

COMPLEX-WIDE TRENDS IN THE DISPOSITION OF ENVIRONMENTAL RESTORATION WASTES

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ABSTRACT

Since 1990, the Environmental Restoration (ER) program has provided stakeholders estimates of the volumes of contaminated media and projections of waste from the cleanup of Department of Energy (DOE or the Department) sites throughout the complex. These estimates and projections of waste have varied substantially from year to year. Estimates of contaminated media are affected by many factors, both technical and programmatic. Technical factors consist of determining of the extent of contamination, *i.e.*, a combination of historical knowledge, monitoring information, and field characterization results, as well as any associated assumptions. Programmatic factors are comprised of Departmental policies and programmatic decisions regarding the scope of the ER program. Projections of waste volumes rely first on the technical and programmatic factors affecting the estimate of contaminated media and second on available cleanup technologies and additional assumptions regarding land use and cleanup levels. These latter assumptions often involve agreements with stakeholders, the U.S. Environmental Protection Agency (EPA), and state and local governments.

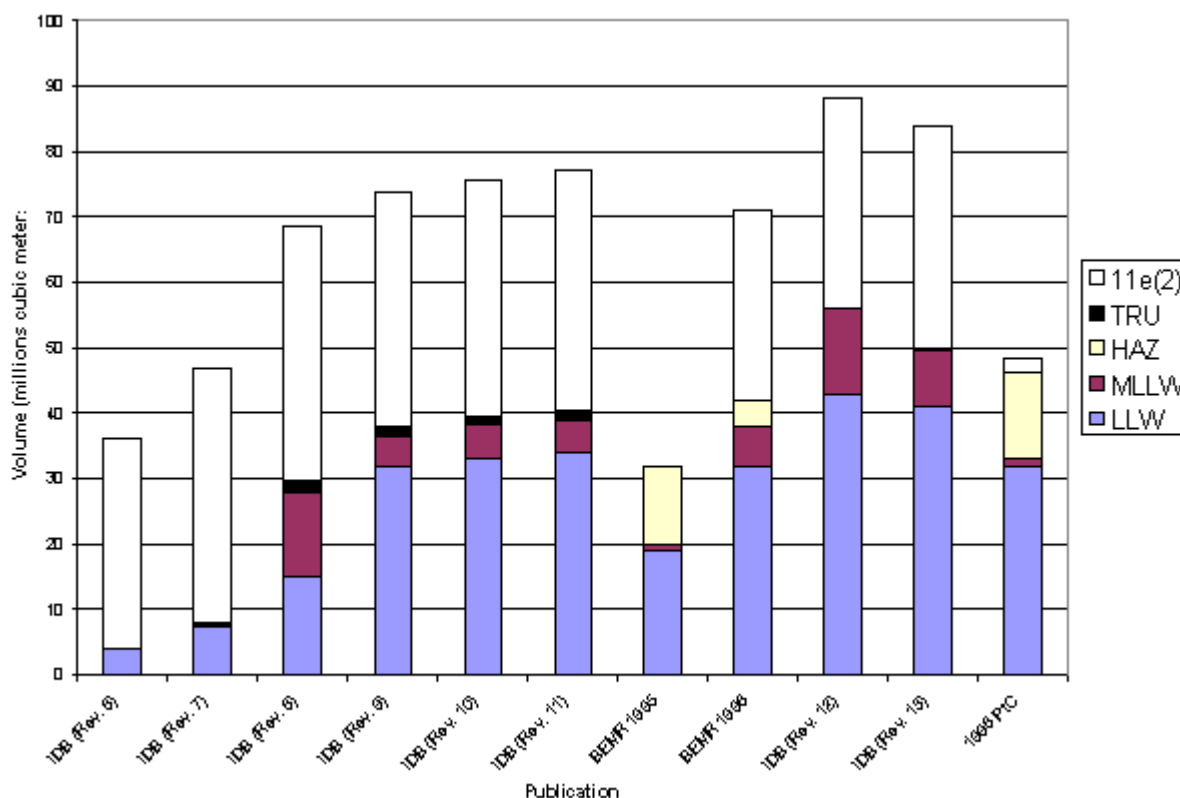
Because ER program estimates and projections rely extensively on such factors, they have, not surprisingly, varied from year to year. This paper reviews the evolution of ER estimates from 1990, when the estimates were incomplete, to 1998, when factors such as completions, transfer of cleanup activities outside the Department, and changing assumptions noticeably reduced estimates. This paper also examines three specific sites to analyze specific changes in the estimates at a site level and to categorize these changes into a number of factors.

INTRODUCTION

Over the past nine years, estimates of the volumetric scope of the ER program have been published in numerous documents, from the *Integrated Database (IDB) for 1990* (IDB Rev. 6) to the 1998 *Accelerating Cleanup: Paths to Closure* (1998 PtC). The ER program has provided these volume estimates for both contaminated media and projections of waste to be generated from the remedial actions and decommissioning of facilities at sites in the Department.

Because they were developed for varying purposes and were undertaken at different points in time, ER's estimates of the scope of the cleanup and the planned response strategies have varied substantially from document to document and from year to year. Overall, estimates have ranged from about 32 million to approximately 88 million cubic meters, as indicated in Figure 1. These complex-wide totals have varied significantly due to the assumptions and scope of each publication, the evolving scope of the ER program, progress in characterization of contamination, and the progression to a life-cycle perspective.

This paper reviews three types of reports: IDBs, *Baseline Environmental Management Reports* (BEMRs), and the 1998 PtCB to examine ER's estimates, analyze the differences between the volume estimates reported in these documents, and evaluate trends over time for contaminated media estimates and disposition projections. By reviewing these historical estimates, this paper explains the sources of variation for a large fraction of ER's estimates over the past nine years.



The analysis conducted for this paper reviewed six sites and one program, the Uranium Mill Tailings Remedial Action Program (UMTRAP). For brevity, this paper discusses only three sites (Fernald Environmental Management Project, Hanford, and the Nevada Test Site). This paper defines the terms used in this document, reviews the historical volume estimates and waste projection data for the three sites, and documents the multiple technical and programmatic factors affecting ER's estimates and projections. This paper concludes by summarizing the major factors that caused the differences in the various ER estimates and projections complex-wide.

ER TERMINOLOGY

This section defines the terminology used in this paper for describing the extent of environmental contamination and how the Department plans to address the contaminated environmental media.

Contaminated Environmental Media and Waste Streams

The overall mission of ER is to protect human health and the environment from risks posed by inactive, surplus structures and contaminated environmental media. These structures and media contain radioactive and chemically hazardous contaminants as a result of historical research and weapons production activities.

ER estimates of contaminated media and projections of waste are currently collected at the stream level. A stream (contaminated media or waste) is a unique combination of medium type, contaminant/waste type, and planned response strategy. These terms are defined below.

Contaminated media and waste streams are classified by environmental medium type. For the purposes of the analyses in this paper, ER streams are classified by the following types:

groundwater/surface water/waste water, soil/sediment, rubble/debris, sludge/residues, and other liquids.

Discussions in this paper are limited to solid contaminated media and waste only. Aqueous media (*i.e.*, groundwater, surface water, waste water, and other liquids) are not discussed because of the difficulty in obtaining meaningful volume estimates for analysis. For example, none of the IDB reports collected any data on aqueous media, limiting the potential historical data sources to three reportsB the 1995 BEMR, the 1996 BEMR, and the 1998 PtC. A few aqueous waste streams have such large volumes (*e.g.*, a zone of approximately 4.7 billion cubic meters of contaminated groundwater in Idaho) that all trends in both aqueous and non-aqueous volume estimates and strategies would be obscured.

Waste Types

Waste is generated when contaminated media are addressed with ex-situ response strategies. For example, soils contaminated with radionuclides that are excavated and disposed of in an engineered disposal facility would be considered waste. If these soils were capped in place, *i.e.*, addressed with an in-situ response strategy, then their classification would remain as contaminated media.

To describe the nature of contamination for wastes, this paper uses the following waste type classifications:

\$ 11e(2) Byproduct Material (11e(2)): As defined in Sect. 11e(2) of the *Atomic Energy Act of 1954* (Public Law 83-703, as amended), 11e(2) byproduct material is tailings or waste produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. Materials being managed under Title I of the Uranium Mill Tailings Radiation Control Act of 1978 (Public Law 95-604) are defined as residual radioactive material distinct from 11e(2) by-product material. This residual radioactive material is largely uranium mill tailings, as well as soil and debris contaminated with uranium mill tailings. Because residual radioactive material has similar physical and radiological properties as 11e(2) by product material, this paper combines both materials in the 11e(2) category.

\$ Hazardous Waste (HAZ): The U.S. Environmental Protection Agency (EPA) specifies the following criteria for HAZ waste:

- B meets the definition of a solid waste,
- B does not qualify for any of the specified exemptions from hazardous waste, and

- B either is listed by the EPA in the Code of Federal Regulations (40 CFR, Part 261, Subpart D) or exhibits any of the four hazardous characteristics identified by the EPA in the Code of Federal Regulations (40 CFR, Part 261, Subpart C)

To simplify the presentation of data in this document, the HAZ category includes materials subject to either the Resource Conservation and Recovery Act (RCRA) (Pub. L. 94-580 (1976), as amended) or the Toxic Substances Control Act (TSCA) (Pub. L. 99-579). TSCA materials include polychlorinated biphenyls (PCBs) and asbestos.

- \$ Low-Level Waste (LLW): LLW is radioactive waste that is not classified as high-level waste, transuranic waste, spent nuclear fuel, byproduct material, or naturally occurring radioactive material (Low-Level Radioactive Waste Policy Amendments Act of 1985, Public law 99-240).
- \$ Mixed Low-Level Waste (MLLW): MLLW is waste that meets the definitions of both low-level waste and hazardous waste.
- \$ Transuranic Waste (TRU): TRU is radioactive waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, as defined by DOE Order 5820.2A. Transuranic elements are those elements beyond uranium on the periodic table, including neptunium, plutonium, americium, and curium.

While sites may also report sanitary waste, this document does not review these waste streams.

For tracking purposes and for brevity, ER uses a waste type (*e.g.*, LLW) that represents the nature of the contaminants in the media to classify contaminated media, even though contaminated media addressed through in-situ response strategies do not generate waste. In this paper, the following naming conventions are used for classifying contaminated media by contaminant type:

- \$ 11e(2) byproduct material and residual radioactive material are 11e(2)-contaminated,
- \$ media contaminated with RCRA/TSCA constituents are HAZ-contaminated,
- \$ media contaminated with radionuclides are LLW-contaminated,
- \$ media contaminated with both radionuclides and RCRA/TSCA constituents are MLLW-contaminated, and
- \$ media contaminated with transuranic elements are TRU-contaminated.

The most recent data collection efforts asked sites to provide the response strategies for the contaminated media and waste. These response strategies may be approved by regulators and stakeholders or may only be provided for planning purposes. Where approved (*i.e.*, based on a signed decision document such as Record of Decision), these response strategies reflect the input of stakeholders, availability of cleanup technologies, planned land uses for the site, and signed regulatory decisions. Where signed decision documents were not available, sites projected disposition plans for planning purposes only. Because information regarding the approval status of response strategies is not always available, this paper refers to all response strategies as planned.

For the purposes of comparative analysis, the planned response strategies of the 1996 to 1998 data sets (IDB Rev. 12, the 1996 BEMR, IDB Rev. 13, and the 1998 PtC) were grouped into three larger categories:

in-situ, ex-situ, and to be determined (TBD)/not provided. Descriptions of each of these categories follow, with definitions of each of the specific planned response strategies.

Planned Response Strategies

Response strategies grouped in the in-situ category require no removal of contaminated media, and therefore generate essentially no waste to be treated and/or disposed of, other than personal protective equipment. Volumes of in-situ contaminated media represent the best estimate of contaminated media in place. The in-situ category includes response strategies of varying levels of active remediation that leave contaminated media volumes in place:

- \$ **In-situ Treatment:** Response strategy consisting of treatment of contaminated media in place (e.g., chemical stabilization, biodegradation, flushing).
- \$ **In-situ Containment:** Response strategy consisting of the placement of a barrier, seal, or diversion to contain the further spread of contamination (e.g., capping, lateral barrier, interception).
- \$ **Access/Institutional Controls:** Response strategy consisting of monitoring and limiting public access and/or usage of an area containing contaminated media (e.g., physical restrictions, monitoring, administrative restrictions.).
- \$ **No Further Action:** Response strategy in which a decision of no further action is anticipated.

Although no further action is not usually classified as an in-situ strategy since it requires no active response, it is included in the in-situ category for the purposes of this analysis because for some data sources it was not possible to separate no further action response volumes from access/institutional control response volumes.

Ex-situ response strategies involve the removal of contaminated media for active treatment, storage, and/or disposal or recycling. Ex-situ contaminated media are, by definition, waste streams for which volume estimates represent the total amount of waste removed. The ex-situ category consists of the following response strategies:

- \$ **Collect and Treat:** Response strategy consisting of the removal of contaminated media for the purpose of physical or chemical processing.
- \$ **Collect and Recycle:** Response strategy consisting of the removal of contaminated media for processing and reuse.
- \$ **Collect and Store:** Response strategy consisting of collection of contaminated media for processing and reuse.
- \$ **Collect and Dispose:** Response strategy consisting of the removal of contaminated media for the purpose of direct disposal in an engineered cell.

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The ATBD/Not Provided category includes all contaminated media for which a specific response strategy has either not yet been determined or was not provided in a given data set. The actual response strategies for contaminated media volumes in this category may be in-situ or ex-situ in future data sets.

This paper describes ER scope and planned response strategies in terms of contaminated media. ER waste-in-inventory volumes are small (in the 1998 PtC, for example, it was approximately 2 percent of the total volume) and have been combined in this paper with contaminated media volumes for simplification.

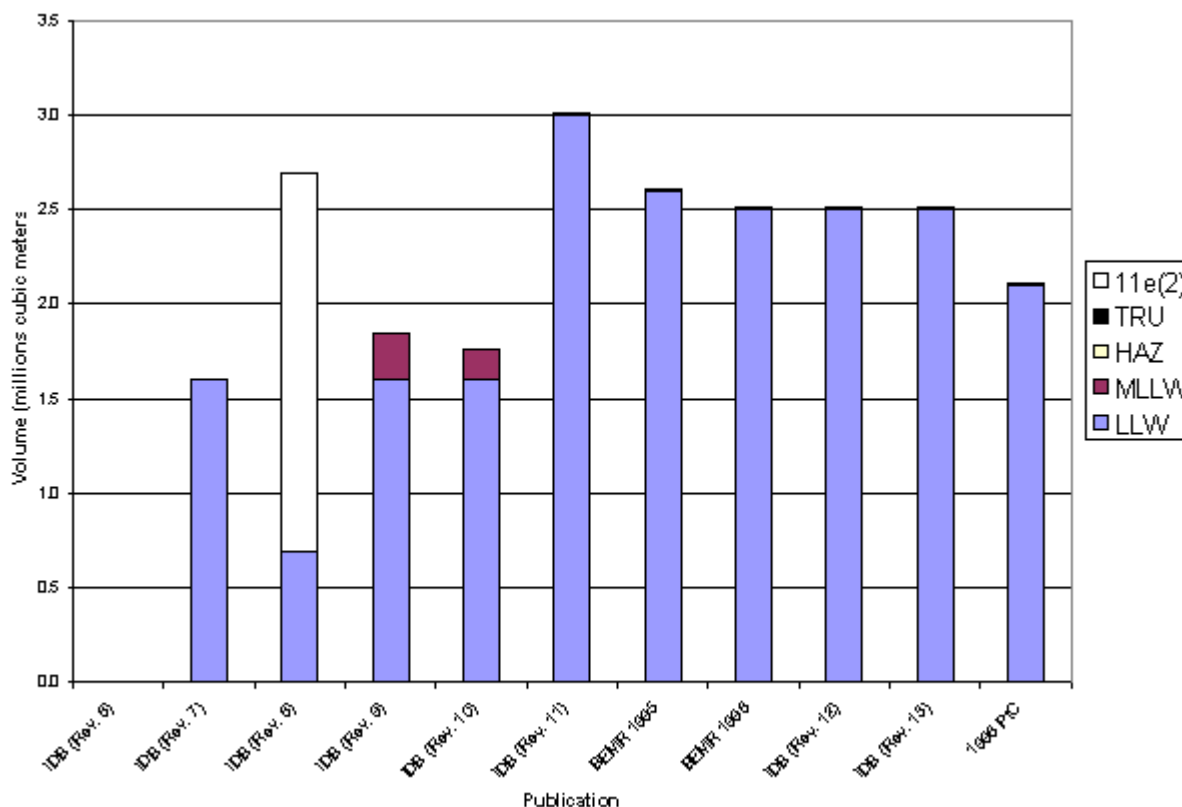
COMPARISON BY SITE

Comparisons are provided for three sites: Fernald Environmental Management Project, Hanford Site, and the Nevada Test Site. For each of these sites, this analysis compares total contaminated media and waste volumes provided in each of the data sets, as well as the projected response strategies as reported in the four most recent data sets.

Fernald Environmental Management Project (FEMP)

The Fernald Environmental Management Project (FEMP) is the site of the former Feed Materials Production Center, whose mission was to produce feed materials (principally uranium) for nuclear reactor fuel as part of the national defense program. FEMP converted uranium ore to uranium metal, which was fashioned into target elements for reactors that produced weapons-grade plutonium and tritium. Production at the plant was suspended in 1989.

The majority of the contamination at FEMP is LLW with smaller volumes of MLLW and some 11e(2) byproduct material. Figure 2 shows the volumes by contaminant type reported by FEMP for each of the eleven data sets.



Prior to the 1995 BEMR, these estimates ranged from 1.6 million cubic meters in IDB Rev. 7 to 3 million cubic meters in IDB Rev. 11. Beginning with the 1995 BEMR, FEMP reported fairly consistent volume

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estimates, progressing from 2.7 million cubic meters in 1995, to approximately 2.5 million in 1996, to 2.1 million in 1998.

FEMP reported its highest volume estimate in IDB Rev. 11, at 3 million. Although IDB Rev. 11 was published subsequent to the publication of the 1995 BEMR, the IDB contained data collected almost one full year prior to the 1995 BEMR data collection effort, which reflected additional information.

Prior to the 1995 BEMR, FEMP estimates showed much greater variation. This variation was due largely to the ongoing characterization effort at FEMP. IDB Rev. 6 (published October 1990) did not include any remedial action volume data because these projections were not yet available. Because all volumes at FEMP at the time were associated with remedial actions, no volume estimates for FEMP are shown for IDB Rev. 6.

Among the larger differences in the estimates presented in Figure 2 are the nearly 2 million cubic meters of 11e(2) -contaminated media reported in IDB Rev. 8, and substantial volumes of MLLW-contaminated media that were reported in IDB Revs. 9 and 10. Discussions with the site regarding these differences clarified that the 11e(2) and MLLW volumes reported in IDB Revs. 8, 9, and 10 were overstated, as the units of the reported estimates were miscommunicated. (1)

The planned response strategies for contaminated media and waste have been fairly consistent for the past three years, varying very little. With the exception of 10,000 cubic meters with a TBD planned response strategy reported in IDB Rev. 12, all volumes at FEMP have consistently had a planned ex-situ response strategy, as shown in Table I.

Table I - Estimated Volumes and Planned Response Strategies at the Fernald Environmental Management Project				
Publication	Ex-Situ Response Strategy	In-Situ Response Strategy	TBD/Not Provided	Total
1996 BEMR	2.5	0	0	2.5
IDB Rev. 12	2.5	0	0.01	2.5
IDB Rev. 13	2.5	0	0	2.5
1998 PtC	2.1	0	0	2.1
Figures in millions of cubic meters. All figures rounded to two significant figures.				

The 10,000 cubic meters of TBD volumes in IDB Rev. 12 were the K-65 residues. In later publications, the planned response strategy for these residues was vitrification. The majority of ER waste (1.6 million cubic meters in the 1998 PtC) is planned to be disposed of in an on-site CERCLA cell.

Overall volume declined by about 400,000 cubic meters in the data reported in the 1998 PtC. Discussions with the site regarding these differences confirmed that the decrease in overall volume reported in the 1998

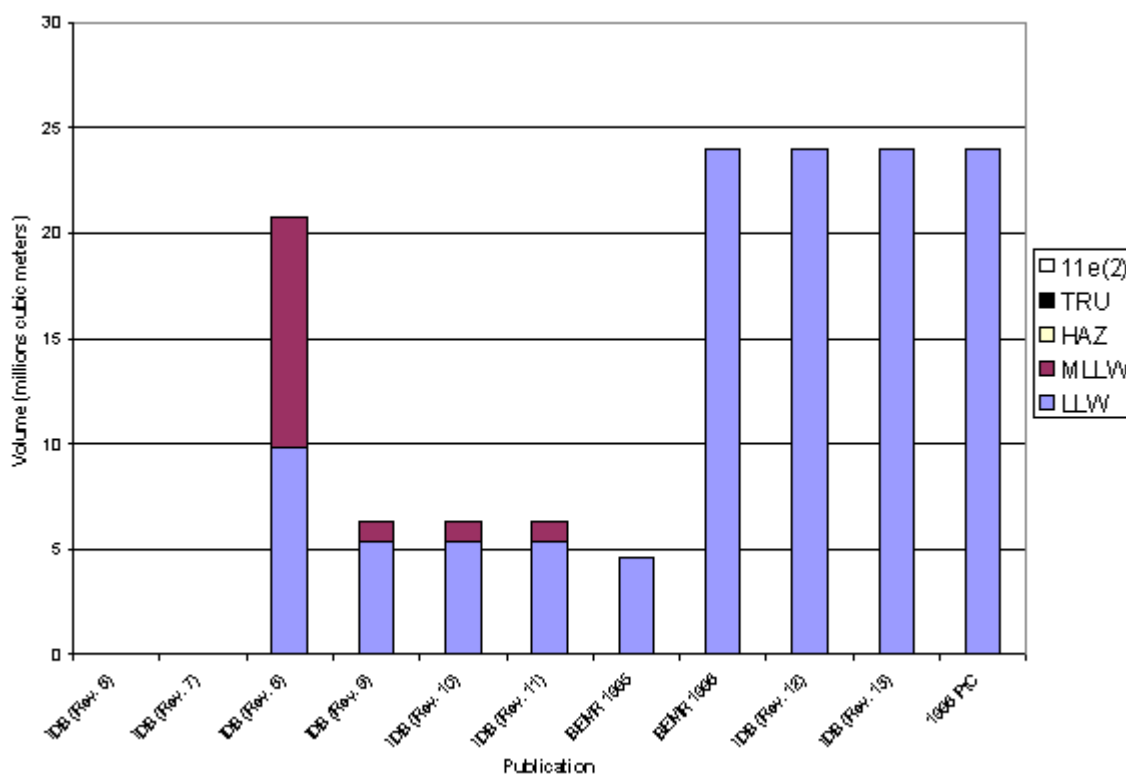
PtC was due to more precise estimates of the amount of debris and soil generated by the cleanup efforts at FEMP. Part of the decrease was due to disposal off-site of approximately 17,000 cubic meters of LLW.

(2)

Hanford Site

The Hanford Site was primarily focused on plutonium production operations and has nine reactors, five chemical processing plants, and over 140 underground storage tanks. All weapons related activity has now ceased. The site maintains some energy research projects, but is mainly focused on environmental remediation, with the Office of Environmental Management as landlord.

As shown in Figure 3, the vast majority of contaminated media at Hanford is LLW. These estimates have ranged from 4.6 million cubic meters to 24 million cubic meters in the most recent publications. MLLW-contaminated media estimates were much more prominent in the earlier estimates, from an initial estimate of 11.3 million cubic meters in IDB Rev. 8 to 880,000 cubic meters in the following three reports. These estimates decreased further in the 1995 BEMR to 22,000 cubic meters; the last four publications each reported less than 2,000 cubic meters of MLLW-contaminated media and waste. Hanford also reported relatively small volumes of HAZ (10,000 cubic meters) in the 1998 PtC.



Discussions with Hanford representatives indicated that the variation in MLLW estimates were due to the overall volume estimates being reported as LLW, even though they may be LLW or MLLW. Hanford has not needed to distinguish between the two waste types for two reasons: (1) the Environmental Restoration Disposal Facility (ERDF) was designed to handle both LLW and MLLW generated by cleanup of the 100

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Area, and (2) capping of the 200 Area contamination will address both hazardous and radiological contaminants. (3)

The large volume of TRU reported for the 1995 BEMR was due to the preliminary nature of the estimates of the volume TRU-contaminated materials at specific Hanford areas (*e.g.*, Area 618-11). Later estimates based on more current and detailed information revised the overall Hanford estimates to substantially lower volumes, approximately 1,500 cubic meters. (4)

Hanford projections have been very consistent, with an estimate of approximately 24 million cubic meters from 1996 to 1998. Because the estimates in IDB Revs. 9, 10, and 11 only focused on waste requiring disposal, the estimates for these years were much lower, totaling approximately 6 million cubic meters. Adding the additional volumes of contaminated media that are not currently planned to be disposed of, (*i.e.*, the 20 million cubic meters at the 200 Area) would bring to the total estimate in line with other published estimates for the Hanford Site.

In the 1995 BEMR, Hanford estimated approximately 4.6 million cubic meters of waste. These estimates, a decrease of 800,000 cubic meters from the previous three years' estimates. This decrease in the estimate was due to better data on the areal extent, slope and depth of contamination. For example, earlier estimates had assumed 30 feet of excavation below the foundation of structures, while later estimates required only 15 feet below the foundation. (5)

The volumes associated with planned response strategies have also remained very consistent over the last three years, as shown in Table II.

Table II - Estimated Volumes and Planned Response Strategies at the Hanford Site				
Publication	Ex-Situ Response Strategy	In-Situ Response Strategy	TBD/Not Provided	Total
1996 BEMR	3.9	20	0	23.9
IDB Rev. 12	3.9	20	0	23.9
IDB Rev. 13	3.9	20	0	23.9
1998 PtC	3.8	20	0	23.8
In millions of cubic meters. All figures rounded to two significant figures.				

Nearly all of the in-situ volume reflects the 20 million cubic meters of 200 Area LLW soils, which are to be capped in place. The majority of the ex-situ volume is anticipated to be disposed of on-site, at the ERDF.

Nevada Test Site (NTS)

For over forty years, the primary mission of the Nevada Test Site (NTS) was to conduct field testing of both nuclear and conventional explosives in connection with the research and development of nuclear weapons. Above ground testing of nuclear weapons ceased in 1963, and since October 1992, all subsurface nuclear testing has ceased as well. At present, NTS is one of the primary LLW disposal sites for DOE.

As shown in Figure 4, the vast majority of ER estimated volumes at the Nevada Test Site are classified as LLW-contaminated, accounting for between 88 and 99 percent of the total reported volume estimate and ranging between about one and 14 million cubic meters.

Field representatives identified three primary factors responsible for the differences between the estimates:

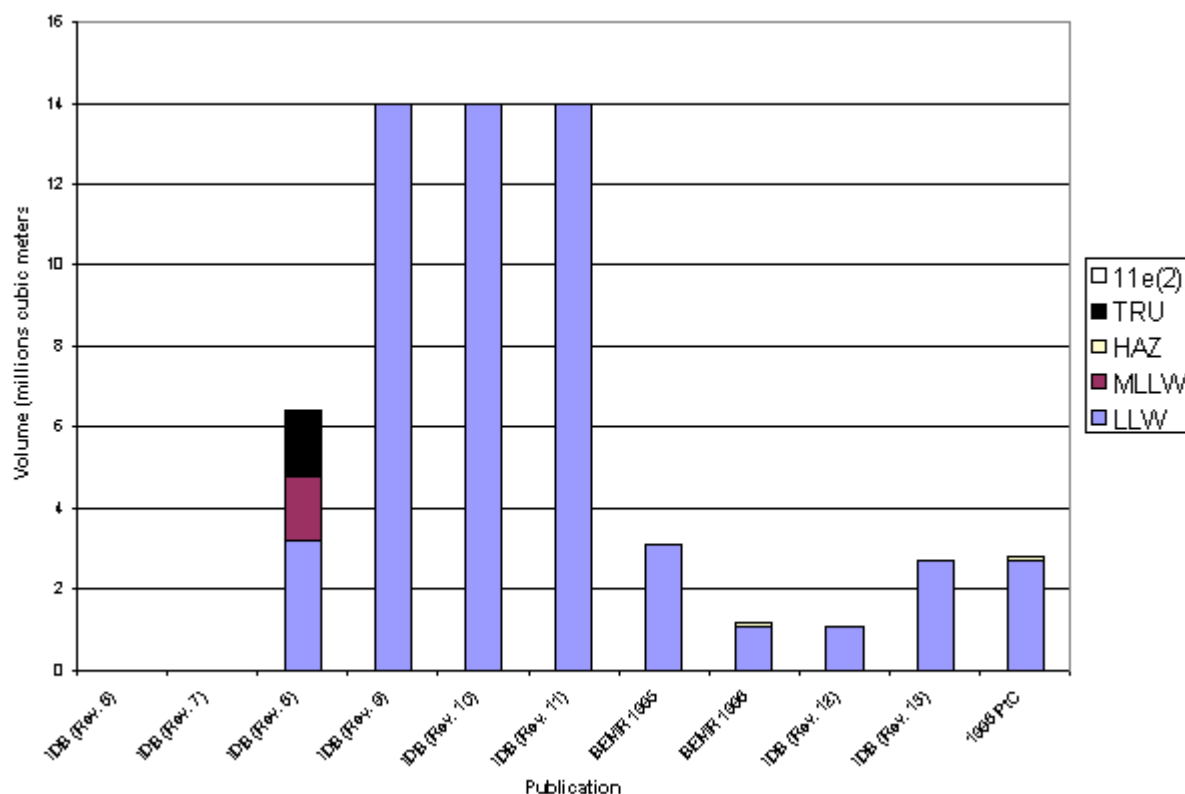
- \$ better characterization,
- \$ the assumed future land use, and
- \$ the assumed cleanup level.

For example, the large decrease in estimated volume from 14 million cubic meters to 3 million cubic meters was due to better characterization and the exclusion of possible future testing areas. Such areas with an ongoing testing mission are excluded from the scope of ER estimates; access/institutional control will be used to address the contamination. (6)

The decrease from the 3 million cubic meters reported in the 1995 BEMR to the one million cubic meters reported in the 1996 BEMR was due to a change in the assumed cleanup level. The 1995 BEMR assumed that the site would remediate soils contaminated with plutonium at levels in excess of 40 pico curies per gram. (7) The 1996 BEMR assumed that a final cleanup level would be negotiated near the 200 pico curie per gram level. (8) Additionally, the volume estimates increased for IDB Rev. 13 and the 1998 PtC reports due to the inclusion of the soils from the Underground Test Areas, which the 1996 BEMR and IDB Rev. 12 specifically excluded from their estimates of volumes from remedial actions. (9)

Nevada Test Site also reported smaller volumes of MLLW and HAZ-contaminated media. HAZ volumes, collected for the two BEMRs and the 1998 PtC only, ranged from 80,000 in the 1996 BEMR to 110,000 in the 1998 PtC; no volume was reported in the 1995 BEMR. MLLW-contaminated media was reported in two years only: 1.6 million in IDB Rev. 8 and 10,000 in the 1998 PtC.

Only IDB Rev. 8 reported TRU-contaminated media, 1.6 million cubic meters. This projection of TRU waste volumes was based on the assumption that specific technological capability would be available to concentrate the radionuclide contaminants, resulting in the classification of this projected waste stream as TRU waste. This technology was determined to be impractical, and so was not employed, resulting in the revised lower TRU volume estimates and larger LLW volume estimates in later publications.



While Table III appears to suggest a clear shift in planned response strategy over the last three years towards in-situ responses, an examination of the factors causing the changes does not support such a view.

Table III documents that the ex-situ planned response volumes have dropped from over one million to less than 300,000 cubic meters. The decrease in ex-situ volumes is mostly the result of better characterization of the contaminated media streams with a planned ex-situ response.

Publication	Ex-Situ Response Strategy	In-Situ Response Strategy	TBD/Not Provided	Total
1996 BEMR	1.1	0.08	0	1.18
IDB Rev. 12	1.1	0	0	1.1
IDB Rev. 13	0.29	2.4	0	2.69
1998 PtC	0.27	2.5	0	2.77
In millions of cubic meters. All figures rounded to two significant figures.				

These lower estimates were based on additional characterization information derived from actual cleanup activities at two release sites (*i.e.*, Double Tracks and Clean Slate II). The ex-situ volumes are anticipated to be transferred to the Waste Management program for disposal on-site.

The increase in volumes planned to be addressed with in-situ response strategies was due to the inclusion of additional scope, which was not included in earlier estimates of volumes from remedial actions. These volumes were excluded because the NTS estimates submitted to the 1996 BEMR and IDB Rev. 12 generally focused on waste only, not contaminated media.

CONCLUSIONS

Using the analyses discussed above, as well as other sites reviewed as part of the research for this paper, a substantial portion of the changes in the ER estimates and projections can be explained. To better describe the various factors affecting the estimates and projections, this paper has organized them into two categories: definition of scope and projection of waste.

Definition of Scope

\$ Improved Understanding

Estimates of contaminated media are based on technical data compiling field characterization of the extent of the contamination in the environment. Early on, the ER program was still undertaking extensive characterization studies. Initial published estimates of ER contaminated media acknowledged these gaps and outlined the ER program's efforts to collect these data. Sites also incorporated many conservative assumptions into some estimates, as they considered both actual releases into the environment and suspected releases. As remedial and decontamination and decommissioning (D&D) activities progress, better technical data will become available and estimates of the volume of contaminated media will continue to be adjusted to reflect this greater understanding.

By 1996, the ER program had made substantial progress in the assessment of contamination at the Department's sites. Of the nearly 10,500 potential release sites, virtually all had been partially characterized and approximately 46 percent had been fully characterized. (10)

The progress made up to 1996 is borne out by the generally upward trend evident in the total volume of contaminated media reported complex-wide (see Figure 1). As cleanup activities progress, sites will continue to improve their estimates as they improve their understanding of the nature and extent of the contaminated media within their scope. For example, at FEMP, better characterization resulted in a decrease of 400,000 cubic meters, from 2.5 million cubic meters in IDB Rev. 13 to 2.1 million cubic meters in the 1998 PtC (See table I).

\$ Programmatic Decisions

Programmatic factors that affect ER estimates can range from decisions regarding the number of facilities requiring D&D and their assumed cleanup level to decisions regarding which contaminant type volumetric information will be collected and reported. These decisions can greatly affect the resulting contaminated media estimate in a given year. For example, the 1996 BEMR estimate for the Savannah River Site (SRS) reflected substantial D&D activities and recorded very large volumes of LLW and MLLW. In contrast, the 1998 SRS PtC estimates assumed that many of its facilities would be put into long-term monitoring, rather

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than be decommissioned. The SRS PtC document states that there are too many uncertainties, too many unknowns, and considerable cost differences with different approaches to factor them into the SR [sic] cleanup strategy at this time. (11) This change in assumptions significantly decreased the estimates at SRS for LLW, MLLW and TRU.

The decision on which contaminant types to collect and report data also significantly affected the overall estimates. For example, none of the IDBs reported information on HAZ-contaminated media or waste, which particularly affected the estimates at SRS and the Oak Ridge Reservation (ORR). Similarly, the 1995 BEMR did not include mill tailings or 11e(2) byproduct material in its summary presentation of media and waste volumes, leaving the entire UMTRA Program out of its scope.

\$ Completion of Cleanup Activities

Since the ER program first began reporting estimates in 1990, it has completed cleanup at a substantial number of small sites and at specific projects at large sites (e.g., 1100 Area at Hanford). These completions can significantly affect the overall ER estimates, as is shown in Figure 1 for the 1998 PtC data. Because the 1998 PtC focused on remaining activities, it excluded the completed UMTRAP surface remediation, which resulted in an overall decrease in volume by about 32 million cubic meters of 11e(2)-contaminated media.

\$ Program Transfer

In fiscal year 1998, Congress directed DOE to transfer the Formerly Utilized Sites Remedial Action Program (FUSRAP) cleanup activities to the U.S. Army Corps of Engineers. Since the 1998 PtC did not include historical achievements, it did not include any contaminated media or waste associated with this program, resulting in a substantial decrease of over one million cubic meters.

\$ Other

In some publications, sites reported waste only while in other publications, all contaminated media were reported. For example, the Hanford Site did not include the 200 Area soils in IDB Revs. 8, 9, and 10, which it planned to cap in place. These soils were included in later publications and increased the Hanford LLW estimate by 20 million cubic meters.

Projection of Waste Volumes

ER waste projections are based on the contaminated media estimates together with information on 1) available technologies that address the contamination, 2) reasonably foreseeable land use preferences and decisions, and 3) regulatory agency input regarding cleanup decisions.

\$ Technologies

Available cleanup technologies drive whether specific remedial action or D&D activities are feasible. The assumed cleanup technology can also affect the projection of waste that will result from a given ex-situ response strategy. In some instances, e.g., the various underground nuclear tests, excavation of the contaminated media is impractical and in some cases infeasible. In such cases, only containment and

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monitoring response strategies are available to the ER program. Projections of waste generation rates, therefore, are very low.

For example, in IDB Rev. 8, NTS assumed it would have the technology to concentrate the long-lived radionuclides removed from contaminated soils, generating substantial volumes of TRU waste. Later projections did not rely on the availability of this technology. Similarly, other areas of contamination face technological feasibility barriers, such as the Underground Test Area at the Nevada Test Site.

\$ Land Use

The future land use anticipated at or near an area of contamination determines the extent of cleanup. Where sites are released for unrestricted land use, the cleanup requirements are more stringent and waste projections more significant than sites that continue some access controls.

For example, in the 1996 BEMR the Department assumed that the gaseous diffusion process buildings at the K-25 Site in ORR would be removed to grade and reported very substantial estimates of contaminated media. When this assumption changed (IDB Rev. 13 and the 1998 PtC) and DOE assumed re-industrialization for the site, the media estimates and waste projection estimates decreased significantly.

\$ Cleanup Levels

Cleanup levels and remedies for each contaminated area are developed through processes established by Federal and State laws and other legal requirements. As plans for a site evolve through the regulatory process and the involvement of stakeholders, the assumed cleanup level can change, significantly changing the overall estimate of contaminated media and waste to be addressed in a contaminated area.

For example, between the 1995 BEMR and the 1996 BEMR, the assumed cleanup level for NTS was revised from 40 pCi/g to 200 pCi/g, which resulted in a decrease of 2 million cubic meters of LLW.

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- (10) 1996 BEMR, Volume I, p. 3-13.
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