

Niagara Falls Storage Site

Formerly Utilized Sites Remedial Action Program

Waste Disposal Options and
Fernald Lessons Learned
Technical Memorandum

Lewiston, New York
September 28, 2011



US Army Corps of Engineers
Buffalo District
BUILDING STRONG

Interim Waste Containment Structure



Slide 1 - John Busse

Welcome to the Niagara Falls Storage Site (NFSS) Waste Disposal Options and Fernald Lessons Learned Technical Memorandum Public Workshop. This presentation focuses on the first in a series of five (5) TMs developed to support the Feasibility Study for the Interim Waste Containment Structure (IWCS) at the NFSS. The Corps' goals in developing these TMs are to present background information for key technical components and get your feedback early in the FS process.

Tonight we hope to get your feedback on some of the material presented in the Tech Memo which covers potential waste disposal options for materials currently stored in the Interim Waste Containment Structure (or IWCS). We will also present information on how materials similar to those stored in the IWCS were successfully remediated at a site in Fernald, Ohio. But first, I'd like to take a moment to introduce the Corps' NFSS Project Team:

- Jane Staten – NFSS Project Engineer
- Michelle Barker – Regional Technical Specialist
- Dr. Karen Keil – Risk Assessor
- Neil Miller – Health Physicist
- David Frothingham – Environmental Engineering Team Leader
- Bill Frederick – Environmental Project Management Team Leader
- Jeff Hall – Environmental Health Team Leader
- Arleen Kreuzsch – Outreach Specialist
- Natalie Watson – Outreach Specialist
- Bruce Sanders – Public Affairs Officer
- Andrew Kornacki – Public Affairs Officer
- Roger Burch – Strategic Planner
- Douglas Sarno – Forum Facilitation Group, IWCS FS Technical Facilitator
- SAIC (Julie Reiting, Principal Scientist; George Butterworth, Principal Investigator; Steve Conner, Project Manager)

WELCOME!

Agenda

- 6:00 - 6:10** Opening remarks and introductions
- 6:10 - 6:30** The CERCLA process
- 6:30 - 7:00** Fernald Lessons Learned and their applicability to the NFSS
- 7:00 - 7:10** Fernald Lessons Learned Questions
- 7:10 - 7:40** Wastes in the Interim Waste Containment Structure (IWCS) & Considerations for Off-Site Disposal
- 7:40 - 7:55** IWCS Waste Disposal Questions
- 7:55 - 8:00** Transition to small group dialogue
- 8:00 - 8:45** Small group dialogue
- 8:45 - 8:55** Small group reports
- 8:55 - 9:00** Workshop concludes



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Slide 2 – Doug Sarno

The purpose of tonight's workshop is to get your feedback regarding information presented in the "Waste Disposal Options and Fernald Lessons Learned Technical Memorandum" which we will refer to tonight as the "Lessons Learned Tech Memo".

I'd like to begin with an explanation of the cleanup process, as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the role public involvement has in this process. We will discuss where the NFSS is in that process. We will then move on to a review of the successful remediation of NFSS-like materials at Fernald, Ohio, followed by a summary of the wastes contained in the IWCS and facilities that could accept the wastes for disposal. Questions will be taken from the audience following the presentation of each topic.

At the conclusion of the presentation, we invite you to join small breakout group discussions. The break out groups will allow the NFSS project team to respond directly to your questions. You may also submit questions by sending us an e-mail or by filling out a comment card. The comment period began August 1st (when the TM was issued) and ends one month after this public workshop. That means comments should be submitted before October 28, 2011.

Interim Waste Containment Structure (IWCS) Operable Unit (OU) Feasibility Study (FS) Process and Public Participation



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Slide 3 – Doug Sarno

This presentation will provide a brief overview of the steps involved in the Feasibility Study (FS) Process for the Interim Waste Containment Structure (IWCS) Operable Unit (OU).

It will also discuss how Public Participation will be integrated into this process and the role and scope of the technical facilitator.

This is intended to serve as a brief review of the process we are taking in the FS to set up the main topic of tonight's workshop on Fernald lessons learned and off-site disposal options.

The IWCS is One of Three Operable Units (OUs) to be Addressed at the NFSS

1. IWCS
2. Balance of Plant
3. Groundwater



Slide 4 – Doug Sarno

The IWCS is one of three key projects or operable units that make up the remedial program for the NFSS. The IWCS contains the vast majority of the contamination and will likely be the most complex and costly of the three. The Balance of Plant OU will look at soils and other materials that are located outside the IWCS. The groundwater OU will then explore any contamination in the groundwater.

A separate remedial process is being conducted for each of the three OUs.

Tonight we are addressing the IWCS.

CERCLA is the Governing Regulation for FUSRAP Sites

- CERCLA: The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 - the law which established the response authority and cleanup fund (Superfund) for the Nation's cleanup of inactive and abandoned hazardous waste sites



Slide 5 – Doug Sarno

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, also known as CERCLA or Superfund, is the law and EPA program that is followed by FUSRAP to conduct investigation and cleanup of sites.

FUSRAP follows the CERCLA process in its investigation of the site and will use the remedial decision-making of CERCLA in making each of the three decisions for each of the OUs.

CERCLA Lead Agency Status at Federal Facilities

- At non-National Priorities List (NPL) sites like NFSS, the Federal agency with jurisdiction over the facility is the lead agency
- EPA has oversight of remedial actions at Federal facilities on the NPL like Fernald

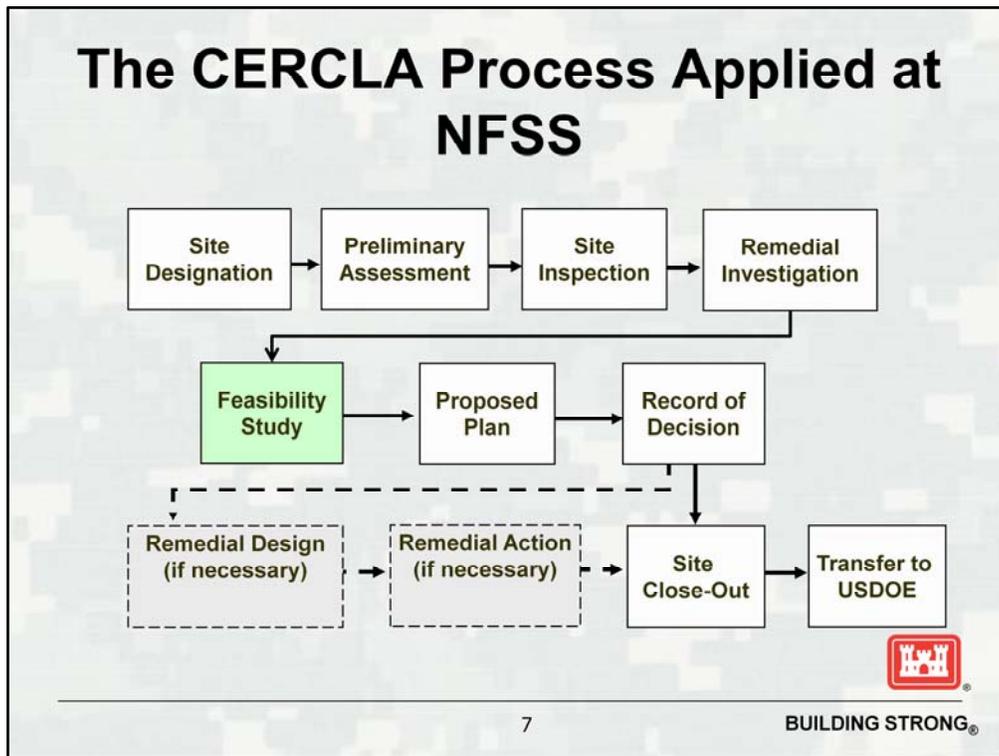


Slide 6

The NFSS is not on the National Priorities List (NPL) which identifies the highest priority sites in the country. This is due in large part to the fact that the IWCS was already in place at the time the site was scored, and was managing the vast majority of risk posed by the site.

As a non-NPL federal facility under CERCLA, the Corps is the lead agency and has overall responsibility for managing the remediation process and all decision-making with input from other agencies and the public.

Fernald which we will hear about shortly, was on the NPL and the US Environmental Protection Agency was the lead agency and had oversight over the remediation process there.



Slide 7

This is a figure showing the CERCLA process that you have seen before and is in a number of Corps reports. The NFSS has completed the investigation stages shown on the top line for all three OUs and is now in the feasibility study stage for the IWCS OU. Each OU will have its own FS and decision process. The FS for the IWCS OU will continue for the next two years and involve a number of steps and reports which we will discuss next.

At the end of the FS, the Corps will evaluate a range of remedial alternatives and propose one of them in a proposed plan. This proposed plan will be released for formal public comment, the comments will be considered and necessary changes made and the final decision recorded in a Record of Decision or ROD.

The FS process on the other two OUs could begin during the FS for the IWCS OU, however, those final decisions will be directly dependent on the decision for the IWCS OU and cannot be evaluated until after the IWCS OU decision is made.

Any actions proposed will then be implemented through a detailed remedial design process and remedial action. It is possible that remedial action for some or all of the OUs will be done in a coordinated manner.

Once remedial action is complete and all objectives met, the site will go through closeout and enter long-term stewardship at which point it will be transferred to the US Department of Energy (DOE) for management under its long-term stewardship program.

CERCLA Feasibility Study (FS)

- Study to develop and evaluate remedial alternatives
- Uses data gathered during the RI
- RI data used to define objectives of the response action and to develop remedial action alternatives
- Includes detailed analysis of each alternative



Slide 8

This is the CERCLA definition of an FS just to provide us with some context for this stage in the process.

The key elements of the FS are to define remedial objectives, develop alternatives, and then conduct a detailed analysis of those alternatives to allow for a final decision on a course of action.

IWCS OU FS Range of Remedial Alternatives

- Removal of the entire IWCS contents with off-site disposal
- Removal of all or some of the residues with off-site disposal
- Removal of residues with placement in a new, engineered, on-site, long-term storage facility
- Treatment could be applied to any of the above
- Limited action—enhanced IWCS containment and environmental monitoring
- No action (baseline alternative required by CERCLA)



Slide 9 – Doug Sarno

The preliminary range of remedial action alternatives was outlined in the FS Workplan in December 2009.

CERCLA requires that a full range of alternatives be explored including a no action alternative.

For the IWCS OU this translates to a wide combination of on- and off-site disposal, with or without leaving materials in the IWCS. Options could also include building a new on-site facility to manage some or all of the materials.

It is important to note that there is no presumptive alternative. None of these options has been developed or evaluated yet. The technical memorandum we are discussing tonight identified currently available off-site disposal locations and the likely associated costs of disposal of IWCS materials. This is important information that will help us to understand potential solutions, but the development and analysis of actual off-site options will not occur until next year.

CERCLA Remedy Selection Criteria

Threshold Criteria (must be met)

- Overall protection of human health and the environment
- Compliance with ARARs (applicable or relevant and appropriate requirements)

Balancing Criteria (basis of technical analysis)

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying Criteria (considered after formal comment period)

- Agency acceptance
- Community acceptance



Slide 10 – Doug Sarno

All remedial action alternatives will be evaluated using the nine evaluation criteria established under CERCLA.

These criteria are organized in three tiers. Threshold criteria must be met for any alternative to be selected, and this analysis will be conducted for all alternatives. Of course overall protection of human health and the environment is the top priority. All alternatives must also meet legal requirements that are determined to be applicable or relevant and appropriate (ARAR) to the site.

All alternatives that meet the threshold criteria are evaluated by a detailed analysis of the five balancing criteria.

Finally, comments received on the proposed plan will be used as modifying criteria to ultimately determine the final decision. It is important to note however, that the Corps will not be waiting until formal comment on the proposed plan to obtain public and agency input. This input will be gathered and considered throughout the process.

Five Technical Memoranda (TM) Being Developed for the IWCS OU FS

1. Waste Disposal Options and Fernald Lessons Learned (now)
2. Radon Assessment (fall/winter 2011)
3. Health Effects of Hypothetical Exposures to Contaminants from the IWCS (fall/winter 2011)
4. Remedial Action Objectives and Applicable or Relevant and Appropriate Requirements (spring 2012)
5. Remedial Alternatives Technologies Development and Screening (summer 2012)
6. FS Report will present the overall evaluation of alternatives (2013)

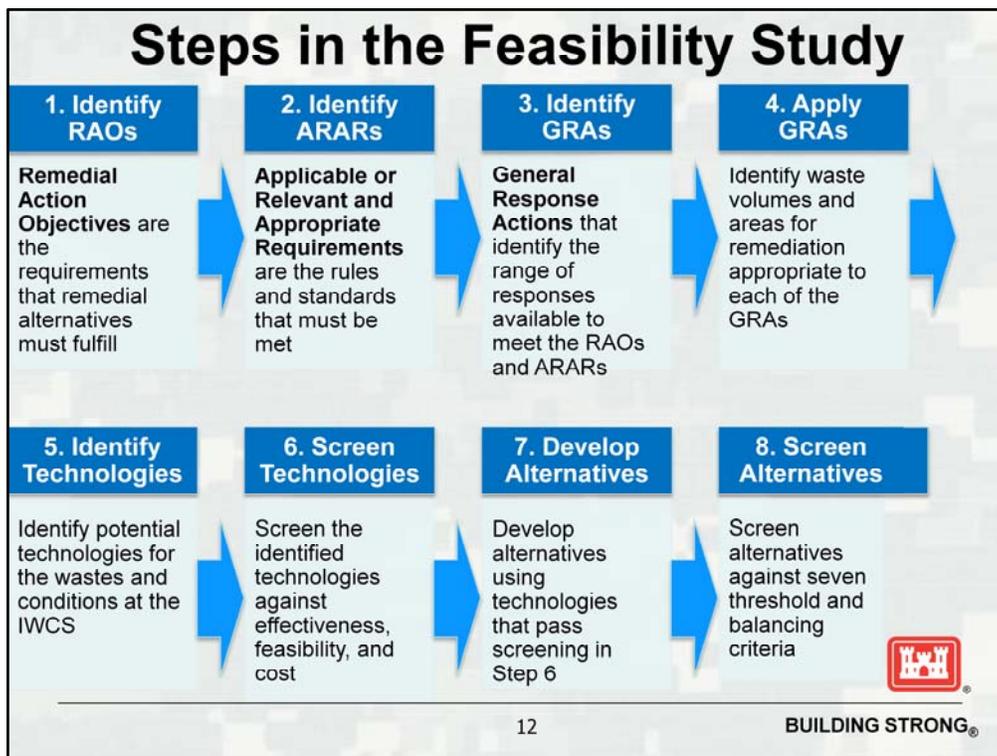


Slide 11 – Doug Sarno

To help explain and communicate key concepts throughout the FS process and to also generate public and agency input, the Corps has identified five technical memoranda that will explore key aspects of the FS. Tonight's workshop looks at the first of these memoranda and the next four will be released between now and the middle of 2012.

Taken together, these technical memoranda will make up the majority of the FS, and public input and discussion will be a key part of the technical memoranda process.

The full FS report will compile the results of these memoranda. It will be released in 2013 and present the overall evaluation of alternatives. A preferred alternative will subsequently be identified in the Proposed Plan.



Slide 12 – Doug Sarno

This slide provides an overview and description of the key steps in the FS process.

The first steps in the process set clear requirements for alternatives through development of remedial action objectives (RAOs) and identification of applicable or relevant and appropriate requirements (ARARs). The radon assessment and health effects technical memoranda will be used to ensure that protection of human health and the environment will drive those objectives.

The RAOs and ARARs will then be captured in a technical memorandum to allow for additional public discussion and input.

Once objectives are in place, general response actions are developed and applied to the different waste volumes within the IWCS. These provide a more detailed range of alternatives to help identify technologies that will be explored. These are not yet detailed alternatives. Tonight's technical memorandum will be important to developing the range of responses available to NFSS.

Next, available technologies are identified and then screened against effectiveness, feasibility, and cost. Those that pass this screening are used to develop detailed alternatives. Remedial alternatives technologies and screening will be the subject of the final technical memorandum late next spring.

The final steps are to develop and screen detailed alternatives against the CERCLA criteria.

Finally, all this information and public input along with the evaluation of the alternatives will be captured in the FS report in 2013.

Public Participation During the IWCS OU FS Goes Well Beyond CERCLA Requirements

**Participation activities will focus on the five
Technical Memorandum and include:**

- Fact Sheets for each TM
- Discussion at monthly community meetings of the Community Action Council (CAC)
- Corps-sponsored workshops for each TM
- Facilitate public input on topics important to the community and relevant to the FS



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Slide 13 – Doug Sarno

As discussed, there are multiple opportunities for public input and discussion about key components of the FS throughout the process.

Over the course of the next year, the technical memoranda will be the focus of this input.

Each memorandum will follow a similar process of input and discussion at large public workshops like this one, and at monthly community meetings being sponsored by the Community Action Council.

The technical facilitator is supporting the CAC and the Corps has agreed to attend these meetings as part of the overall public participation process on the IWCS OU.

Role of the Technical Facilitator

(see detailed handout)

Serve as a liaison between the Corps and community members on technical issues associated with the preparation and development of five technical memoranda and the FS report for the IWCS OU:

- Serve as a point of contact with the community to assist with understanding issues and providing input
- Support Corps community outreach
- Attend and facilitate meetings, prepare summaries of community concerns, prepare issue briefs



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Slide 14 – Doug Sarno

The technical facilitator is available to support the entire community regarding IWCS OU FS activities.

A handout with his full scope of work and contact information is in your packets.

The technical facilitator will be helping to facilitate all public and community meetings during this process, and available to help the community understand and input to the FS process.

Fernald Lessons Learned and Applicability to the NFSS

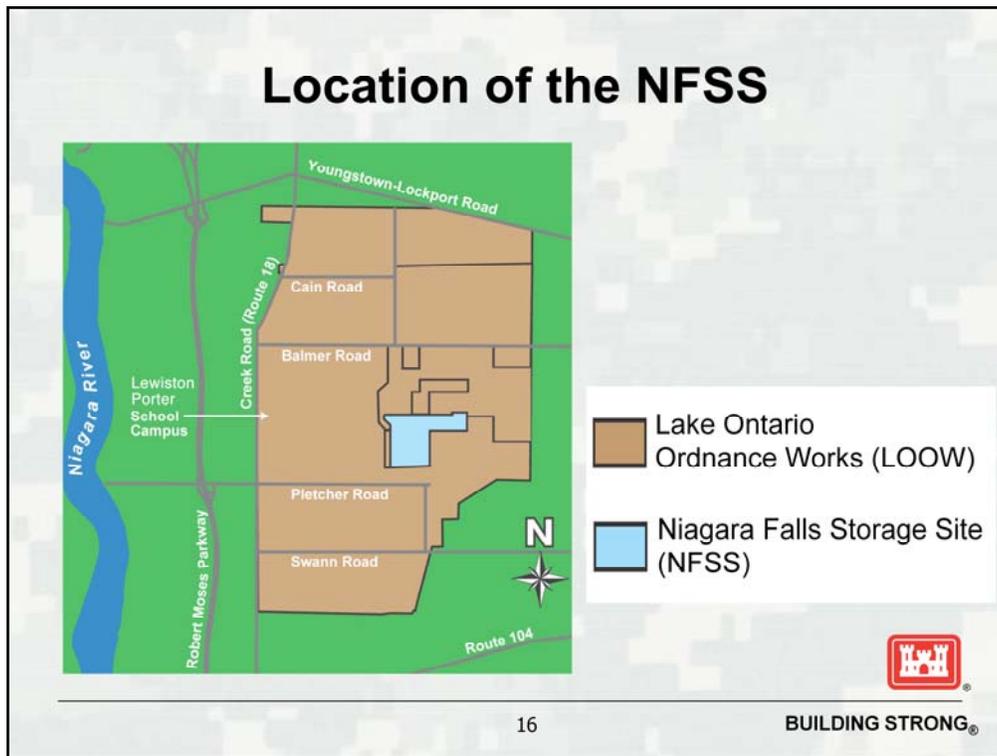


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Slide 15 – Julie Reitinger

Now let's turn our attention to the Fernald Lessons Learned and how they could apply to the NFSS.



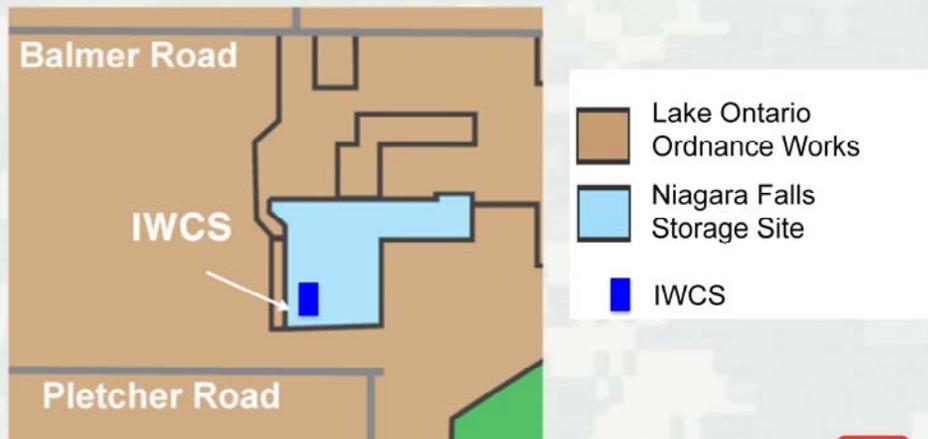
Slide 16 – Julie Reitingger

Let's begin with a quick review of site history. In 1942, the U.S. Government acquired approximately 7,500 acres of land in order to create the Lake Ontario Ordnance Works (LOOW) which is shown here in tan. The LOOW produced TNT for one year.

In 1944, the Manhattan Engineer District (MED) was granted use of a 191-acre portion of the LOOW for storage of radioactive residues. This area was identified as the NFSS which is shown in light blue. Just to orient you, the NFSS is located down Pletcher Road east of here

Between 1944 and 1954, the MED and its successor agencies periodically shipped radioactive residues and materials to the NFSS for storage. The residues present at the NFSS are the materials left over after processing uranium ore to create uranium metal which was then used in development of the atomic bomb. The most radioactive of these residues are the K-65 residues.

Location of the Interim Waste Containment Structure (IWCS)



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Slide 17 – Julie Reitinger

During the 1980s, the Department of Energy conducted several remediation activities to consolidate the K-65 residues, other radioactive residues, contaminated building debris, and contaminated soil from various areas across the LOOW into the IWCS. The IWCS is an engineered structure designed to restrict radon emissions, infiltration of water from precipitation, and prevent the migration of contamination to groundwater. The IWCS is the dark blue area on the NFSS.

What is the Purpose of the Lessons Learned Technical Memorandum?

Support development of the Feasibility Study

- Fernald Lessons Learned – what can we learn from a successful example?
- Waste Disposal Options for IWCS Contents – what do we need to consider?



Slide 18 – Julie Reitingner

The Lessons Learned TM was developed to support the FS for the IWCS OU.

The purpose of the Lessons Learned Technical Memorandum was to look at how the U.S. Department of Energy (DOE) successfully removed, treated and disposed of K-65 residues from a site in Fernald, Ohio, which are similar to those stored in the IWCS at NFSS.

The Lessons Learned Tech Memo identifies current or potential future offsite disposal facilities for the IWCS waste.

Questions We Answer Tonight

- How do Fernald and the NFSS compare?
- How were K-65 residues handled during removal at Fernald?
- What did we learn from Fernald?
- Where could the IWCS wastes be disposed offsite?



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Slide 19 – Julie Reitinger

In order to explain some of the key findings of the Lessons Learned Tech Memo, we plan to answer these main questions and to discuss how these results will be used as part of the development of the FS for the IWCS Operable Unit (OU) at the NFSS. These four questions are...

One portion of the Technical Memorandum focuses on the CERCLA remediation project conducted for the Fernald Site in Ohio. The Fernald Site is a good source of information on how remediation of the IWCS could be conducted because Fernald successfully removed, treated, and disposed of K-65 residues. In order to gather information on how the Corps could potentially manage the K-65 residues, we thoroughly reviewed what was done at the Fernald Site.

Tonight we will discuss how Fernald and NFSS compare? Let's take a look at some background information on the Fernald Site, first.

First, what is Fernald?

The Feed Materials Production Center in Fernald, Ohio, produced uranium fuel cores from 1951 to 1989.



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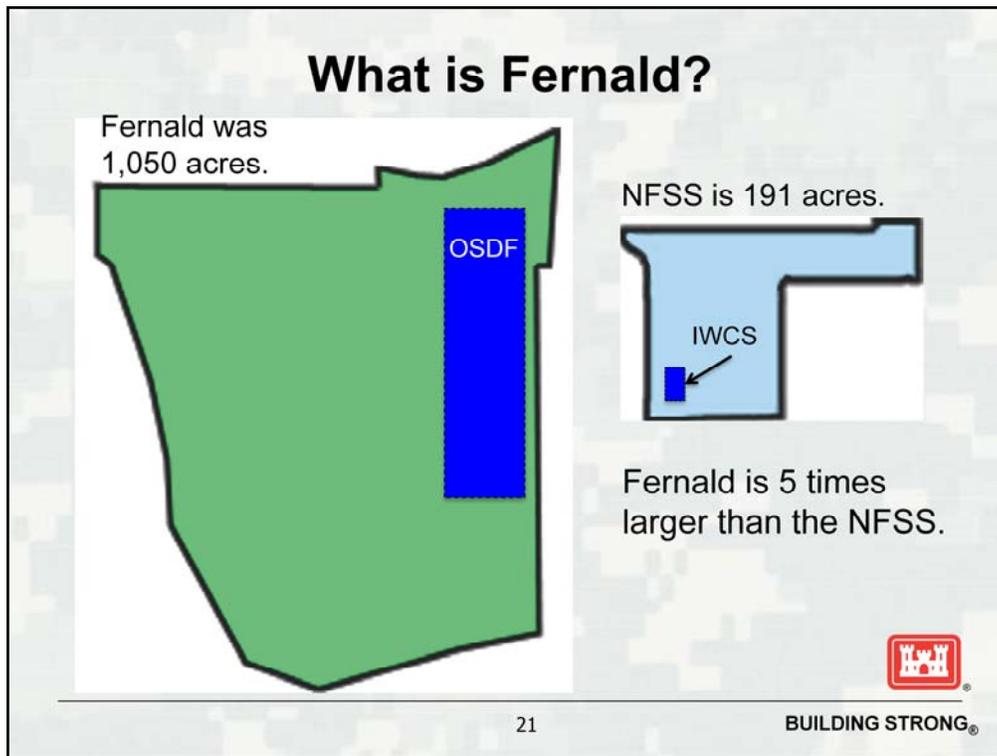
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Slide 20 – Julie Reitinger

Fernald is a DOE site located approximately 18 miles northwest of Cincinnati, Ohio. The plant was known as the Feed Materials Production Center. The production operations at Fernald converted uranium ore into metal in support of the Nation's weapons program.

The Feed Materials Production Center was active from 1951 to 1989.

In 1989 uranium metal production ceased at Fernald and the EPA placed Fernald on the National Priority List due to the nature and extent of contamination. Planning for remediation started shortly thereafter.



Slide 21 – Julie Reitingger

The K-65 residues at the NFSS and Fernald were both processed for the Manhattan Project at the Mallinckrodt Chemical Works in St. Louis, MO. Refinement of the Mallinckrodt K-65 residues continued at the Feed Materials Production Center at Fernald and during uranium operations at Fernald, two above-ground silos were filled with K-65 residues similar in form, chemistry, and radiological activity to those at NFSS.

In addition to storage of K-65 residues, Fernald also produced high purity uranium metal from feed materials and occupied an area more than 5 times larger than then NFSS.

In 1989 uranium metal production ceased and USEPA placed Fernald on the National Priority List. Planning for remediation started shortly thereafter. Restoration of the site began in 1994 and was completed in 2006.

Fernald has a 123-acre on-site disposal facility. The size of the disposal facility at NFSS (the IWCS) is 10 acres.

What is Fernald?



Before

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Slide 22 – Julie Reitingner

At Fernald, the higher activity K-65 residues were shipped off-site for disposal at Waste Control Specialists facility in Andrews, Texas.

Several other remediation projects were also conducted at the Fernald Site included dismantling over 300 buildings, restoration of waste pits, removing over 100,000 drums of waste and 31-million pounds of uranium product.

- Remediation of K-65 residues in Silos 1 & 2 cost approximately \$490 million and took 12 years to complete (1994 to 2006).
- Remediation was also needed for approximately 225 acres of the Great Miami Aquifer, which is one of the largest drinking-water aquifers in the Nation.
- Remediation cost was approximately \$4.4 billion.

What is Fernald now?



After Remediation and Restoration



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Slide 23 – Julie Reitinger

Over 99% of the total Fernald waste volume was lower level radioactive waste (contaminated soil and debris) which was consolidated into a new on-site disposal cell. Long-term monitoring and maintenance of the on-site disposal facility is conducted by the DOE.

In 2007, 1,050 acres of the former Feed Materials Production Center were opened to the public as the Fernald Nature Preserve.

Remediation for the Fernald Site cost approximately \$4.4 billion.

Questions We Answer Tonight

- **How do Fernald and the NFSS compare?**
- How were K-65 residues handled during removal at Fernald?
- What did we learn from Fernald?
- Where could the IWCS wastes be disposed offsite?



Slide 24 – Julie Reitingner

Let's now take a side-by-side look at Fernald and the NFSS to see how the two sites compare.

How do Fernald and the NFSS compare?

	Fernald Site	NFSS
DOE site with Storage of K-65 residues	✓	✓
Radiological risk mostly due to radium-226 and radon-222	✓	✓
Manufactured radiological materials	✓	



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Slide 25 – Julie Reitinger

Both the Fernald and NFSS stored K-65 residues.

For both projects, most of the radioactive risk is due to the decay of Radium-226 into radioactive Radon gas.

No manufacturing of radiological materials took place at NFSS.

How do Fernald and the NFSS compare?

	Fernald Site	NFSS
Underlying groundwater is a principal source of drinking water for the region	✓	
Adjacent land use primarily residential and agricultural	✓	
On National Priority List (NPL)	✓	



Slide 26 – Julie Reitinger

Unlike the NFSS, the Fernald Site is located over a productive aquifer that serves as the principal source of drinking water for the regional area. That makes it a key environmental asset. At Fernald, groundwater from the aquifer was contaminated with uranium up to one mile south of the Fernald Site.

Land use adjacent to the Fernald Site was primarily residential or resident farmers.

Fernald was placed on the National Priority List (NPL) in 1989. This is because the K-65 residues were stored in the silos, the site had open waste pits, and contamination from the site was impacting the groundwater used for drinking water.

The IWCS was not included on the NPL because it was concluded that the IWCS poses little threat to human health and the environment.

Although Fernald and NFSS are similar and the success at Fernald can help us remediate NFSS, there are significant differences between the two sites. For that reason, not everything that was done at Fernald can be carried over directly to the NFSS. So, the unique characteristics of NFSS must be considered as we develop the remedial strategy for the site.

Questions We Answer Tonight

- How do Fernald and the NFSS compare?
- **How were K-65 residues handled during removal at Fernald?**
- What did we learn from Fernald?
- Where could the IWCS wastes be disposed offsite?



Slide 27 – Julie Reitinger

One of the objectives of the Technical Memorandum was to understand how the K-65 residues were remediated at Fernald to see what could be implemented for NFSS.

Because of the radiological activity associated with the K-65 residues, the remediation at Fernald involved construction of a full-scale industrial complex to complete the project safely with minimal impact to workers, the public, and the environment.

How were K-65 residues handled during removal at Fernald?



- Silo 3 with cold metal oxides in foreground
- Silos 1 & 2 containing K-65 residues shown with earthen berms in background



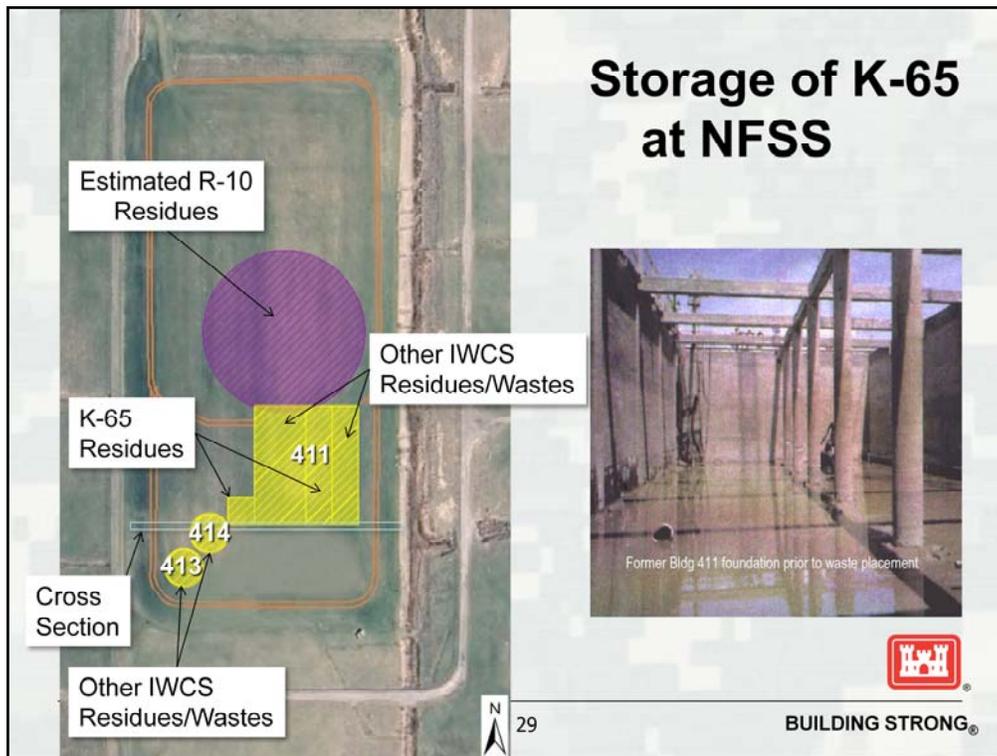
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Slide 28 – Julie Reitingner

One major difference that is important to discuss in comparing NFSS and Fernald is where the K-65 residues were stored.

- At Fernald, the K-65 residues were stored in two above-ground silos (Silos 1 and 2). A third silo, Silo 3, which can be seen in the foreground of this photo, was used to store cold metal oxides which are not a waste type found at NFSS. Silos 1 and 2 are in the background.
- Earthen berms were placed around the sides of Silos 1 & 2 to shore up the silo walls and to provide additional shielding to reduce radioactive exposure to workers and the public. The containerization also was intended to reduce the escape of radioactive radon gas.
- Silos 1 and 2 contained only the K-65 residues. During the K-65 removal, an opening in the top of the silo was used to access the waste. The silos provided some containerization that was a key aspect to removal of the residues.

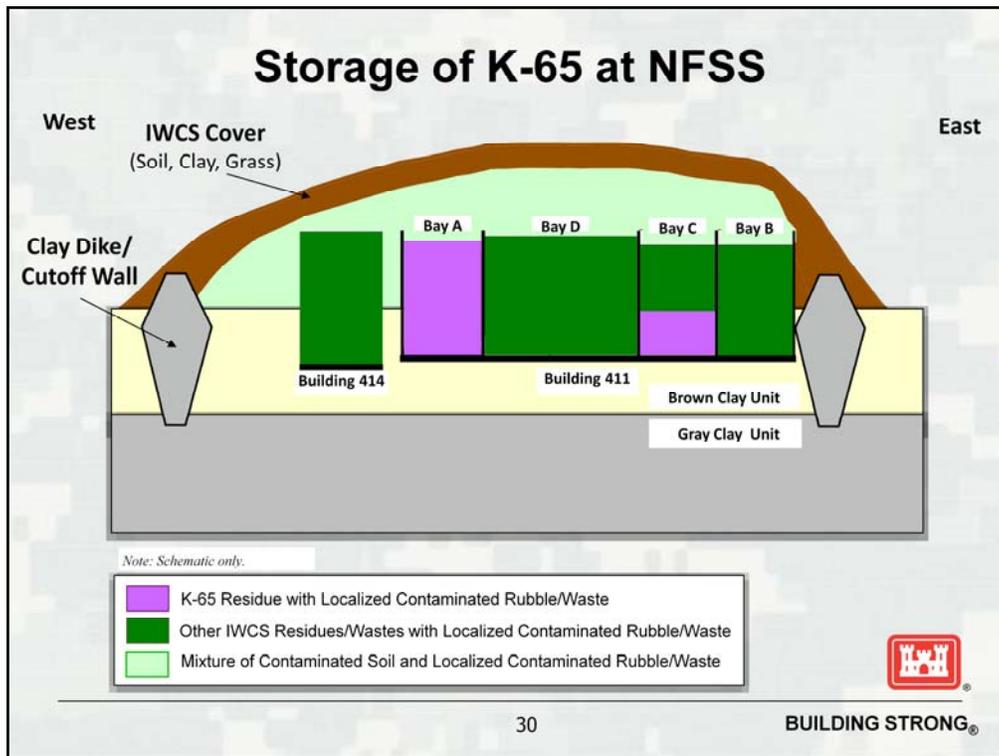


Slide 29 – Julie Reitinger

At the NFSS, the K-65 residues and other wastes are consolidated in the IWCS. The current configuration of the IWCS limits the accessibility and complicates removal operations compared to the storage of K-65 residues prior to remediation at Fernald.

This slide shows where several types of wastes at the NFSS are located within the IWCS. The K-65 and other high activity residues were placed in building foundations in the southern half of the IWCS. The three buildings include Building 411, 413, and 414. This picture on the right, shows the basement of Building 411 prior to the storage of the K-65 residues. The three buildings were originally part of the former water treatment facility used by the Lake Ontario Ordnance Works, so they were designed to hold water. The R-10 residues are lower-activity residues which were placed north of Building 411.

Let's take another look at the placement of the residues in the south end of the IWCS from a cross-section view of this section right here.



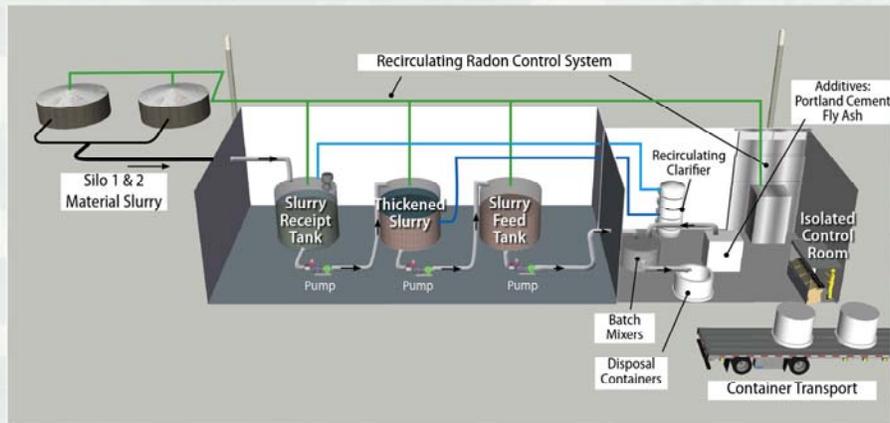
Slide 30 – Julie Reitinger

This cross section is cut through the southern end of the IWCS, specifically showing Building 411 and 414, looking north.

- The K-65 and other residues were placed into four bays in the basement of Building 411. You can see that the K-65 residues were purposefully placed on the bottom and then were covered over by other residues and wastes. Placing the residues at the bottom of the IWCS provides both shielding of the radioactivity and containment of the radon.
- One thing that this figure does not convey is that miscellaneous construction debris, chunks of concrete, rebar, etc. were also placed within the bays of Building 411 and outside of Building 411.

A key difference is that the placement and storage of these wastes in the IWCS is significantly different from Fernald. At Fernald, the silos only contained K-65 residues, while at IWCS, the residues are located beneath the other residues and wastes.

How were K-65 residues handled during removal at Fernald?



Fernald used remote handling in a closed remediation facility.



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Slide 31 – Julie Reitingger

This figure depicts the process that was used at Fernald to safely handle, treat, package, and ship K-65 residues from Silos 1 and 2 to an off-site disposal facility.

At Fernald, the removal of the K-65 residues was accomplished using a technique referred to as hydraulic mining. High-pressure water was used 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.

The handling, treatment, and packaging process was conducted in a specially designed building with remote handling equipment, air containment system, and radon abatement structures to protect workers from radiation.

How were K-65 residues handled during removal at Fernald?



Fernald K-65 Remediation Facility
Radon Control System



Radon Control System increased worker safety and efficiency and prevented off-site releases



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Slide 32 – Julie Reitinger

One of the key technical components of the Silos 1 & 2 Remediation Project was radon control. A Radon Control System was designed to capture radon gas from the silos and the remediation facility during the removal and treatment actions to prevent worker and public exposures.

- The radon control system provided continuous air management with backup systems to reduce downtime.
- It reduced the need for Personal Protective Equipment, such as respirators, resulting in increased worker safety and efficiency.
- The radon control also eliminated potential off-site exposures because the radon gas was contained and treated.

A radon control system will be required at NFSS if the residues are removed.

How were K-65 residues handled during removal at Fernald?



Chemical stabilization used to make waste safe to ship and store.



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Slide 33 – Julie Reitinger

The K-65 residues were treated so they could be transported and accepted for offsite disposal. 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 filled into custom-designed containers shown in this picture and allowed to set into a solid waste form.

- The containers were placed on custom-designed, light-weight flatbed trailers for shipment offsite. Each truck leaving Fernald carried two loaded ½ inch thick steel containers (shown above) standing 6½ feet tall with a 6-foot diameter and weighing nearly 20,000 lbs each.
- Fernald shipped a total of 3,770 canisters of K-65 residue offsite for disposal over a period of 12 months. This works out to approximately seven trucks per day. Truck transportation was completed with one traffic incident. No containers were rejected by the disposal facility.

A similar method to treat and ship the K-65 residues would be required at NFSS if the K-65 residues are removed and disposed of offsite.

Questions We Will Answer Tonight

- How do Fernald and the NFSS compare?
- How were K-65 residues handled during removal at Fernald?
- **What did we learn from Fernald?**
- Where could the IWCS wastes be disposed offsite?



Slide 34 – Julie Reitinger

What lessons did we learn overall from the Fernald Site Remediation of the K-65 residues?

What did we learn from Fernald?

Vitrification Pilot Plant



Before Startup

Demolition

- Selecting remedial technologies has to balance the predictability of proven methods against the promise of innovative methods



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Slide 35 – Julie Reitinger

Lesson Learned: The selection of remediation technologies plays a key role in being able to successfully remediate the K-65 residues.

At Fernald, a treatment method called vitrification was initially selected for the remediation of the K-65 residues. Vitrification was selected based on promising bench scale studies that showed that the treatment could maximize the long-term stability of the residues over other treatment methods. Vitrification uses extremely high heat (i.e. temperatures ranging from 2,900 to 3,650 degrees Fahrenheit) to melt waste material into a liquid state. On cooling, a glass-like solid forms which permanently immobilizes the waste.

Testing of the vitrification treatment process was required to collect data that could be used to design a full-scale treatment facility. A vitrification pilot plant (as shown in the picture above) was built at the Fernald Site to conduct the testing. Many technical and operational difficulties were encountered throughout the testing stage. During the final stages of testing using a non-radioactive surrogate material, a hole formed in the bottom of the plant's melter refractory and containment was lost. The \$60 million vitrification project was canceled and the pilot plant was torn down. The treatment method for the K-65 residues was then changed to chemical stabilization, which was successfully implemented at the Fernald Site.

Using proven technologies could improve the predictability of the remediation system by avoiding the need to develop and test a new technology and by removing the risk that an innovative technology may fail.

The FS will evaluate technologies for possible use at the IWCS. The advantages of a new technology will be balanced against the need for treatability studies, development at the industrial scale, effectiveness, schedule, and cost in the FS.

What did we learn from Fernald?



Robust safety management was a cornerstone for success.



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Slide 36 – Julie Reitinger

Lesson Learned: Safety was a cornerstone for success at Fernald.

The actions taken at the Fernald Site were performed with an integrated approach to safety management.

- The goal was to systematically integrate safety into management decisions and work practices at all levels so that remediation was accomplished while protecting the public, the workers, and the environment.
- Using remote waste handling equipment reduced the need for workers to be in close proximity to the residues and, together with the radon abatement methods, reduced the level of protective equipment required. The use of a radon control system eliminated environmental releases. These actions resulted in increased worker safety and efficiency and public and environmental protection.
- The high degree of commitment to health and safety by both management and employees resulted in a cohesive workforce that achieved stretches of 1.5 million and 0.5 million safe man hours without a lost-time injury.

Attention to safety will also be necessary for any remedial actions taken at the NFSS.

What did we learn from Fernald?

Encourage community involvement for more informed decision-making



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Slide 37 – Julie Reitinger

Lesson Learned: The Fernald citizens provided valuable input to the project.

- At Fernald, a citizens group was started in 1993 and provided input on various issues that were most critical to the community.
- In these photos, community members are shown participating in a “Future Site” simulation that involved goal-setting activities regarding the future use of the site. A primary driver for cleanup decisions, the goal-setting activities evaluated cost versus risk reduction for different remediation strategies.
- The final future land use for majority of the Fernald Site was defined as recreational, resulting in creation of the Fernald Nature Preserve. It was also determined that a smaller portion of the Fernald Site would house the on-site disposal cell and was designated as industrial land use.
- At Fernald, stakeholders agreed that if the most radiologically contaminated materials were disposed of offsite, the remaining 3 three million cubic yards of lower activity waste could be safely disposed in an on-site disposal facility.

That’s why we appreciate your being here. We value your input and we want you to be involved in the process. One purpose of the TMs is to provide you with information you need to become familiar with the project and to provide you with an opportunity to provide input or ask questions.

What did we learn from Fernald?

- Removal of K-65 and other high activity residues can be done successfully.
- Success requires
 - Public involvement
 - Detailed planning
 - A focus on worker and public safety
 - Precise execution
 - Testing and monitoring



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Slide 38 – Julie Reitinger

Lesson Learned: The Fernald experience shows that K-65-residues can be successfully removed.

This success required commitment from Fernald and the community. It was based on detailed planning throughout the project, a dedication to operating safely for the protection of site workers and the public, execution using a comprehensive systems of controls, and testing and monitoring to ensure that operations were progressing safely and effectively.

Because the residues were removed, handled, and disposed, the project required the design, construction and operation of an industrial facility, and after completion the entire facility had to be deconstructed and disposed.

Questions Concerning Fernald Lessons Learned



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Slide 39 – Doug Sarno

Questions We Answer Tonight

- How do Fernald and the NFSS compare?
- How were K-65 residues handled during removal at Fernald?
- What did we learn from Fernald?
- **Where could the IWCS wastes be disposed offsite?**



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Slide 40 – George Butterworth

At this point we need to focus on the current off-site disposal options for wastes that might be removed from the IWCS.

- Fernald sent some (including the K-65 residues) off-site for disposal.
- For the IWCS, potential off-site disposal facilities were evaluated and the results included in the technical memorandum.

The following slides will focus on off-site disposal options and which of those options are available for the various IWCS wastes. We will also assess what the potential off-site disposal costs might be.

Where could the IWCS wastes be disposed offsite?

Waste Disposal Considerations

- Disposal of waste is regulated by Federal and state laws
- Disposal is based on waste classification
- Waste acceptance criteria must be met and varies for each facility
- Transportation of waste is regulated
- Cost varies significantly



Slide 41 – George Butterworth

When considering where IWCS waste could be disposed off-site, there are a number of factors that must be taken into consideration:

- Disposal of waste is regulated by Federal and State laws and regulatory agencies. Each commercial waste disposal facility must obtain a license or permit before they can accept waste. Their license/permit will specify what type of waste can be handled at that facility and accepted for disposal. The acceptable waste is based on what can be safely placed in the unit in terms of protecting human health and the environment.
- The waste disposal facility will have waste acceptance criteria mandated by the license/permit. Waste acceptance criteria are the rules that control the waste classifications, concentrations levels, waste forms, and packaging that can be accepted for disposal.
- The waste would have to be transported to the disposal facility. To ensure public health and safety, waste transport is regulated by the Department of Transportation (DOT). DOT regulations give requirements for waste containers, weight limitations, and radiological exposure levels from the containers to both the driver and the public. These regulations must be followed to transport the waste offsite and to a disposal facility.
- Cost for waste disposal varies significantly for the various waste classifications and activity levels. In general, the unit disposal costs increase with increased radioactivity and hazard.

Where could the IWCS wastes be disposed offsite?

- All licensed/permitted waste disposal facilities have waste acceptance criteria for what they can accept
- These criteria are approved by the regulatory agency
- Criteria typically specify the following requirements:
 - Which classifications of waste can be handled at that site
 - Concentration limits for various radionuclides
 - Acceptable waste forms
 - Acceptable waste containers



Slide 42 – George Butterworth

Waste acceptance criteria (these are in essence rules) are established to define the conditions of the license/permit. The waste acceptance criteria are different for different facilities. They are dependent on the type of waste to be handled and the location of the disposal facility. No waste can be shipped to a facility unless it meets all of the waste acceptance criteria.

Where could the IWCS wastes be disposed offsite?

- Waste classifications associated with the IWCS Wastes
 - Byproduct Material [designated 11e.(2)]
 - Low-Level Radioactive Waste
 - Low-Level Mixed Waste

- Other waste classifications that are significant but are not found at the IWCS
 - High-Level Waste
 - Transuranic Waste



Slide 43 – George Butterworth

There are numerous waste classifications associated with radioactive waste disposal.

As indicated on the slide, the waste classifications assumed for the IWCS wastes are:

- Byproduct Material designated at 11e.(2)
- Low level radioactive waste (LLRW)
- Low-level mixed waste (LLMW)

There are also two other classifications that are NOT found at IWCS. They are:

- High-Level waste
- Transuranic waste

Byproduct Material designated as 11e.(2)

There are four different classifications of byproduct material. The classification at the IWCS is 11e.(2) which refers to byproduct materials that are mill tailings or wastes produced by the extraction or concentration of uranium or thorium from ore.

Low-level radioactive waste

Low-level radioactive waste (LLRW) is a general term for radioactive waste with low levels of activity that is not high level waste such as spent nuclear fuel, transuranic waste produced by the defense nuclear weapons program, tailings and other by-products, or naturally occurring radioactive material ([NORM](#)).

Low-level mixed waste

“Mixed waste” must contain two components: (1) LLRW and (2) a hazardous waste as defined by hazardous waste regulations. If both waste types are present, then the waste is classified as Low-Level Mixed Waste. So Low-Level Mixed Waste is LLRW with some hazardous material mixed in.

Other waste classifications that are NOT found at the IWCS are:

High-level waste

High-level waste is defined to be the highly radioactive material resulting from spent nuclear fuel reprocessing. It can be:

- liquid waste directly produced during nuclear fuel reprocessing
- solid material derived from the liquid wastes having a sufficient concentration of fission products

Transuranic waste

Transuranic waste is defined based on the elements in the waste and their concentration. It must have elements with an atomic number greater than 92 at concentrations greater than 100,000 picocuries per gram (pCi/g), or at levels that the NRC may prescribe to protect the public health and safety. Currently, the only disposal facility for transuranic waste is the Waste Isolation Pilot Plant located in Carlsbad, NM. The transuranic waste that it can accept is defined to be waste containing more than 100,000 pCi of alpha-emitting transuranic isotopes, per gram of waste, with half-lives greater than 20 years.

In addition to the waste classification, there are other waste acceptance criteria factors that need to be taken into consideration is selecting potential off-site disposal facilities. These are discussed in the next slide where we show the potential off-site disposal facilities identified in the technical memorandum that could handle the various waste classifications associated with the wastes within the IWCS.



Slide 44 – George Butterworth

As we've already discussed, waste disposal facilities have waste acceptance criteria for the materials they can take for disposal. Waste acceptance criteria control other things besides the type of waste accepted such as the acceptable waste container, the amount of radioactive material in a container, the way a container is packaged and labeled, the exposure levels on the outside of a container, and the physical and chemical form of the waste.

The Lessons Learned Tech Memo looked at waste acceptance criteria based on:

- Radionuclide-specific concentration limits,
- Physical waste forms (i.e., solid, liquid, etc.),
- Waste shipping container types, and
- Transportation modes and identified disposal facilities that can receive the types of waste found in the IWCS.

This slide shows the location of the potential waste disposal facilities that could currently receive the types of waste found in the IWCS.

- U.S. Ecology (Idaho)
- Nevada National Security Site (Nevada)
- Energy Solutions (Utah)
- Waste Control Specialists (Texas)

Waste Control Specialists (Andrews, TX) and EnergySolutions (Clive, UT) are shown in green because these two facilities currently can accept 11e.(2) waste as well as other wastes. That means they can accept all three waste classifications in the IWCS. The facilities shaded white can accept the LLRW and LLMW in the IWCS, but not the 11e.(2) wastes.

This is a preliminary list of currently available disposal facilities that could accept waste materials from the NFSS. Additional facilities could be licensed between now and when the IWCS Feasibility Study is completed and will be taken into consideration for any alternatives involving off-site disposal.

Where could the IWCS wastes be disposed offsite?



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Slide 45 – George Butterworth

We've discussed what the off-site disposal facilities are for the three key waste classifications and the waste acceptance criteria that must be met for disposal. Now let's focus on the wastes we have in the IWCS and what their potential disposal options might be.

The waste materials stored within the IWCS are divided into six major categories based on the nature of the material (rather than the waste classification). Let's take a look at those categories and how they will impact the selection of a disposal facility.

Where could the IWCS wastes be disposed offsite?

Category	Radioactivity (Radium-226)	Approx. Volume in the IWCS	Assumed Classification for Disposal
K-65 Residues	520,000 pCi/g	4,030 yd ³	11e.(2)
•Other IWCS Residues/Wastes			11e.(2)
•L-30	•12,000 pCi/g	•7,960 yd ³	
•L-50	•3,300 pCi/g	•2,150 yd ³	
•F-32	• 300 pCi/g	•440 yd ³	
Tower Soils	10,400 pCi/g	4,115 yd ³	11e.(2)
Contaminated Rubble/Waste	6,181 pCi/g	46,610 yd ³	11e.(2)
R-10 Residues and Soil	95 pCi/g	59,500 yd ³	11e.(2)
Contaminated Soils	16 pCi/g	248,100 yd ³	11e.(2), LLRW and LLMW



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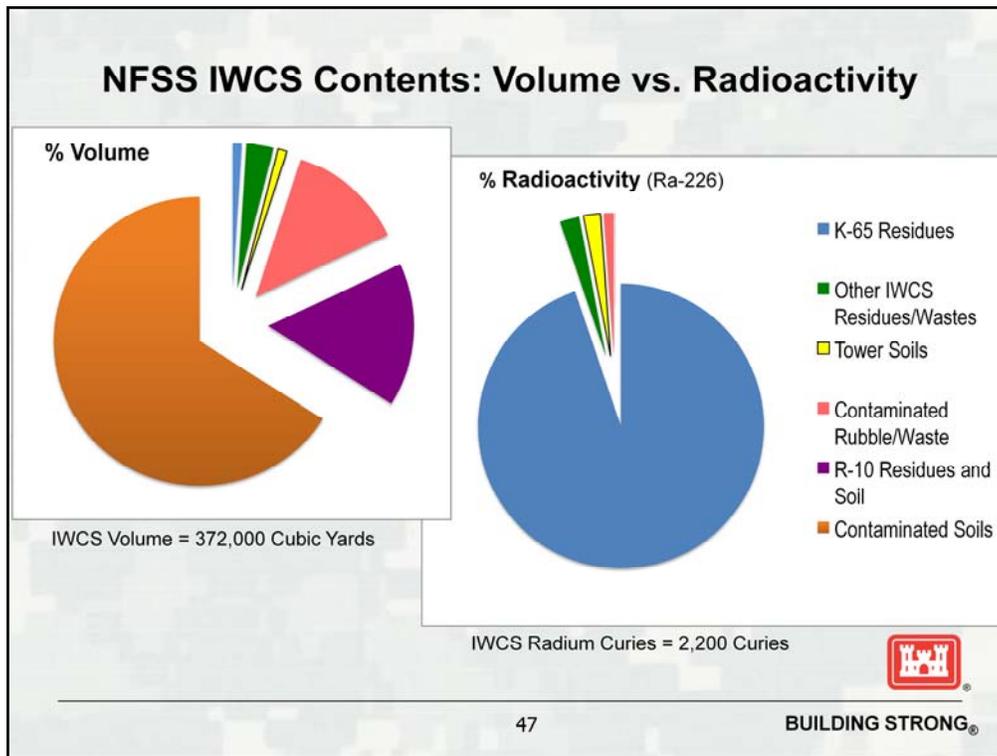
Slide 46 – George Butterworth

When you look at the wastes in the IWCS, it makes sense to break them out according to the nature of the material, as shown here. Basically, the wastes are separated based on what they are made of and the level of radioactivity.

The six radioactive waste categories in the IWCS and assumed waste classifications were assigned. This allowed the Corps to identify the potential off-site disposal facilities discussed earlier for the various waste classifications in order to provide information for evaluating removal alternatives in the FS. Actual waste classification will be dependent on the actual radiological and chemical concentrations associated with the waste to be shipped off-site for disposal. The waste classification is important since it determines where specific waste can be disposed.

The information presented in this table provides a summary of the six waste categories within the IWCS and their respective radium activity levels, estimated volumes and assumed waste classifications. The volumes have an impact on potential disposal costs as well as remediation duration, worker safety, transportation, and costs.

The bulk of the waste placed in the IWCS was contaminated soil and debris associated with the storage, handling, and transfer of the residues into the IWCS. Residues were the waste produced by the extraction of uranium from uranium ores. As noted above, the contaminated soils waste category could fit into three different waste classifications. Contaminated soils in direct contact with the residues (e.g., contaminated soils placed in Buildings 411, 413 and 414) were assumed to be managed as 11e.(2) wastes. Ten percent of the contaminated soil category volume was assumed to be managed as Low-Level Mixed Waste. The remaining volume of contaminated soil is assumed to be managed as Low-Level Radioactive Waste. Although the waste is primarily associated with contamination that resulted from the storage and handling of uranium ore processing residues, there is the potential for other waste not typically associated with uranium ore processing to be present. Based on the various disposal facilities' waste acceptance criteria for their 11e.(2) disposal cell, any ore processing residue waste that contains other waste (radiological or chemical) not typically associated with the ore processing cannot be disposed of in their 11e.(2) disposal cell. In this case, the waste would have to be managed as either a Low-Level Radioactive Waste or a Low-Level Mixed Waste.



Slide 47 – George Butterworth

This graphic is another way of looking at the six categories of wastes in the IWCS.

- The majority of the waste volume is contaminated soil, which have low levels of radioactivity.
- The residues are a very small portion of the volume of waste in the IWCS

You can see that the K-65 residues are, by far, the most highly radioactive of the IWCS materials, but they also have the smallest volume of all the waste categories. They make up only 1% of the volume contained in the IWCS. If we include Tower Soil and the other residues stored within Building 411, we account for 5% of the volume contained within the IWCS. The remaining waste categories have much lower levels of radioactivity and make up 95% of the volume contained within the IWCS. It's important to keep in mind that radium-226 accounts for over 90% of radiological content in the IWCS, and that Building 411 itself houses 99% of the radiological content. Looked at another way, the vast majority of the IWCS waste has much lower radioactivity than the K-65 residues.

Also note that the percentage of radioactivity for the "R-10 Residues and Soil" and the "Contaminated Soil" waste categories are so low that they do not appear on the chart even though they constitute the majority of the waste volume within the IWCS.

Where could the IWCS wastes be disposed offsite?

- Estimate of disposal costs were made based on the assumed waste classifications.
- Final waste classifications will be dependent on actual radiological and chemical concentrations in any wastes being shipped off-site for disposal.



Slide 48 – George Butterworth

Disposal costs were estimated for each of the waste categories based on their assumed waste classifications. The Corps realizes that some of the materials removed from the IWCS would exceed the limits for radionuclides contained in the waste acceptance criteria for some of the disposal facilities. It is possible to blend the highly radioactive waste with lower activity materials so that the limits are met for specific disposal facilities. This process of downblending could be used to meet the disposal site's waste acceptance criteria and/or Department of Transportation shipping requirements. Although downblending will increase waste handling, volume of the waste, and ultimately, disposal costs, it is an effective way to prepare the waste so that it can be disposed. Treatment methods or materials may also be used to meet the waste acceptance criteria.

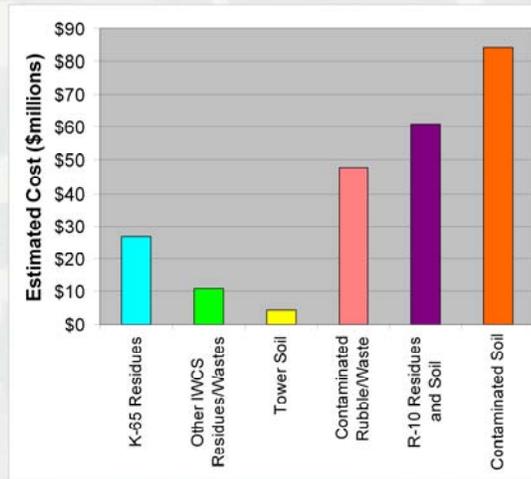
The Lessons Learned Tech Memo includes preliminary estimates of waste volume and disposal costs. These estimates were developed to increase the current understanding of the volume of IWCS wastes, the volume of waste created by mixing to meet disposal and shipping requirements, and Waste Acceptance Criteria requirements for the selected disposal facilities. These estimated costs should be considered preliminary due to uncertainty in the assumptions and the probability that these assumptions will be modified during the development of alternatives in the feasibility study. The volume estimates were based on meeting the disposal site waste acceptance criteria as well as the Department of Transportation regulations. For instance, the waste acceptance criteria for one facility is 100,000 pCi/g of Ra-226 but the activity level had to be at 80,000 pCi/g or less to meet the Department of Transportation requirements. So, in order to transport the K-65 residues, they would have to be downblended from ~520,000 pCi/g to 80,000 pCi/g. This downblending resulted in an increase in volume for the K-65 residues by a factor of 6.5. The effect on volume increase is presented in Table 6-6 of the technical memorandum where the waste volume multipliers are provided.

The estimated disposal costs are presented in the next slide.

Note that the actual costs will be dependent on the actual waste classification. The actual waste classification will be determined at the time any waste is generated and characterized. It will be dependent on the analytical results for the radiological and chemical concentrations in the wastes.

Where could the IWCS wastes be disposed offsite?

Estimated disposal costs (in \$ millions)



- Disposal costs *only*
- Waste treated to meet limits for shipment and disposal
- 11e.(2) wastes except for portions of Contaminated Soil
- Estimated cost for disposal of all wastes: \$235M



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Slide 49 – George Butterworth

This slide shows the estimated cost for disposal of the wastes. The costs shown are for disposal only. They do NOT include:

- Waste removal
- Handling and management
- Treatment
- Processing
- Containers
- Transportation
- Construction and deconstruction of the infrastructure needed to conduct these operations safely.

The estimated disposal cost is a result of all of the things we have been discussing for the past few minutes:

- Waste classification: Most of the wastes categories are expected to be 11e.(2) waste. The Contaminated Soil is the only exception—the assumption is that Contaminated Soil would be approximately 80% Low Level Radioactive Waste and approximately 10% 11e.(2) and 10% Low Level Mixed Waste. The significance of this is that Low Level Mixed waste has the highest cost per cubic yard, 11e.(2) waste is slightly less, and Low Level Radioactive Waste is less than half of the other classes.
- Waste Acceptance Criteria: the K-65 residues would exceed the Department of Transportation and disposal facility limits for all of the facilities that could currently accept the waste. For that reason, the IWCS high-activity waste must be treated before it is shipped. If the same method is used as was used at Fernald, this would increase the disposal volume of the K-65 residues by a factor of 6.5. Some of the facilities would require even greater increases in volume, so the costs shown in the Waste Disposal Options and Fernald Lessons Learned Technical Memorandum are estimated minimums.
- Volume: waste disposal cost is set as a cost per cubic yard. The sheer volume of Contaminated Soil makes it the most expensive category to dispose of. It even overcomes the fact that it is the cheapest category per unit volume.

These costs are preliminary. In the FS, detailed cost estimates for the various alternatives will be run. We can expect updates for:

- Waste acceptance criteria, as the standards for existing disposal sites are updated and if any new disposal facility is built,
- Volume, as we continue to study IWCS records and if any new site data is obtained. Also, the treatment method and strategy for a removal could affect the waste volume that needs disposal.

More information on this will be provided in the Remedial Alternatives TM and the FS.

Summary

- Any waste shipped off-site for disposal must meet that disposal facility's waste acceptance criteria
- There are a limited number of potential disposal facilities.
- Disposal costs for IWCS wastes would be dependent on volumes and classification of wastes shipped off-site for disposal.



Slide 50 – George Butterworth

In summary, there are options for shipping IWCS wastes off-site for disposal. Any waste removed from the IWCS and shipped off-site would have to meet the waste acceptance criteria for the specific facility where the waste were being shipped. Each facility can only accept wastes that meet their waste acceptance criteria. Remember, the waste shipments must also meet DOT requirements as well for disposal site limits.

There are a number of disposal facilities across the United States, however, facilities that can accept the higher activity 11e.(2) Byproduct wastes are limited. More disposal facilities can accept LLRW and LLMW. This may change over the upcoming years and will be taken into consideration throughout the CERCLA process for the IWCS Operable Unit.

As illustrated earlier, the actual disposal costs will be dependent on the waste volumes and associated waste classifications for any wastes shipped off-site for disposal.

Questions Concerning Waste Disposal Options



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Slide 51 – Doug Sarno

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Slide 52 – Doug Sarno

We now welcome you to participate in a break out group, where more information from the Waste Disposal Options and Fernald Lessons Learned Technical Memorandum will be discussed.

But first we would like to reiterate that the Corps values the community's input and welcomes your verbal comments. A transcript of tonight's meeting will be prepared and posted to the NFSS web site. You are also welcome to fill out comment cards which were distributed in tonight's meeting materials. Or, you can e-mail or write us at the address shown on this slide.

Please provide your comments by October 28, 2011.

Thank you for your involvement in this project.

Table Discussions

- Allow us to have more in-depth dialogue around the issues
- Allow you to talk directly with Corps staff and explore ideas more fully
- We will have 45 minutes for discussion followed by very brief report-outs
- Each table is facilitated
- Please identify a community spokesperson to report out from each table
- All discussion will be captured and summarized



Topics We Will Discuss Tonight

- Overall impression of the presentation
- Future land use of the NFSS
- Community values or concerns important to the FS process
- Important Fernald lessons learned
- Key community issues to the evaluation of the range of alternatives
- Detailed questions in your handouts



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Slide 55 – Doug Sarno

A transcript of tonight's meeting will be prepared and posted to the NFSS web site. You are also welcome to fill out comment cards which were distributed in tonight's meeting materials. Or, you can e-mail or write us at the address shown on this slide.

Please provide your comments by October 28, 2011.

Thank you for your involvement in this project.