Section 1.0 Hanford Uranium Mass Balance Project

1.1 Project Overview

On August 8, 1999, the Secretary of Energy announced a comprehensive set of actions to address issues at the Department of Energy's (DOE) Paducah Gaseous Diffusion Plant in Paducah, Kentucky, that may have the potential to affect the health of the workers. One of the issues with DOE complex-wide significance involved the need to determine whether radioactive fission products and plutonium in uranium feed and waste streams existed in concentrations that present potential health or environmental concerns. The fission products and transuranic contaminants are contained in uranium that has been irradiated in a nuclear reactor and then processed in a separations plant to recover the uranium for reuse.

A working group was established to address this issue from a DOE complex-wide perspective. The Hanford Uranium Mass Balance Project was established to provide Hanford-specific data to the working group for inclusion in a complex-wide report. The Project Team was established, staffed with present and former Hanford workers, many with direct experience related to the facilities, processes and materials involved in the recycling of uranium or with the identification and retrieval of historical data at Hanford.

Between October 1999 and April 2000, a systematic search of available historical data was conducted and technical members of the Project Team evaluated relevant information. This report represents the results and conclusions of their evaluation.

1.2 Purpose and Scope

The purpose of this Project was to develop and provide data to the DOE Working Group that is responsive to a letter from the Deputy Secretary of Energy [Glauthier 1999] to all DOE elements dated September 15, 1999, and two follow-up memorandums from EH-1 [Michaels 1999]. Specifically, the data was to be sufficient to permit the working group to:

- Identify the mass flow of DOE recycled uranium from early production to March 1999, including ultimate use and disposition, and create an inter-site flow sheet for public availability.

- Identify the characteristics and contaminates in the major uranium streams, specifically, the technetium, neptunium, plutonium or other isotopic content of concern to worker or public health and safety.

- Conduct site mass balance activities sufficiently thorough to identify any significant implications for personnel exposure or environmental contamination.

- Conduct an occupational radiation exposure profile project at the Paducah, Portsmouth, and former Oak Ridge K-25 facilities.

The Hanford Uranium Mass Balance Project included an evaluation of shipments, receipts, and current inventories of recycled uranium to quantitatively estimate the flow and characteristics of recycled uranium to and from Hanford. It also included an evaluation of all Hanford facilities involved in processing recycled uranium, particularly with respect to the potential for concentrating plutonium or radioactive contaminants in the recycled uranium.

The uranium materials within the scope of this project are:

- All uranium (depleted, natural, or enriched, and in all physical and chemical forms) that has ever been irradiated in a reactor and separated from all or some of the fission products and transuranic products.

The uranium materials considered out-of-the-scope of this project are:

- Irradiated fuel and targets which have not been processed to separate all or some of the fission products and transuranic products from the uranium.

- Uranium in waste or under environmental management.

- Uranium in sources, samples, or under NRC agreement or State controls.

This information is intended to enable DOE to assess the historical potential for worker exposure from recycled uranium and its trace transuranic and fission product impurities.

1.3 Project Implementation Strategy

DOE Richland Operations Office (RL) management determined that the Project Team would be staffed with present and former Hanford chemists, engineers and other workers with knowledge of the Hanford facilities, processes and materials related to the recovery and reuse of recycled uranium. The Team also included personnel with experience in DOE nuclear material control and accountability, and document classification and declassification requirements and processes.

Hanford currently has approximately 75,000 boxes of historical records in archives, both on site and off. A discussion of the document research process used on this study is provided in Appendix E. The Project organization and functional activities are depicted in Figure 1-1.

In addition to the database searches, the RL Project Team made extensive use of the first hand knowledge of Team members to identify and search out specific

specifications, flowsheets, and analytical and shipping documentation known to have been prepared and used at Hanford.

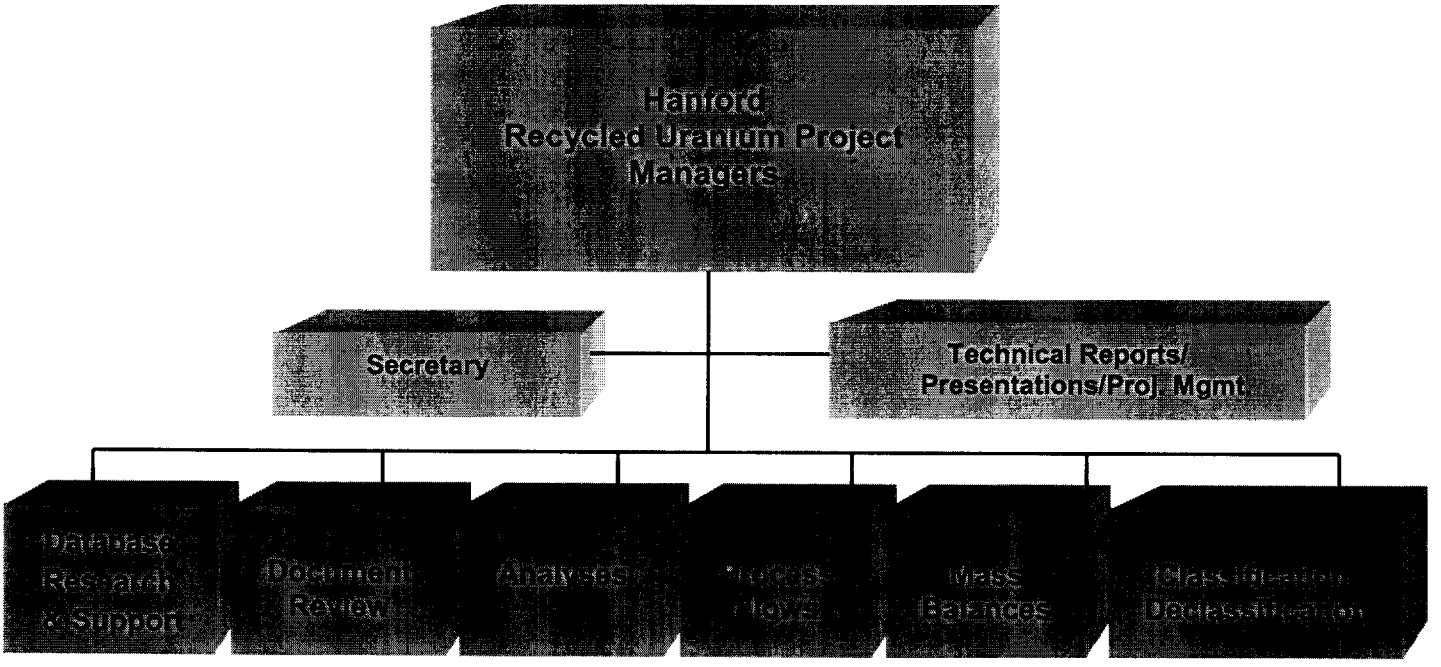

Figure 1-1 Hanford Recycled Uranium Project Functional Breakdown

1.4 Assumptions

The following assumptions were made by the RL Project Team during their review:

- Only production scale facilities were considered "in-scope." Facilities and materials utilized for research and development activities were considered to be "out-of-scope" for this project.

- Uranium is assumed to be "recycled uranium" only after it has been irradiated and then processed to separate it from the plutonium and fission products as pure UNH.

- Any uranium received at Hanford beginning in July 1952 and thereafter is assumed to be recycled uranium. This is the earliest that Hanford believes recycled uranium could have been returned to Hanford, since shipments of recycled uranium from Hanford did not begin until March, 1952.

- Radioactive contaminants in the uranium trioxide shipped from Hanford for which no radiochemical data has been found are assumed to be in the same range as those for which analytical data was located.

References

Glauthier 1999
Memorandum, T. J. Glauthier, Deputy Secretary of Energy, to All Department Elements, *Paducah Gaseous Diffusion Plant -- Follow-Up Activities*, U. S. Department of Energy, Washington, DC, September 15, 1999