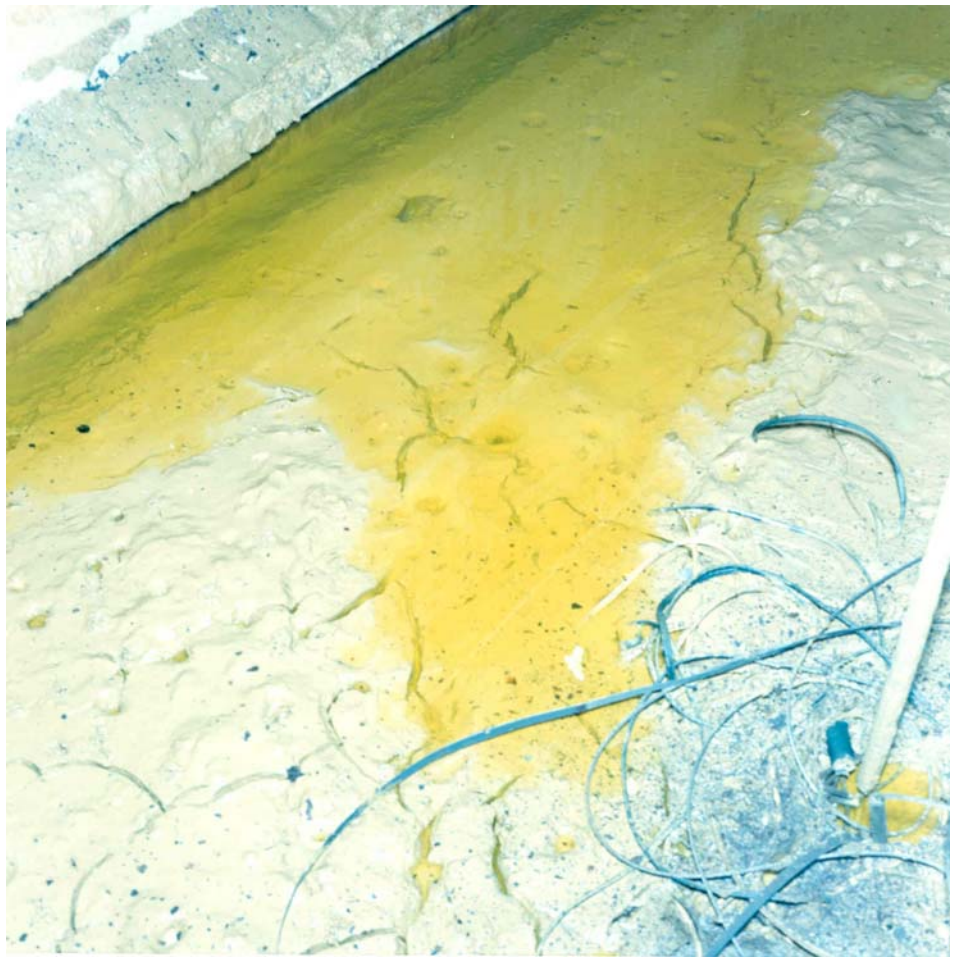
Outside of primary tank wall

Salt waste that leaked from tank and is contained in annulus pan

SRS Tank Waste Volume and Radioactivity



STEEL DEPTH MEASURING TAPES DISCARDED IN TANKS



SRS WASTE TANK SLUDGE

Characteristics of the 3 sites

	Savannah River	Hanford		Idaho National Laboratory
Number of Reprocessing Methods	1 Neutralized	3 Neutralized		1 Acid
Number of Tanks	51 Double Shell (DS)	149 SS*	28 DS	7 Bin Sets
Tanks Closed	2			
Amount of Glass Produced, m^3	1,500		0	0
Nearest River Flow, m^3/sec	0.5		3,360	intermittent
Depth to Water Table, m	9.9		90	143
Average Annual Precipitation, cm	124		16	22
Average Annual Soil Infiltration, cm	40		16	22

* Single Shell

Major Findings & Recommendations (I)

- **DOE's overall approach for management and disposal of tank wastes is workable, but important technical and programmatic challenges remain.**
- **The essential question, How clean is clean enough? depends on a range of technical and non-technical factors. There is no unique answer to this question.**
- **DOE should pursue a more risk informed, consistent, participatory, and transparent process for making decisions about how much waste to retrieve from each of its tanks or group of tanks, and how much of that waste to dispose at each of the three sites. This will lead to better decisions and reduce programmatic risk.**

Major Findings & Recommendations (II)

- **There is still time to develop tools and processes to address problems the committee identifies in the report, and others that may crop up.**
- **DOE should initiate a targeted, aggressive, collaborative research program to develop and deploy needed innovative technologies for tank waste retrieval, treatment, closure, and disposal.**
- **DOE's current knowledge of tank waste characteristics is adequate for retrieving waste from tanks at all three sites.**

Major Findings & Recommendations (III)

- **DOE should decouple its schedule for tank waste retrieval from its schedule for tank closure for those tanks that still contain significant amounts of radioactive material after initial waste retrieval is completed.**
- **DOE should continue to seek transparent, independent peer review of critical data and analyses used to support decisions about tank waste retrieval, processing, and disposal even if review is not required under the 2005 NDAA.**
- **DOE should develop conceptual plans now for a post-closure monitoring program and begin to build provision and/or sensors for monitoring into its tank closures and disposal facilities.**

Watch List

Other significant issues that DOE will have to resolve with deliberate speed:

- Remediation of plugged and leaking underground pipes and interwall spaces in double-walled tanks;
- Disposition of calcine bin waste at the Idaho site
- Regulatory approvals for the off-site disposal of some Hanford tank waste and Idaho sodium-bearing waste
- The philosophy and methodology for post-closure monitoring
- Plans for carrying out long-term stewardship, including how the federal government will maintain control “in perpetuity” at sites unsuitable for unrestricted release.

Committee

Frank L. Parker, CHAIR, Vanderbilt University

Hadi Abu-Akeel, AMTENG Corp

John S. Applegate, Indiana University School of Law

Howie Choset, Carnegie Mellon University

Allen G. Croff, Oak Ridge National Laboratory (retired)

Patricia J. Culligan, Columbia University

Ken Czerwinski, University of Nevada, Las Vegas

Rachel Detwiler, Braun Intertec Corp

Edwin E. Herricks, U. of Illinois at Urbana-Champaign

Tissa Illangasekare, Colorado School of Mines

Milton Levenson, Bechtel International (retired)

Paul A. Locke, Johns Hopkins Bloomberg School of Public Health

Michael H. Mobley, Mobley Radiation Consulting

Dianne R. Nielson, Utah Dept. of Environmental Quality

Ken E. Philipose, Atomic Energy of Canada, Ltd. Chalk River Laboratories, Ontario

Alfred P. Sattelberger, Los Alamos National Laboratory

Anne E. Smith, Charles River Associates

Leslie Smith, University of British Columbia

Don Steeples, University of Kansas

CONSULTANT

Rodney C. Ewing, University of Michigan

STAFF

Micah Lowenthal, Study Director
Barbara Pastina, Study Director
John R. Wiley, Sr. Staff Officer
Darla Thompson, Research Assoc
Laura D. Llanos, Sr. Program Asst
Marili Ulloa, Sr. Program Asst

ACKNOWLEDGEMENTS

The committee's report acknowledges the input and assistance of many people without which the study could not have succeeded. These include

- DOE personnel in DC and at the sites
- DOE contractor personnel
- USNRC staff who are reviewing many of the same issues
- State regulators
- Staff from the Yakama Indian Nation
- NRC Staff