CONF-950868--31
ANL/EA/CP--87182

ON-SITE DISPOSAL OF DECONTAMINATED AND DISMANTLED (D&D) MATERIALS: A MANAGEMENT APPROACH

By

John S. Hall
U.S. Department of Energy - Fernald Area Office
P.O. Box 538705
Cincinnati, Ohio 45253-8705

Todd R. Clark
Fernald Environmental Restoration Management Corporation
P.O. Box 538704
Cincinnati, Ohio 45253-8704

Michael J. Davis
Kurt C. Picel
Environmental Assessment Division
Argonne National Laboratory
9700 S. Cass Avenue
Argonne, Illinois 60439

For Presentation

at the

ENVIRONMENTAL RESTORATION 1995 CONFERENCE

DENVER, COLORADO

AUGUST 13-18, 1995

DISCLAIMER

Control #1284
John S. Hall
U.S. Department of Energy
P.O. Box 538705
Cincinnati, Ohio 45253-8705
Phone: (513) 648-3018 Fax: (513) 648-3976

ON-SITE DISPOSAL OF DECONTAMINATED AND DISMANTLED (D&D) MATERIALS: A MANAGEMENT APPROACH

INTRODUCTION

The Fernald Environmental Management Project (FEMP) is a federal facility located near Cincinnati, Ohio that is owned by the U.S. Department of Energy (DOE). The facility is being remediated according to the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended. Operable Unit 3 (OU3) of the FEMP consists of 232 buildings and other structures that formerly housed various uranium and thorium metallurgical and chemical processes. The buildings are constructed primarily of steel and concrete, with transite siding. The structures are being decontaminated and dismantled using an interim remedial action approach. An interim record of decision for the decontamination and dismantling (D&D) of FEMP buildings and structures was signed in July 1994. The disposition of the debris and other waste materials generated by the interim action is being addressed by the final remedial action for the operable unit. A final record of decision for disposition of the material is expected in 1996. The Proposed Plan for the final remedial action will be submitted to the U.S. Environmental Protection Agency in September 1995. The preferred alternative for the final disposition of the material generated by the interim remedial action is disposal of most of the material in an engineered disposal cell located on the FEMP property.

Management of waste materials generated by the interim remedial action is complicated by the fact that the FEMP is located in an environmentally sensitive area and by the complex nature of the materials. The principal aquifer located beneath the site, the Great Miami Aquifer, is designated as a sole-source aquifer under the Safe Drinking Water Act. Disposal of any wastes at the FEMP must be protective of the aquifer. Although similar construction materials (e.g., concrete, steel, and transite) were used in most structures, dismantlement of OU3 structures will result in a very heterogeneous waste stream, both in terms of types of materials and levels of contamination. Wastes to be managed also include contaminated production equipment and drummed materials associated with former production activities, as well as structural materials. Wastes will be contaminated at various levels, although contamination levels on structural materials will generally decrease following decontamination of the structures. All of these factors complicate the management of OU3 materials.

Control #1284
John S. Hall
U.S. Department of Energy
P.O. Box 538705
Cincinnati, Ohio 45253-8705
Phone: (513) 648-3018 Fax: (513) 648-3976

This paper discusses the approach proposed by the FEMP for the management of materials resulting from the interim remedial action. The components of the management approach being used to address disposal of the heterogeneous wastes from OU3 in an environmentally sensitive manner are discussed below, followed by some conclusions.

COMPONENTS OF THE MANAGEMENT APPROACH

The approach that is proposed to manage OU3 materials consists of four major components: 1) the identification of construction materials for segregation into various waste-management categories for final disposition in appropriate waste-management facilities, 2) the use of administrative decisions to minimize the placement of the most heavily contaminated materials in an on-property cell, 3) the development of technical criteria to limit the placement of certain materials in the cell, and 4) the evaluation of wastes to determine if appropriate criteria have been met.

The management approach being developed relies heavily on the utilization of existing process knowledge and characterization data to support management decisions for the wastes. A conservative characterization of intact structures was possible using process knowledge and other information as the basis for sampling locations. The management approach being developed will make efficient, conservative use of existing information to support protective, on-site disposal of most of the wastes.

Material Segregation

Material segregation is the functional means by which the management and disposition of wastes from dismantled construction materials will be effected. Wastes will be segregated into primary and secondary categories. Primary categories define the waste class types that drive the overall disposition options for materials, e.g., meets or does not meet a particular waste acceptance criterion. Secondary categories describe nine basic groups for managing materials by type. Of these, concrete and inaccessible metals combine to represent 80% of the total waste to be generated.

An inventory of construction materials was used to generate estimates of volumes of the nine material type categories (Table 1). Characterization data collected during the remedial

Control #1284
John S. Hall
U.S. Department of Energy
P.O. Box 538705
Cincinnati, Ohio 45253-8705
Phone: (513) 648-3018 Fax: (513) 648-3976

investigation are currently being used to estimate the apportionment of these volumes into the primary disposition categories mentioned above. Final estimates of these latter volumes are awaiting finalization of criteria for evaluating waste with respect to applicable acceptance criteria, as discussed below.

TABLE 1 - Estimated Debris Quantities by Category[1]

Material Description	Bulked Volume[2] (cubic feet)	Percent of Total
Accessible Metals - structural steels	1,025,000	7
Inaccessible Metals - visibly clean light gauge metals not suited for unrestricted release	5,820,000	40
Process Related Metals - gross contaminated tanks, pipes, ducts, and material handling equipment	496,000	3
Painted Light-gauge Metals - ductwork, doors, and metal sheeting	12,000	<1
Concrete and Masonry - slabs, walls, columns, and asphalt	5,890,000	40
Acid Brick	27,000	<1
Non-regulated Asbestos Containing Material - transite sheeting, floor tile, fire brick, and composite roofing materials	97,000	<1
Regulated Asbestos Containing Material - insulation and contaminated personal protective equipment	110,000	<1
Miscellaneous - fabric, wood, drywall, and office trailers	1,254,000	9
Total	14,731,000	100

Notes:

1. Containerized process residues and products destined for off-site disposal are not included above.
2. Bulked volume refers to containerized volumes for burial or offsite transportation.

Control #1284
John S. Hall
U.S. Department of Energy
P.O. Box 538705
Cincinnati, Ohio 45253-8705
Phone: (513) 648-3018 Fax: (513) 648-3976

Once waste evaluation criteria are finalized, it is proposed that materials will be classified into appropriate segregation categories as they exist in standing structures. This approach would allow all available process knowledge and existing characterization data to be brought to bear for an accurate and reliable categorization of the materials for appropriate disposition. It is further proposed that once the best attempt has been made to categorize materials with respect to waste disposition class on the basis of existing knowledge and data, no further characterization or monitoring of the materials would be required prior to disposition of the materials. An integral part of this approach would be careful tracking of the materials from their source to their final disposition location.

The debris from structures and equipment D&D will be placed into segregation categories by the demolition subcontractor as the dismantlement progresses. The segregated materials will be stored until the final remedial action for OU3 is implemented. Interim storage is required to allow for disposal cell construction and for generation of contaminated soils needed for backfill for the debris disposal. (It is undesirable to place uncontaminated soil in the cell.) Much of the contaminated soil needed for backfilling around OU3 debris is located beneath the FEMP structures and is not accessible until some building dismantlement activities are complete. A minimum soil-to-debris ratio for the disposal cell of 3:1 is planned. Temporary storage containers used for interim storage would be emptied at the on-property cell and reused to the extent practical.

Administrative Decisions on Material Disposition

Several critical administrative decisions have been made concerning OU3 wastes:

- The most heavily contaminated material will be excluded from consideration for on-property disposal. In particular, uranium product, heavily contaminated process equipment and piping, and residues from decontamination will not be considered for disposal on property.

- Certain metals (those in the accessible metals category) will be recycled to the extent practical.

- Technical criteria will be developed limiting the on-property disposal of other OU3 wastes. In particular, such criteria will be developed for concrete (porous media) and for painted

Control #1284
John S. Hall
U.S. Department of Energy
P.O. Box 538705
Cincinnati, Ohio 45253-8705
Phone: (513) 648-3018 Fax: (513) 648-3976

metals (coated media). These two categories address the majority of all OU3 materials. Other materials will be managed in a conservative manner on the basis of similarity to these two materials.

Because of the location of the FEMP, it is not generally acceptable to stakeholders to place all wastes into an on-property cell. In order to limit the mass of contaminants (primarily uranium) that could be placed in a cell, DOE will administratively exclude all heavily contaminated materials from consideration for on-property disposal. Recycling of some materials will also limit the quantity of waste to be placed in the cell. Those wastes that are being considered for placement in an on-property cell will have to meet technical criteria to ensure that their placement in the cell is protective of the underlying aquifer.

Development of Criteria for On-Property Disposal

Wastes placed in an on-property cell must not endanger the sole-source aquifer underlying the site. Criteria need to be established to specify what wastes are acceptable in the cell. Criteria governing disposal of OU3 wastes in an on-property cell are currently being developed. Site stakeholders will determine the acceptability of the criteria proposed to be established in the record of decision.

On the basis of characterization results for OU3 materials and the analysis of the potential for impacts on the Great Miami Aquifer, the contaminants of most concern in terms of their placement in an on-property cell are technetium (Tc) and uranium (U). Uranium was the principal material processed at the FEMP. Technetium is a fission product that was introduced at low levels at the FEMP in recycled uranium material processed at the site. Although only small quantities of technetium are present in OU3 materials, it is significant because of it relatively high mobility.

Two types of criteria are being considered for limiting the disposal of wastes containing technetium and uranium. One involves a concentration-based limit applied to material that would be placed in the cell. The second involves a limit on the total mass or activity of the contaminant that could be placed in the cell. Such criteria are being examined for concrete and for painted metals, which are the major sources of the two contaminants in OU3 wastes being considered for on-property disposal. Leaching tests have been performed using a variety of samples of contaminated concrete and coating materials from the former production buildings

Control #1284
John S. Hall
U.S. Department of Energy
P.O. Box 538705
Cincinnati, Ohio 45253-8705
Phone: (513) 648-3018 Fax: (513) 648-3976

to support the development of these criteria. This testing allows for development of site and media-specific values for leachability of each of the contaminants.

For U, a concentration-based waste acceptance criterion (WAC) will be employed. This WAC will be applied to wastes on a unit basis, e.g., per load or per a designated area of construction material within a standing structure under the proposed management approach. The unit basis has not yet been finalized.

Control of Tc inputs into the disposal cell, on the other hand, does not appear to be amenable to the use of a WAC in the sense it is being considered for U, due to the high leachability of Tc from construction materials, and the fact that Tc leaching behavior is difficult to model. Therefore, controlling Tc loading to the cell is currently being proposed to be done on the basis of a limit on the total mass of Tc to be allowed into the cell. The application of this latter criterion, then, by its very nature, has to be conducted on the basis of evaluating the total mass of Tc in OU3 wastes. Approaches to implementing the different criteria for wastes containing Tc and U and associated issues are discussed below.

Evaluation of Wastes to Determine If Criteria Are Achieved

Evaluating wastes with regard to meeting the concentration-based WAC for U can be effected in basically two different ways, 1) evaluating construction materials in place prior to demolition, excluding materials that exceed WAC, and allowing materials that meet WAC to be placed in the cell without further monitoring, or 2) monitoring wastes loads prior to admitting them to the cell to establish that materials in each load meet WAC. The first approach is consistent with the overall management approach described above and is far preferable to the second approach because of the advantage of the existing knowledge base for the standing materials. This knowledge base consists of a vast quantity of process knowledge and routine survey data from the operational period of the plant, as well as the substantial body of detailed chemical and radiochemical characterization data collected in the recent remedial investigation for the operable unit.

Most of this knowledge would be superseded under the second approach, wherein a final evaluation of the construction wastes would be conducted after structures are dismantled. The former knowledge, in fact, would be unusable if construction debris were not carefully

Control #1284
John S. Hall
U.S. Department of Energy
P.O. Box 538705
Cincinnati, Ohio 45253-8705
Phone: (513) 648-3018 Fax: (513) 648-3976

segregated during dismantlement. This final monitoring effectively requires an independent characterization of the materials, a characterization that would be exceedingly difficult and labor intensive, given the heterogeneity of the contaminated wastes and the difficulty in accessing contaminated surfaces in containerized wastes.

Assuming the first approach is acceptable, a WAC would be applied to standing, or *in-situ*, materials, resulting in a predisposition of the wastes. The unit basis for applying WAC, therefore, would vary with the region or extent of contamination in a given material. It is expected that using field judgments as to the extent of a given region of contamination in a given material that is in excess of the WAC would be the most practical, reliable and effective means of implementing a concentration-based WAC. Regions of materials so identified would be excluded from the cell and/or subjected to treatment as necessary.

Evaluating wastes, or construction materials destined to be wastes, with regard to a mass-based criterion for limiting Tc placement in the proposed disposal cell requires an overall perspective of OU3 materials and Tc contamination therein. Since there would be a limit on the total mass of Tc admitted to the cell, the entire inventory of materials in OU3 needs to be considered as a whole, rather than as individual pieces, which would be the approach under a concentration-based criterion. As under the management approach for U, it is proposed that the management of Tc contaminated materials rely on existing knowledge and characterization data obtained in the remedial investigation. Such data may be supplemented with additional field surveys to refine the region of contamination. Data obtained in the remedial investigation have already been used to estimate Tc quantities in all material items comprising the OU for the purpose of estimating a total source term for Tc. These estimates are available for managing materials under a mass-based limit for Tc.

In this review of Tc contamination in OU3 materials it must first be determined if the total quantity of Tc in those materials exceeds the cell limit (with some safety factor applied). If not, no materials would need to be excluded on the basis of this criterion. If, on the other hand, the total quantity exceeds the allowable quantity, then certain contaminated materials containing the excess quantity of Tc would be identified for exclusion from the cell or for further treatment. Any material would qualify for exclusion, but materials containing the highest concentrations of the most leachable forms of Tc would be selected first. In such materials, the total quantity of Tc could be reduced through spot removal of contamination through scabbling or other

Control #1284
John S. Hall
U.S. Department of Energy
P.O. Box 538705
Cincinnati, Ohio 45253-8705
Phone: (513) 648-3018 Fax: (513) 648-3976

surface removal techniques. Estimates of the quantity of Tc removed would be required so that a revised total quantity could be computed.

Beyond meeting the mass-based limit for Tc, additional efforts to eliminate readily removable Tc from materials may also be carried out in the spirit of achieving the lowest practical quantity of contaminant being placed in the cell. The practices employed in such an effort would be determined in the field on a case-by-case basis.

CONCLUSIONS

The FEMP has developed an approach that will allow on-property disposal of contaminated materials generated by the demolition of site structures. The use of material segregation, administrative controls, criteria limiting waste to be disposed in the cell, and existing characterization data and historical knowledge will allow for the safe and effective disposal of such wastes in an on-property disposal cell. More specifically,

- It is possible to manage OU3 wastes conservatively so that on-property disposal in a sensitive area is acceptable.
- The acceptability of the approach to stakeholders depends on the exclusion of the most contaminated materials (a balanced approach).
- A large knowledge base consisting of process knowledge, survey data, and results provided by the previous characterization of OU3 structures will allow the efficient management of OU3 waste materials.
- Specific technical criteria need to be developed to ensure that limits are placed on the materials acceptable for the cell. For the FEMP, the materials of most importance are concrete and painted metals. The contaminants of most concern are technetium and uranium.

Control #1284
John S. Hall
U.S. Department of Energy
P.O. Box 538705
Cincinnati, Ohio 45253-8705
Phone: (513) 648-3018 Fax: (513) 648-3976

Co-Authors:

Todd R. Clark
FERMCO
P.O. Box 538704
Cincinnati, Ohio 45253-8704
Phone: (513) 648-4113 Fax: (513) 648-3956

Michael J. Davis
Kurt C. Picel
Argonne National Laboratory
9700 S. Cass Avenue
Argonne, Illinois 60439
Phone: (708) 252-7697 Fax: (708) 252-6414
Phone: (708) 252-4018 Fax: (708) 252-4336