Waste Disposal Options and Fernald Lessons Learned Technical Memorandum
Frequently Asked Questions

Niagara Falls Storage Site – Waste Disposal Options and Fernald Lessons Learned Technical Memorandum

No.	Question	Response
1	What are the NFSS Feasibility Study (FS) Technical Memoranda and how will they be used in the FS process?	The Niagara Falls Storage Site (NFSS) Feasibility Study (FS) Technical Memoranda are supporting documents to be used for the development of the FS Report for each of the NFSS Operable Units (OUs) (i.e. Interim Waste Containment Structure (IWCS), Balance of Plant, and Groundwater). The technical memoranda will document and evaluate key elements that must be addressed in the FS, and will provide a means for communicating fundamental issues necessary for the development and evaluation of remedial alternatives for the three OUs. The technical memoranda will provide opportunities for active public involvement during the development of the FS. The information from these technical memoranda will assist the Corps in developing a better understanding and estimate of the degree of complexity, costs and effectiveness, both short-term and long-term, for each alternative in the FS. For example, the Corps issued a fact sheet that presented the objective and purpose of each technical memorandum prior to its development to provide the public with an early opportunity for review and comment. The public will have another opportunity for review and comment following completion of each technical memorandum. Five technical memoranda are being prepared in support of the development for the IWCS FS. Additional technical memoranda will be developed for the Balance of Plant and Groundwater OUs. The IWCS OU technical memoranda are: • Waste Disposal Options and Fernald Lessons Learned • Radon Assessment • Preliminary Evaluation of Health Effects for Hypothetical

		Exposures to Contaminants from the IWCS • Remedial Action Objectives and Applicable or Relevant and Appropriate Requirements • Remedial Alternatives Technologies Development and Screening
2	What is the purpose and objective of the Waste Disposal Options and Fernald Lessons Learned Technical Memorandum?	The purpose of the Waste Disposal Options and Fernald Lessons Learned Technical Memorandum was to: • Present a summary of remediation activities conducted by the U.S. Department of Energy (USDOE) for the K-65 residues stored at Fernald, Ohio, • Identify and discuss Fernald lessons learned from handling, processing, and disposing of the K-65 residues, as well as other materials similar to those that will likely be found within the IWCS at the NFSS, and • Evaluate potential off-site waste disposal options for the waste within the IWCS. The specific objectives of the technical memorandum are to: • Identify similarities between the remediation of the Fernald K-65 residues and the potential remediation of the IWCS K-65 residues and other associated waste, • Identify lessons learned associated with the remediation of the Fernald K-65 residues that may apply to the potential remediation of the IWCS K-65 residues and other associated waste, • Identify current or potential disposal options for the IWCS waste streams that may be generated during remediation activities, and • Provide a preliminary estimate of waste volumes and disposal costs for the expected waste streams to assist in evaluating potential remedial alternatives in the IWCS FS.
3	Why were Fernald Lessons Learned evaluated to support the NFSS IWCS FS?	There are fundamental similarities between the uranium processing residues that were managed at Fernald and those present in the IWCS. Specifically, the high radium content K-65 residues present in the

		IWCS were also stored in aboveground silos at the Fernald facility, which has already undergone cleanup and successful closure under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Due to the presence of the K-65s at both sites, elements of the completed Fernald remedial project will be considered during the development of remedial alternatives for the IWCS FS, including: • The retrieval, treatment, shipping, and disposal of the K-65 residues and other wastes; • The site radiological control program; and • Stakeholder and workforce involvement. Lessons learned from the Fernald remedial activities will help to refine potential remedial alternatives for the IWCS.
4	How were the K-65 residues stored at Fernald and how was that different than the conditions at NFSS?	The K-65 residues were stored at Fernald in two cylindrical aboveground concrete silos with steel reinforcement. The silos had domed tops and were surrounded by an earthen berm to provide structural support and shielding from radiation. The containerization reduced the escape of radioactive radon gas. A total of approximately 8,900 cubic yards (yd^3) of K-65 residues were contained in two silos. The residues at the NFSS were placed inside of concrete-reinforced buildings that were designed to hold water with foundations below grade; approximately 10,550 yd^3 of residues (including 4,030 yd^3 of K-65 residues) were put in the IWCS. The residues are covered by layers of other wastes and materials, and then by a constructed clay cap. Similar to Fernald, the materials placed above the residues in the IWCS minimize the release of radon gas and shield gamma radiation. Unlike Fernald, disposal in the IWCS included a range of materials (e.g. building rubble, piping, construction equipment, and contaminated soil), not just residues.
5	What was the lesson learned for handling and disposing of K-65 residues at Fernald that can be applied to the evaluation of remedial alternatives at NFSS?	The primary lesson learned from Fernald activities was that the K-65 residues can be handled and disposed successfully and safely. Handling of the wastes included removal, treatment, packaging, shipping, and disposal.

		The K-65 residues were removed from the silos and treated to meet the U.S. Department of Transportation (DOT) regulations for shipment of radioactive waste and to meet the off-site facility's waste acceptance criteria for disposal of radioactive waste. Treatment of the Fernald K-65 residues consisted of chemical stabilization by blending the material with fly ash and Portland cement. The treated waste was poured into custom-designed containers and allowed to set into a solid waste. A radon control system was constructed to control emanation of radon gas during the retrieval, treatment and temporary storage of K-65 residues. As part of the remediation facility design, much of the equipment was designed to operate automatically and remotely to minimize personnel exposure to radiation. The waste container handling system was designed to produce filled containers that were secure and safe for transportation and final disposal directly into the off-site disposal cell. Lessons learned concerning these processes used at Fernald can be used to evaluate and design potential remedial alternatives for the IWCS.
6	What was the lesson learned for removing K-65 residues at Fernald that can be applied to the evaluation of remedial alternatives at NFSS?	Hydraulic mining was utilized to remove and transfer the K-65 residues at Fernald from the silos to temporary storage tanks while awaiting construction and startup of the on-site remediation facility. The hydraulic mining method used at Fernald employed high-pressure water to flush the residues out of the silos in the form of a slurry. This slurry was then pumped through piping to the remediation facility. The remediation facility was designed to receive K-65 slurry, prepare the material for treatment using chemical stabilization, and to fill containers for loading and shipment to an off-site disposal facility. When hydraulic mining of the K-65 and other residue material for removal is evaluated for the IWCS FS, the waste retrieval design and operation features used at Fernald will be appropriate for consideration.

		This will include both the advantages and disadvantages of the process as proven at Fernald. In any case, the differences in specific conditions would make it necessary to modify the Fernald waste removal design in evaluating remedial alternatives for the NFSS IWCS.
7	What were the lessons learned for protecting on-site workers and the community at Fernald that can be applied to the evaluation of remedial alternatives at NFSS?	During remediation efforts at Fernald, construction and operation of a radon control system (RCS) was used to control radon gas emanation during the retrieval, treatment, packaging and storage of K-65 residues. By containing and treating the radon gas, operation of the RCS effectively negated any radon leakage to the environment (including both on-site workers and the public) during the remediation project. Using remote waste handling equipment reduced the need for workers to be in close proximity to the residues and, together with radon gas abatement, reduced the level of personal protective equipment required. These actions resulted in increased worker safety and efficiency as well as protection of the public and environment. Additionally, implementation of an integrated safety management program across all facets of the project helped address some of the significant safety challenges at Fernald, which included multiple demolition and construction project activities and the movement of heavy equipment. Any potential remedial alternative for the NFSS IWCS, especially alternatives that involve activities in or around the residues, will include an integrated safety system for protection of workers, the public, and environment as was designed and conducted at Fernald. The system would be designed specifically for NFSS, but the lessons learned from operation of the Fernald RCS, remote equipment operation, and integration of safety programs would be considered and applied as appropriate.

8	What are waste classifications?	Waste classification is a process used to group wastes that pose similar risks or hazards to human health and the environment so that they can be appropriately managed with minimal impact to the environment. Waste characterization, which includes the analysis and evaluation of the constituents in a waste or the means by which the waste was generated, determines how a waste is classified. The waste classification ultimately determines the requirements for treatment, storage and disposal according to regulatory criteria established by the Federal or state governments. The classification of a particular waste can limit the facilities that can receive the waste for treatment and/or disposal as well as impose constraints on the type(s) of packaging that may be used to transport and dispose of the waste. The waste classification becomes a primary consideration in evaluation of options for treatment, storage and disposal.
9	What waste classifications were used for Fernald wastes?	The K-65 residues and the other silo contents stored at the Fernald Site were classified as 11e.(2) byproduct material as defined under the Atomic Energy Act of 1954 for the purpose of disposal. Wastes generated at the Fernald Site from other on-site soil remediation and decontamination and demolition activities were classified as low-level radioactive waste and mixed low-level radioactive waste.
10	What is 11e.(2) byproduct material and what does this classification mean?	11e.(2) refers to byproduct material as defined in Section 11e.(2) of the Atomic Energy Act of 1954. Under this definition, byproduct material includes the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material. This classification means that there are specific Federal and state regulations that define the management, handling, and disposition of these materials. The importance of this classification to the NFSS is that Congress has specified that the ore processing residual materials in the NFSS IWCS are considered 11e.(2) byproduct material for the purpose of disposal.

11	What are waste acceptance criteria?	Waste acceptance criteria (WAC) are specific requirements that must be met for a waste to be placed (for treatment, storage and/or disposal) at a licensed facility. WAC control such things as the type of waste accepted, the type of waste container used, the amount of radioactive material in a container, the way a container is packaged and labeled, the contamination levels on the outside of a container, and the physical and chemical form of the waste.
12	What lesson learned regarding disposition of waste can be taken from the Fernald remediation project?	The main lesson learned from the Fernald remediation project regarding disposition of waste is that the K-65 residues can be disposed at an appropriately licensed off-site waste disposal facility. The K-65 residues were treated so they could be transported and accepted for off-site disposal. After considering multiple candidate facilities, Waste Control Specialists (WCS), a facility in Texas, was selected as the off-site repository (for temporary storage) of the treated K-65 residues. WCS was eventually issued a license for the disposal of 11e.(2) byproduct material in 2008, thus allowing permanent disposal of the Fernald K-65 waste containers in their byproduct cell.
13	What was the lesson learned for treating K-65 residues at Fernald that can be applied to the evaluation of remedial alternatives at NFSS?	The key lesson learned regarding treatment of the K-65 residues at Fernald is that the residues can be successfully treated for shipment and disposal at an off-site waste disposal facility. Once the K-65 residues were removed from the silos at Fernald, they were treated to meet the U.S. DOT regulations for shipment of radioactive waste and to meet the off-site facility's WAC for disposal of the radioactive waste. Treatment of the Fernald K-65 residues consisted of chemical stabilization by blending the material with fly ash and Portland cement. The treated waste was placed into custom-designed containers and allowed to set into a solid waste form. A similar method to treat and containerize the K-65 residues could be considered when evaluating potential remedial alternatives in the IWCS FS.

14	What was the lesson learned regarding vitrification at Fernald? The vitrification treatment process heats the waste materials to such temperatures that the materials fuse to a glass-like state, which permanently immobilizes the radioactive and non-radioactive metals within the vitrified waste form.	The Corps learned that vitrified wastes are leach-resistant and effectively reduced the radon gas emanation rate from the vitrified K-65 material to acceptable levels. The Corps also learned that vitrification was technically difficult and ultimately a different technology was used called chemical stabilization. Chemical stabilization is a non-thermal treatment process that mixed the K-65 residues with chemical additives such as Portland cement, flyash, or other silicates. While vitrification was ultimately deemed to be not applicable at Fernald due to technical issues, technical advances have improved the technology. As a result, vitrification will be included in the evaluation of potential IWCS remedial technologies in the IWCS FS.
15	What was the lesson learned for resource recovery from the K-65 residues at Fernald?	The Corps learned that for Fernald K-65 material, the reprocessing of silo wastes to recover radiological or inorganic constituents was not feasible due to poor treatability test results involving chemical separation techniques (see *Record of Decision for Operable Unit 4*, Fernald Environmental Management Project Fernald, Ohio. November 1994.).
16	Can the K-65 residues be reprocessed for use in a nuclear reactor?	The K-65 residues cannot be reprocessed for use in a nuclear reactor because such reactors use enriched (purified) uranium or plutonium as fuel, which are not present in the K-65 residues.
17	What off-site location was used for disposal of K-65 residues from Fernald?	Treated K-65 residues from Fernald were shipped and disposed at WCS, a licensed waste disposal facility in Texas.
18	How were the K-65 residues transported from Fernald to the off-site disposal facility?	Once the K-65 waste containers were filled, cured, sealed, and certified, they were transferred to a flat bed truck and secured. Each truck was capable of handling two containers, in accordance with U.S. DOT requirements.

19	What kind of shipping containers were used to transport K-65 residues from Fernald?	K-65 residues from Fernald were packaged for shipment in ½-inch thick steel cylinders that were 6 foot 3 inches in diameter and 6 foot 7 inches high, with a maximum gross weight of approximately 11 tons. The disposal volume of each container was approximately 200 cubic feet. The containers were designed and tested to comply with the U.S. DOT IP-2 package requirements. A total of 3,776 containers were used to ship the Fernald K-65 residues.
20	Were community concerns about construction traffic and noise considered in the Fernald remediation program?	Input from the community was sought during the planning and implementation of the Fernald remediation project. A citizens group provided valuable input on various issues that were most critical to the community. Concerns about construction traffic and noise were addressed during regularly planned meetings with community groups. Specific actions taken during any potential remedial activities (such as traffic, noise, etc.) at the NFSS are considered short-term impacts and will be evaluated as part of the effectiveness criteria in the detailed analysis of the FS. The Corps will continue to request feedback from the public as the site moves through the CERCLA process.
21	How many trucks were used at Fernald to transport K-65 residues from Fernald to the off-site disposal facility?	Nearly 2,000 shipments of treated K-65 residues were made to the off-site waste disposal facility via flat bed truck.
22	How long did it take to complete the K-65 residue removal operations at Fernald?	The removal and off-site shipment of the K-65 material from Fernald took nearly two years. A brief timeline for the K-65 removal is as follows: • September 2004 - Bulk retrieval of the K-65 material from the storage silos was initiated. • May 2005 - Treatment and packaging of the Fernald K-65 material was initiated. • June 2005 - Shipment began for off-site disposal in Texas. • May 2006 - The last shipment of the K-65 material left Fernald for off-site disposal.

23	What types of on-site facilities were required to support the removal, treatment, and packaging of K-65 residues at Fernald?	The following were the main on-site facilities used to support the removal, treatment and packaging of the K-65 residues at Fernald: • Radon Control System (RCS) Facility – housed the RCS used to control and remove radon gas emissions from the K-65 residues. • Accelerated Waste Retrieval Systems - provided facilities and equipment for transferring the K-65 residues from the storage silos to temporary storage tanks while awaiting construction and startup of the remediation facility and then the transfer from the temporary storage tanks to the remediation facility. • Transfer Tank Area - allowed for storage of the material in a safer configuration than the storage silos while remediation by the selected treatment alternative was put in place • Wastewater Treatment Processing Facility - removed excess total solids, lead, and radium from the process water before it was discharged safely to the environment. • Waste Treatment and Packaging Remediation Facility - designed and constructed to accept the K-65 residues in slurry form as they were transferred from the temporary storage tanks via the waste retrieval system. The waste was then treated and processed into final form and loaded into the final waste containers, which were placed on the transport trailers and readied for shipment to an off-site disposal facility.
24	What are the potential off-site facilities for disposal of NFSS IWCS wastes and where are the facilities located?	Comparison of the known characteristics of the IWCS waste streams to the WAC for potential waste disposal facilities led to identification of the following viable waste disposal facilities for NFSS wastes: • EnergySolutions (Utah); • U.S. Ecology (Idaho); • Waste Control Specialists (Texas); • Wayne Disposal, Inc. (Michigan); and • Nevada National Security Site (Nevada). The WAC used for identifying viable facilities included physical waste forms (i.e. solid, liquid, etc.), radionuclide-specific concentration limits, waste shipping container types, and transportation modes.

25	How and when will potential land uses for the NFSS be evaluated and determined?	Land-use decisions will not be made in the IWCS FS. Land use for the NFSS will be determined as part of the FS for the Balance of Plant, which will evaluate remedial alternatives using cleanup goals consistent with the determined land use.
26	Was transportation of wastes by rail considered at Fernald?	Alternate transportation modes, including shipment of the waste containers in gondola or flat railcars, were evaluated for the Fernald remediation project. A prototype insert for a gondola railcar, to allow the shipment of seven containers per car, was designed, constructed, and successfully tested. During subsequent analysis, it was determined the costs associated with this approach may be higher than the baseline truck approach. It was also determined that flatcars may not be economically feasible, due to the significant supplemental radiological shielding required to meet U.S. DOT requirements for a reasonable payload (5-7 containers per railcar). In addition, the volume of waste at Fernald for off-site disposal was limited because the non-residue waste was disposed of in an on-site disposal cell at Fernald. The use of rail in transporting waste from the NFSS will be evaluated in the remedial alternatives assessment in the IWCS FS. Currently, there is no rail spur available at NFSS, although nearby spurs could be used as part of a bimodal (truck-to-rail) transportation plan.