US Army Corps of Engineers
Buffalo District

# Proposed Plan
## Interim Waste Containment Structure Operable Unit
## Niagara Falls Storage Site

**Authorized under the**
**Formerly Utilized Sites Remedial Action Program**

**Niagara Falls Storage Site**
**Lewiston, New York**

**Prepared by:**
**U.S. Army Corps of Engineers - Buffalo District**
**1776 Niagara Street**
**Buffalo, New York 14207**

**December 2015**

# UNITED STATES ARMY CORPS OF ENGINEERS
# PROPOSED PLAN
# INTERIM WASTE CONTAINMENT STRUCTURE
# LEWISTON, NEW YORK

This proposed plan identifies the preferred alternative for addressing the material contained in the Interim Waste Containment Structure (IWCS) Operable Unit at the Niagara Falls Storage Site in Lewiston, New York, and was prepared to fulfill the public participation requirements of Comprehensive Environmental Response, Compensation, and Liability Act Section 117(a) and the National Oil and Hazardous Substances Pollution Contingency Plan [40 Code of Federal Regulations 300.430(f)(2)]. This document is issued by the United States Army Corps of Engineers, the lead agency for site activities. The proposed plan summarizes information that can be found in greater detail in the Niagara Falls Storage Site remedial investigation reports issued in 2007 and 2011 and the IWCS feasibility study issued in December 2015.

**Public Comment Period**
**December 7, 2015, to February 6, 2016**
The Corps will accept written comments on the proposed plan during the public comment period.

**Public Meeting**
**Wednesday, January 13, 2016, at 6:30 p.m.**
Town of Lewiston Senior Center, 4361 Lower River Road, Youngstown, New York 14171

For more information, the administrative record file is publicly accessible electronically at:

**Town of Lewiston Public Library**
305 South 8th Street
Lewiston, New York 14092

**Youngstown Free Library**
240 Lockport Street
Youngstown, New York 14174

Or by appointment only:
1-800-833-6390 (Option 4)
U.S. Army Corps of Engineers Buffalo District
1776 Niagara Street
Buffalo, New York 14207

The Corps of Engineers proposes that the final remedial action for the IWCS Operable Unit be the alternative designated as Alternative 4, excavation, partial treatment, and off-site disposal of the entire contents of the IWCS, described in more detail in this proposed plan. After evaluating this alternative pursuant to the criteria described in the National Contingency Plan, 40 Code of Federal Regulations Section 300.430(e)(9)(iii), the Corps of Engineers considers it to be protective of human health and the environment and cost effective.

The public is encouraged to review and comment on this proposed plan. The Corps of Engineers will select a final remedy for the IWCS Operable Unit only after reviewing and considering all information submitted during the public comment period. The Corps of Engineers may modify the preferred alternative or select another response action presented in this plan based on public comments.

Members of the public who wish to comment on this proposed plan may submit their comments during the 60-day comment period, which will be from December 7, 2015, to February 6, 2016. Comments may submitted electronically by sending an email to *fusrap@usace.army.mil* or in writing to the Corps of Engineers at the following address by February 6, 2016:

**U.S. Army Corps of Engineers, Buffalo District**
Special Projects Branch, Environmental Project Management Team
1776 Niagara Street
Buffalo, New York 14207-3199

Please refer to this proposed plan, or the IWCS Operable Unit, in all comments. If there are any questions regarding the comment process or the proposed plan, please direct them to the address noted above or telephone 1-800-833-6390 (Option 4). Additionally, there will be a public meeting on Wednesday, January 13, 2016, in the Town of Lewiston Senior Center, 4361 Lower River Road, Youngstown, New York 14171, at which comments and questions can be made.

The supporting documents which further describe the conditions at the IWCS and Niagara Falls Storage Site and form the basis for this proposed plan may be found in the administrative record file for the Niagara Falls Storage Site, which is available electronically at the following locations:

**Town of Lewiston Public Library**
305 South 8th Street
Lewiston, New York 14092
(716) 754-4720

**Youngstown Free Library**
240 Lockport Street
Youngstown, New York 14174
(716) 745-3555

**U.S. Army Corps of Engineers FUSRAP Public Information Center**
1776 Niagara Street, Buffalo, New York 14207
(By appointment only)
(800) 833-6390 (Option 4)

After the close of the public comment period, the Corps of Engineers will review, consider, and respond to public comments. After reviewing and considering all information provided during the comment period, the Corps of Engineers may go forward with the proposed plan, modify it, or select another remedial alternative presented in this proposal. The Corps of Engineers will document the determination of the appropriate remedial response in a record of decision for the IWCS Operable Unit at the Niagara Falls Storage Site.

## SITE BACKGROUND

### Site Location and History

The Niagara Falls Storage Site (NFSS) is a 77.3-hectare (191-acre) property located at 1397 Pletcher Road in the Town of Lewiston, New York, approximately 19 miles (30.6 kilometers) north of Buffalo, New York. The property is owned by the federal government and operated and maintained by the United States Army Corps of Engineers. The site location is shown on Figure 1.

The NFSS represents a portion of the former Lake Ontario Ordnance Works, a former World War II munitions production facility, and was used by the Manhattan Engineer District and U.S. Atomic Energy Commission to store radioactive residues and other materials beginning in 1944. Uranium ore residues were generated through the processing of uranium ore for development of the atomic bomb. The first materials sent to NFSS for storage were radioactive residues from processing uranium ore at the Linde Air Products facility located in Tonawanda, New York. These residues resulted from processing ores with uranium ($U_3O_8$) contents ranging from 3.5 percent to 10 percent and were known as R-10, L-30, L-50, and F-32 residues. Beginning in 1949, radioactive residues from uranium processing at the Mallinckrodt Chemical Works – referred to as the K-65 residues – were shipped to NFSS in 55-gallon drums for storage. The uranium ore from which these residues were generated contained 35 to 65 percent $U_3O_8$, as well as uranium decay products, primarily radium and thorium, in secular equilibrium with the uranium prior to processing. Between 1950 and 1952, the K-65 residues were transferred from the drums to a large concrete (former water storage) tower on site, referred to as Building 434. In addition to the residues, radioactively contaminated materials from decommissioning wartime plants and uranium and thorium billets and rods (processed at private facilities) were sent to the NFSS for temporary storage. Between 1982 and 1986 the U.S. Department of Energy (USDOE), successor to earlier U.S. energy agencies, constructed the Interim Waste Containment Structure (IWCS) to house the residues at NFSS until a final determination on the residue disposition was made.

### NFSS Operable Units

To manage Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) activities at the NFSS, the Corps of Engineers established three separate Operable Units (OUs) that include the IWCS OU, Balance of Plant OU, and the Groundwater OU. The IWCS OU is an engineered landfill within the diked area of the NFSS and applies to all of the material within the IWCS. The Balance of Plant OU includes all of the material at the NFSS not in the IWCS and excluding groundwater. The Groundwater OU refers to groundwater contamination remaining after implementation of the selected remedial actions for the IWCS and Balance of Plant OUs.

The IWCS OU is the first OU to proceed through the feasibility study stage of the CERCLA process because disposition of the IWCS will impact the future land use for the Balance of Plant and Groundwater OUs. The proposed plan summarizes information that can be found in greater detail in the NFSS remedial investigation reports issued in 2007 and 2011 and the IWCS feasibility study issued in December 2015. Details of the contents and construction of the IWCS are provided in the following sections.

## Interim Waste Containment Structure

Between 1982 and 1986, the USDOE constructed the IWCS located in the southwest portion of the NFSS (Figure 2). The IWCS is an engineered landfill that is approximately 300 meters (990 feet) long by 140 meters (450 feet) wide and reaches a maximum height of 10 meters (34 feet) above ground surface. A clay dike/cut-off wall constructed around the IWCS provides an absorption barrier to horizontal radionuclide migration. The cut-off wall also extends across the near-center of the IWCS.

Within the IWCS, the radioactive residues, K-65, L-30, L-50, and F-32, were placed in existing concrete structures that had been part of the freshwater treatment plant for the Lake Ontario Ordnance Works during the 1940s. These buildings, located in the southern end of the IWCS, were made of reinforced concrete and originally designed to securely hold liquids. The R-10 residues remained on the ground in the north end of the IWCS where they were originally placed. In addition to the residues, soil and debris generated from USDOE cleanup activities at the site and nearby areas (termed vicinity properties) were placed over the residues and by 1986, the IWCS was covered by a multi-layered cap. In 1991, miscellaneous contaminated debris and soil were placed in a 99-meter (325-foot) by 59-meter (192-foot) waste containment cell that was excavated within the northern portion of the IWCS (BNI 1991). The excavation did not penetrate the entire depth of the clay cap layer and after waste placement, the cap was restored. A south-north cross-section of the IWCS is presented on Figure 3.

The residues emit high levels of gamma radiation and produce radon gas from the decay of radium-226, both of which present a potential risk to human health and the environment. By covering the residues with lower-activity waste and a multi-layer cap, the IWCS effectively retards radon and gamma emissions and inhibits infiltration of precipitation and migration of contamination to groundwater. The design life of the existing IWCS cap is 25 to 50 years, and the design life of the bottom, dike, and cut-off walls is 200 to 1,000 years (BNI 1986). In the years following completion of the IWCS, several investigations have been conducted to review the physical integrity of the clay cap and dike/cut-off walls [United States Army Corps of Engineers (USACE) 2011]. These investigations have found that the IWCS is intact and effectively containing the materials placed inside. Therefore, the IWCS presents no current risk to human health or the environment. Potential future risks from the wastes in their current form are discussed in Section 2.1.

Waste characterization of the IWCS is based on historical information, analytical records, and process knowledge. No intrusive sampling of the IWCS materials was conducted for the remedial investigation phase (USACE 2007). It was determined that sampling would require a breach of the clay cap, and this breach was considered unacceptable. The available data were reviewed and determined to be sufficient for the purpose of conducting the feasibility study (USACE 2015).

Pursuant to Public Law 108-137, Section 312, all of the ore processing residual materials inside the IWCS is considered “byproduct material” as defined by 11e.(2) of the Atomic Energy Act of 1954 as amended. For the purpose of the IWCS feasibility study, the IWCS OU was divided into Subunits A, B, and C. The 11e.(2) materials in the subunits exhibit a wide range of radioactivity

due to varying concentrations of radium-226. The level of radioactivity and the location of the 11e.(2) material within the IWCS were the main factors used to define the subunits.

The locations of the subunits with respect to the plan view of the IWCS are shown on Figure 4, and a detailed description of the contents of each subunit is presented below:

- **Subunit A: Residues and Commingled Wastes within Buildings 411, 413, and 414.** This subunit includes the K-65, L-30, L-50, and F-32 residues placed in Buildings 411, 413, and 414. Additionally, this subunit includes other 11e.(2) materials placed within the buildings, including soil and rubble/debris contaminated with ore processing residual material. The average radium-226 concentration of the 11e.(2) residues in Subunit A ranges from 300 picocuries per gram (pCi/g) (in the F-32 residues) to 520,000 pCi/g (in the K-65 residues). The estimated total volume of Subunit A is 28,440 cubic yards.
- **Subunit B: Debris and Wastes in the South End of the IWCS.** Subunit B contains the 11e.(2) materials placed south of the central IWCS cut-off wall and outside of Buildings 411, 413, and 414. The 11e.(2) materials in Subunit B consist of rubble/debris associated with storage, handling, and transfer of K-65 residues and various demolished building structures, soil surrounding the debris, and Middlesex Sands[1], all contaminated with ore processing residual material. Subunit B also includes the structures of Buildings 411, 413, and 414. The radium-226 concentrations in Subunit B are highly variable and estimated concentrations range from 16 pCi/g (in contaminated soil) to levels similar to the residues (where debris or soil is in contact with the residues). For simplicity, the average radium-226 activity level in Subunit B is reported to be 16 pCi/g because it represents the activity level of contaminated soil that accounts for about 90 percent of the waste volume in the subunit; however, the total curies attributed to radium-226 in Subunit B considers the estimated radium-226 activity level for each known type of waste present. The estimated total volume of Subunit B is 63,130 cubic yards.
- **Subunit C: Residues and Wastes in the North End of the IWCS**. Subunit C contains the 11e.(2) materials placed north of the central IWCS cut-off wall and includes most of the soil contaminated with ore processing residual material. It includes lesser volumes of R-10 residues and miscellaneous material contaminated with ore residues. The radium-226 concentrations in Subunit C range from approximately 16 pCi/g to 95 pCi/g. The estimated total volume of Subunit C is 186,502 cubic yards.

## Community Outreach Efforts during Development of the IWCS Operable Unit Feasibility Study

To promote public involvement in the early development stages of the IWCS OU Feasibility Study, the Corps of Engineers issued the following four technical memoranda:

- *Waste Disposal Options and Fernald Lessons Learned* (July 2011)
- *Radon Assessment* (January 2012)
- *IWCS Exposure Assessment* (February 2012)

[1] Middlesex sands resulted from sand blasting activities at the Middlesex Sampling Plant located in New Jersey.

- *Interim Waste Containment Structure Remedial Alternatives Technologies Development and Screening* (April 2013)

These documents served to inform the public on key technical issues prior to issuing the final IWCS OU feasibility study. The Corps of Engineers worked with a technical facilitator and held public workshops for each technical memorandum to help explain difficult concepts to the community. In addition to the workshops, the technical facilitator and the Corps of Engineers met regularly with the public to encourage further dialogue. The public was afforded the opportunity to submit comments on each technical memorandum, which were considered during development of the feasibility study. Long-standing community and regulator support for removal of residues from the site is recognized and documented.

## SUMMARY OF SITE RISKS AND REMEDIAL ACTION OBJECTIVES

### Human Health Risks

A CERCLA baseline risk assessment identifies risks related to the No Action Alternative and serves as the baseline against which remedial alternatives can demonstrate reductions in risk. Within a baseline risk assessment, risks are defined as the probability that a person could contract cancer or be exposed to a substance that would cause toxic effects and illness. Estimated cancer risks are generally expressed as the probability (or chance) of an excess cancer risk due to exposure to site contaminants. The National Contingency Plan describes a risk range of one chance in ten thousand to one chance in a million as an acceptable range for CERCLA cleanups. In addition, a CERCLA ecological risk assessment typically identifies any ecological risk concerns at a site.

The USDOE performed a baseline risk assessment of the IWCS in 1986 to quantify long-term risk assuming no action would be taken on the IWCS (USDOE 1986). Under the No Action scenario, it was assumed by USDOE that there is no monitoring, maintenance, or land-use controls, and a resident intruder builds a house in the contaminated materials and spends 30 years at the same residence, eating contaminated food grown in an on-site garden, and drinking contaminated water from a well located at the edge of the contaminated area. The USDOE estimated that the annual radiological dose to the lung tissue from inhalation of radon gas and its radioactive decay products would be approximately 8,000 rem per year, which could be fatal in a few years. They concluded that “By far the most significant radiological pathway, both in terms of dose and adverse health effects, is the inhalation of radon-222 gas (and its radioactive decay products) with resulting dose to the resident-intruder's bronchial epithelium (lining of the lung) and consequent increased risk of lung cancer” (USDOE 1986). Radon-222 gas is a decay product of radium-226, the main radioactive component of the K-65 residues.

USDOE’s assessment was later revisited by the Corps of Engineers in 2012 to reflect an updated understanding of the residues, i.e., that the K-65’s likely contained a greater concentration of radium-226 (USACE 2012). In both the 1986 and 2012 studies, the exposure assessment for the on-site hypothetical resident was limited to the indoor radon inhalation pathway because the estimated radon inhalation risk was so large, the evaluation of lesser exposures (e.g., eating contaminated food grown in a garden on the waste area, drinking contaminated groundwater, or

even exposure to the significant gamma radiation emanating from the residues) was considered unnecessary to determine site risks. The fatal cancer risk for the hypothetical resident was 4 x $10^{-1}$ (4 in 10) via the radon inhalation pathway, which is above the acceptable human health risk range by several orders of magnitude. More recent calculations showed unacceptable risk to a hypothetical maintenance worker during excavation of the residues, assuming no engineering controls (USACE 2012). Since the current and anticipated future use of the site is industrial and the exposure assumptions for the hypothetical maintenance worker are sufficiently similar to those for an industrial worker, a breach of the cap also would pose unacceptable risk to a hypothetical industrial worker.

Despite the presence of other radiological and non-radiological contaminants in the IWCS, the results of the baseline risk assessment showed the greatest risk to the hypothetical resident was the inhalation of radon gas (USDOE 1986). Therefore, the constituents of concern for the IWCS are radium-226 and its short-lived decay products.

## Ecological Risks

The 2007 remedial investigation report included a site-wide, screening-level ecological assessment that concluded that no further evaluation is required because there are no significant or unique ecological resources, there is no critical habitat for threatened or endangered species, and scattered wetlands and ditches are of low quality as a result of prior construction activities at the site (USACE 2007).

The IWCS feasibility study considered loss of site controls, i.e., maintenance and monitoring of the IWCS, and concluded that even if the IWCS containment system degraded and exposed ecological receptors to the contents of the IWCS, the human health risk associated with inhalation exposure would dominate the risk-management process due to a lack of unique ecological receptors. Radiation standards are more stringent for the protection of human health than they are for the environment. In the absence of sensitive habitats or wildlife species that warrant special protections, it is assumed that measures that will protect people from the harmful effects of radioactivity will also be protective of the environment.

## Applicable or Relevant and Appropriate Requirements

CERCLA Section 121 (d) (2) (A) requires that remedial actions meet any federal standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate. CERCLA Section 121 (d) (2) (A) (ii) requires state applicable or relevant and appropriate requirements (ARARs) to be met if they are more stringent than federal requirements. In addition, the National Contingency Plan, published in 40 Code of Federal Regulations Part 300, allows unpromulgated criteria, advisories, or guidance that do not meet the definition of ARARs but that may assist in the development of remedial objectives to be listed as "to be considered."

The following requirements were determined to be ARARs for the remedial alternatives evaluated in the IWCS feasibility study. Not all of them apply to the preferred alternative. A discussion of which ARARs apply to which alternatives can be found in Appendix D of the IWCS feasibility study (USACE 2015).

- 10 Code of Federal Regulation Part 40, Appendix A: Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content:
    - Criterion 4, Site and Design Criteria
    - Criteria 6(1), 6(2), 6(3), 6(5), 6(6), and 6(7), Closure of Waste Disposal Areas
    - Criterion 12, Long-term Site Surveillance
- 40 Code of Federal Regulations Part 61: National Emission Standards for Hazardous Air Pollutants, Subpart Q – National Emission Standards for Radon from Department of Energy Facilities

These ARARs specify performance requirements for on-site 11e.(2) byproduct disposal facilities, as well as release limits for radon from such facilities.

On numerous occasions over the past decade, the Corps of Engineers engaged in discussions about ARARs with the United States (U.S.) Environmental Protection Agency and New York State Department of Environmental Conservation. The New York State Department of Environmental Conservation and U.S. Environmental Protection Agency both recommended ARARs. The Corps of Engineers did not concur that the ARARs recommended were relevant and appropriate. Details regarding the ARAR selection process can be found in Appendix D of the IWCS feasibility study (USACE 2015). Also considered in the ARAR selection process was correspondence from the U.S. Environmental Protection Agency and the New York State Department of Environmental Conservation, presented in Attachment A, that expressed their support for removal and off-site disposal of the residues and wastes contained in the IWCS.

## Remedial Action Objectives

A remedial action objective is a specific goal that remedial alternatives must fulfill to be protective of human health and the environment. Remedial action objectives provide the basis for selecting remedial technologies and developing and evaluating remedial alternatives.

The remedial action objectives for the IWCS OU are designed to provide short- and long-term protection of human health and the environment based on plausible future land uses for the NFSS. CERCLA requires that any action taken be protective of human health and the environment as well as be compliant with identified ARARs. The remedial action objectives for the IWCS OU are as follows:

- Prevent unacceptable exposure of the public and workers to the hazardous substances associated with uranium ore mill tailings (e.g., radium-226 and its short-lived decay products) inside the IWCS.

- Minimize/prevent the transport of hazardous substances within the IWCS to other environmental media (e.g., soil, groundwater, surface water, sediment, and air) outside of the IWCS.
- During implementation of the remedial alternatives(s), minimize/prevent releases and other impacts that could adversely affect human health and the environment, including ecological receptors.

## DISCUSSION OF REMEDIAL ALTERNATIVES

### Summary of Remedial Alternatives

Five remedial alternatives were retained for detailed evaluation in the IWCS OU feasibility study. These alternatives ranged from No Action (Alternative 1) to partial and complete removal of materials in the IWCS. The inclusion of the No Action Alternative is required by CERCLA, but since it was determined in the IWCS feasibility study to not be protective of human health, it will not be considered further in this proposed plan. The remaining four alternatives include:

- Alternative 2 - Enhanced containment of Subunits A, B, and C with land-use controls and monitoring
- Alternative 3A - Excavation, treatment, and off-site disposal of Subunit A; enhanced containment of Subunits B and C with land-use controls and monitoring
- Alternative 3B - Excavation, treatment, and off-site disposal of Subunit A; excavation and off-site disposal of Subunit B; enhanced containment of Subunit C with land-use controls and monitoring
- Alternative 4 - Excavation, treatment, and off-site disposal of Subunit A; excavation and off-site disposal of Subunits B and C

As indicated by the descriptions above, the remedial alternatives share several common elements including:

- Enhanced containment (new cover), land-use controls, and monitoring for a period of 1,000 years (Alternatives 2, 3A, and 3B), and
- Excavation, treatment/containerization of the K-65 and commingled L-30 and F-32 residues, and off-site disposal (Alternatives 3A, 3B, and 4).

The main difference between the alternatives is the volume of material excavated for off-site disposal or alternatively, the volume of material left in-place for long-term maintenance and monitoring. The total radium-226 radioactivity (curies) associated with these volumes is also a distinguishing factor, as is the total cost of each alternative. These details are presented on the next page.

## SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED FOR THE IWCS OU

| No. | Alternative description | Volume excavated[1] (curies removed[6]) | Volume excavated and treated to reduce mobility[2] (curies removed/treated[6]) | Volume left in-place with new cover (curies remain[6]) | Total discounted cost[3] |
|---|---|---|---|---|---|
| 2 | Enhanced containment of Subunits A, B, and C with land-use controls and monitoring | 0 | 0 | 278,072 $yd^3$ (2,144 Curies) | $67.4M (capital: $23.4M) (O&M: $44M) |
| 3A | Excavation, treatment, and off-site disposal of Subunit A[4]; enhanced containment of Subunits B and C with land-use controls and monitoring | 60,587 $yd^3$ (172 Curies) | 6,030 $yd^3$ (1,950 Curies) | 211,455 $yd^3$ (22 Curies) | $303.6M (capital: $259.6M) (O&M: $44M) |
| 3B | Excavation, treatment, and off-site disposal of Subunit A[5]; excavation and off-site disposal of Subunit B; enhanced containment of Subunit C with land-use controls and monitoring | 90,878 $yd^3$ (190 Curies) | 6,030 $yd^3$ (1,950 Curies) | 181,164 $yd^3$ (4 Curies) | $362.4M (capital: $318.4M) (O&M: $44M) |
| 4 | Excavation, treatment, and off-site disposal of Subunit A; excavation and off-site disposal of Subunits B and C | 272,042 $yd^3$ (194 Curies) | 6,030 $yd^3$ (1,950 Curies) | 0 | $490.6M (capital: $490.6M) (O&M: $0M) |

[1]Volumes include materials placed in the IWCS and assumed volumes of potentially impacted clay surrounding the IWCS. Also, this total does not include the 6,030 cubic yards that also will be excavated because this volume will be treated and is included in the adjacent column. Additional details provided in footnote 2.

[2]Treatment includes stabilization, solidification, and containerization of a total of 6,030 $yd^3$ of K-65 (4,030 $yd^3$) and commingled L-30/F-32 (approximately 2,000 $yd^3$) residues in Subunit A.

[3] Since Operation and Maintenance (O&M) costs are incurred over a period of 1,000 years, they are presented as discounted (or present worth) dollars. By discounting all costs to a common base year, it allows the cost of remedial alternatives to be compared on the basis of a single figure representing the amount of money that, if invested in the base year, would be sufficient to cover all costs associated with the remedial action over its planned life. A discount rate of 3.5 percent was applied over the duration of 1,000 years to calculate O&M costs for Alternatives 2, 3A, and 3B. Capital costs are not discounted due to the relatively short durations (8 years or less) associated with construction activities under each alternative.

[4] It is assumed that 32,839 $yd^3$ of Subunit B and 5,338 $yd^3$ of Subunit C will be excavated to access Subunit A that contains 28,440 $yd^3$. So, 32,839 $yd^3$ + 5,338 $yd^3$ + 28,440 $yd^3$ = 66,617 $yd^3$ of material excavated; from the 66,617 $yd^3$, subtract the volume treated, 6,030 $yd^3$, for the resulting 60,587 $yd^3$ shown in the table.

[5] It is assumed that 5,338 $yd^3$ of Subunit C will be excavated to access Subunit A.

[6] Curies reported are due to radioactivity from radium-226.

$yd^3$ – cubic yards

M – million

In accordance with the statutory requirements of CERCLA Section 121, remedial alternatives must comply with two threshold criteria, overall protection of human health and the environment and compliance with ARARs, in order to be carried forward for further evaluation. If a remedial alternative meets the threshold criteria, it is evaluated against the following five balancing criteria:

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

The following sections provide a brief summary of the evaluation of the remedial alternatives against the five balancing criteria; a more detailed evaluation is presented in the IWCS feasibility study.

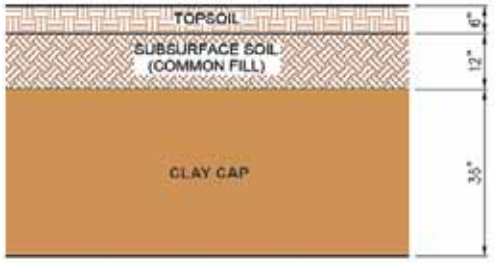
**Alternative 2: Enhanced Containment of Subunits A, B, and C with Land-use Controls and Monitoring**

Alternative 2, Enhanced Containment, is protective of human health and the environment and complies with ARARs and therefore, meets the CERCLA threshold criteria. Two key elements of the remedy are the installation of a new cover and land-use controls and monitoring for 1,000 years, discussed in more detail below.

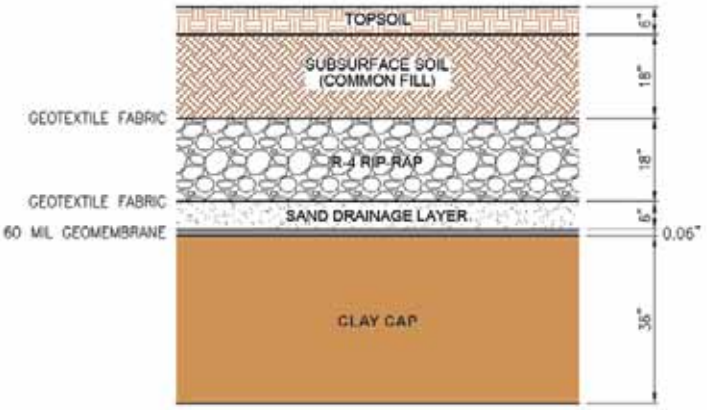
Although the existing cover on the IWCS is protective and effectively inhibits the release of radon and gamma emissions and minimizes the infiltration of water, the proposed new cover provides additional safeguards against damage from potential seismic activity and flooding, as well as biointrusion. Added features include a geosynthetic membrane (geomembrane) that provides a barrier to water infiltration for hundreds of years; decreased side slopes that protect against damage from erosion; and, a riprap layer that discourages intrusion.

A comparison of the main features of the existing and the proposed new covers is shown below.

**EXISTING AND PROPOSED NEW IWCS COVERS**




**Existing Cover**




**Proposed New Cover**

The Enhanced Containment alternative does not remove any radioactive or other waste material from the IWCS, and installation of the new cover would minimally disturb the existing clay cap that provides the main protection against harmful emissions. In addition, this alternative uses standard construction practices, equipment, materials, and controls. Resources, both trained suppliers and material supplies (e.g., clay and rocks), are readily available. Therefore, the implementability and short-term effectiveness for this alternative are rated high. The discounted total cost of this alternative is comparatively the lowest.

As previously mentioned the key components of this alternative include land-use controls and monitoring for 1,000 years, which means that engineered and institutional/administrative controls must prevent human exposure to the material in the IWCS for a very long period of time. Land-use controls would be implemented to maintain perpetual, federal, active control over the site. Long-term surveillance, monitoring, and maintenance of materials within the IWCS would be performed by the federal government. Land-use controls would be defined in a land-use control plan, developed during the remedial design phase. Due to the presence of long-lived radionuclides in the IWCS and consistent with the ARAR, the land-use controls would need to be maintained to provide reasonable assurance of control of radiological hazards to be effective for 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years. Land-use controls would:

- Institute USDOE procedures at this site that would prevent any development (i.e., residential, commercial, or industrial) that would degrade the IWCS containment properties or expose receptors to the IWCS contents.
- Create written rules at this site that would prevent construction activities involving drilling, borings, digging, or other use of heavy equipment that could disturb vegetation, disrupt grading or drainage patterns, cause erosion, or otherwise compromise the integrity of the landfill cover.
- Maintain federal government ownership.
- Perform inspection and maintenance of the fence around the property, roads and access to sampling locations, and any support facilities.
- Perform periodic site inspections and review to verify the integrity of the landfill cap.
- Provide access necessary for continued maintenance, monitoring, inspections, or repair.

The enhanced containment system also would require an environmental monitoring program and a performance review of the continued protectiveness of the area at least once every five years.

The federal government currently owns the NFSS property and will continue to own the property as long as the IWCS exists. And, as long as the IWCS exists, the federal government is committed to ensuring the security of the site and maintaining the IWCS so that it continues to be protective of human health and the environment. Since the baseline risk assessment showed unacceptable risk to a resident intruder who builds a house on the IWCS, these land-use controls are essential to the long-term protectiveness of this alternative because the new cover for the IWCS discourages but does not prevent intrusion.

The government addressed the issue of the long-term reliability of land-use controls in a study prepared for the Waste Isolation Pilot Plant in Carlsbad New, Mexico. The study depended on

"expert judgment analysis" to evaluate the reliability of government controls, possible modes of intrusion, and quantitative measures of probabilities for human intrusion over a period of 10,000 years (Hora et.al. 1991). Although the study was commissioned for a site other than the NFSS, the following general conclusions are relevant to the NFSS given the long half-lives of the radionuclides in the IWCS:

- The facets of society that most directly impinge upon inadvertent human intrusion include the rate of technological development, population growth, economic development (including the price of natural minerals and energy resources), water availability, information and records, and the level of government continuity.
- There is a small likelihood of continued U.S. government controls for the periods studied because "governments are seldom stable for long periods of time, certainly not for the period of time covered for this study."

Although the study evaluated a period of 10,000 years, which is much longer than the 1,000 years required by site-related ARARs, the study concluded that the amount of time required to achieve safe levels of radioactivity (due to the long half-lives of the radionuclides in the waste being considered) is longer than the anticipated "continuity and stability of governments." Similarly, it will take hundreds of thousands of years to achieve safe levels of radioactivity in the IWCS due to the long half-lives of the radionuclides in the K-65 residues. Given the unpredictability of future social, economic, and natural conditions, it cannot be guaranteed that the government will maintain active control of the site and that land-use controls will remain in-place. Therefore, this alternative is rated "moderately" effective over the long term.

The evaluation criterion that addresses the reduction of toxicity, mobility, or volume through treatment represents the statutory preference for selecting remedial actions under CERCLA, i.e., it is one of the primary goals of CERCLA. This preference is satisfied when treatment is used to reduce the toxicity of source materials (that would present a significant risk to human health or the environment should exposure occur) through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media. No treatment of the materials in the IWCS is included in Alternative 2, so it is rated "low" for this criterion.

In summary, Alternative 2 is:

- Rated high for implementability and short-term effectiveness;
- Rated moderate for long-term effectiveness and permanence;
- Rated low for reduction of toxicity, mobility or volume through treatment;
- Requires 1,000 years of operations, maintenance, monitoring, and periodic (five-year) reviews; and
- Costs $67M (capital costs are $23.4M and O&M costs are $44M[2]).

[2] Discounted (or present worth) costs are used to evaluate expenditures that occur over different time periods. By discounting all costs to a common base year, it allows the cost of remedial alternatives to be compared on the basis of a single figure representing the amount of money that, if invested in the base year, would be sufficient to cover all costs associated with the remedial action over its planned life. A discount rate of 3.5 percent was applied over the duration of 1,000 years to calculate O&M costs for Alternatives 2, 3A, and 3B. Capital costs are not discounted due to the relatively short durations (eight years or less) associated with construction activities under each alternative.

**Alternative 3A: Excavation, Treatment, and Off-site Disposal of Subunit A; Enhanced Containment of Subunits B and C with Land-use Controls and Monitoring**

Alternative 3A consists of the removal, treatment, and off-site disposal of Subunit A and enhanced containment of Subunits B and C.

All of the material in Subunit A (28,440 cubic yards), which contains the residues with the higher average radioactivity, will be excavated. The K-65 and co-mingled residues, which represent a fraction of this total (6,030 cubic yards) will be treated by cement solidification/stabilization. Enhanced containment or the installation of a new IWCS cover will protect the material that remains in Subunits B and C. For Alternative 3A, the land-use controls and enhanced containment of Subunits B and C will follow the design previously described for Alternative 2, so they will not be repeated here.

Construction activities performed for Alternative 3A are more complex than those for Alternative 2. Although portions of Subunit B (52 percent of the subunit or 32,839 cubic yards) and Subunit C (3 percent of Subunit C or 5,338 cubic yards) will be excavated to allow for access to Subunit A using industry standard construction equipment and dust control measures, more sophisticated construction equipment and safety protocols will be required for the removal of Subunit A. This distinction is due to the disparate average radium-226 concentrations within the subunits:

- Subunit A - concentrations range from 300 pCi/g (F-32 residues) to 520,000 pCi/g (K-65 residues)
- Subunit B – concentration of 16 pCi/g in the contaminated soil and debris
- Subunit C – concentrations range from 16 pCi/g (soil) to 95 pCi/g (R-10 residue)

In order to safely remove the contents of Subunit A, a radon control system will be constructed to capture and treat radon emissions, and remote technology, including cameras and remotely controlled equipment, will be employed to protect against the harmful direct radiation and radon levels from exposed K-65 residues. In addition, a treatment facility will be constructed to solidify and stabilize the residues and to package the treated waste in containers designed to meet regulations for safe transport and off-site disposal. Despite the advanced and unique technology required to remove and treat Subunit A, Alternative 3A is rated “moderate” for “implementability,” “short-term effectiveness,” and “reduction in toxicity, mobility or volume through treatment” because these are proven technologies that were used successfully to remove and treat K-65 residues at the USDOE Fernald Site in Fernald, Ohio.

The long-term effectiveness and permanence of Alternative 3A is enhanced by the removal and treatment of the K-65 residues that account for only 1 percent of the volume but over 90 percent of the radioactivity (from radium-226) in the IWCS. The treated material will exhibit reduced contaminant mobility and radon emanation. In addition, the treated material will be placed in steel containers that will provide shielding for transport and ultimate disposal. Removal of the K-65 residues significantly reduces the total radioactivity of the waste remaining in the IWCS. Treating and containerizing these residues improves the overall permanent protectiveness of Alternative 3A with regard to the K-65 residues, so Alternative 3A is rated “high” for long-term effectiveness and permanence.

In summary, Alternative 3A is:

- Rated high for long-term effectiveness and permanence;
- Rated moderate for implementability, short-term effectiveness, and reduction of toxicity, mobility or volume through treatment;
- Requires 1,000 years of operations, maintenance, monitoring, and periodic (five year) reviews; and
- Costs $303.6M (capital costs are $259.6M and O&M costs are $44M[3]).

**Alternative 3B: Excavation, Treatment, and Off-site Disposal of Subunit A; Excavation and Off-site Disposal of Subunit B; Enhanced Containment of Subunit C with Land-use Controls and Monitoring**

Alternative 3B consists of the removal, treatment, and off-site disposal of Subunit A, removal and off-site disposal of Subunit B, and enhanced containment of Subunit C. Alternative 3B is very similar to Alternative 3A, with the exception that the entire contents of Subunit B, located in the southern half of the IWCS along with Subunit A, will be excavated for off-site disposal.

The only difference between Alternatives 3A and 3B is the amount of material in Subunit B that will be excavated and disposed of off-site. Although by definition Alternative 3A involves the removal of Subunit A only, a large portion of Subunit B, approximately 52 percent, must be excavated to allow for access to Subunit A. Under Alternative 3B, the remaining 48 percent of material in Subunit B also will be excavated for off-site disposal.

Since Alternatives 3A and 3B are very similar in scope and require similar construction techniques, the detailed discussions presented for Alternative 3A apply to Alternative 3B and will not be repeated here. Furthermore, the detailed description of land-use controls and design for enhanced containment were addressed in Alternative 2, so they will not be repeated here because the main elements of the design remain the same.

In summary, Alternative 3B is:

- Rated high for long-term effectiveness and permanence;
- Rated moderate for implementability, short-term effectiveness, and reduction of toxicity, mobility or volume through treatment;
- Requires 1,000 years of operations, maintenance, monitoring, and periodic (five year) reviews; and
- Costs $362.4M (capital costs are $318.4M and O&M costs are $44M[3]).

[3] The discounted O&M costs for Alternatives 2, 3A, and 3B are all $44M, which is based on the current O&M cost for the IWCS ($1.1M per year). The discounted O&M costs for these 3 alternatives are assumed to be the same because the bulk of the annual O&M budget pays for maintenance of the cap and monitoring of the containment structure, and an equivalent level of effort is presumed for each containment alternative. Also included in this amount is approximately $200,000 for the required five-year reviews.

**Alternative 4: Excavation, Treatment, and Off-site Disposal of Subunit A; Excavation and Off-site Disposal of Subunits B and C**

Under Alternative 4, all of the material in the IWCS is excavated and disposed of off-site. In addition, the K-65 and commingled residues in Subunit A are stabilized, solidified, and containerized by the same methods specified in Alternatives 3A and 3B.

Alternative 4 is very similar in scope and requires similar construction techniques as Alternatives 3A and 3B, so it is also rated high for long-term effectiveness and permanence and moderate for implementability and reduction of toxicity, mobility or volume through treatment. However, under Alternative 4, all of the material in the IWCS is removed, which is 211,455 cubic yards or 76 percent more than Alternative 3A and 181,164 cubic yards or 65 percent more than Alternative 3B. This additional volume results in increased waste handling and transportation and an increased risk for construction-type and vehicle-related accidents. Therefore, Alternative 4 is rated low for short-term effectiveness.

In summary, Alternative 4 is:

- Rated high for long-term effectiveness and permanence;
- Rated moderate for implementability and reduction of toxicity, mobility or volume through treatment;
- Rated low for short-term effectiveness;
- Requires no operations, maintenance and reviews (residual material from the IWCS would be addressed under the subsequent Balance of Plant OU); and
- Costs $490.6M (all capital costs).

## Comparative Analysis of Alternatives

This section of the proposed plan profiles the relative performance of each of the alternatives against the five balancing criteria.

### Overall Protection of Human Health and the Environment

Alternatives 2, 3A, and 3B are considered protective because long-term exposure and risk will be prevented by maintaining perpetual active site control and maintaining the integrity of the enhanced containment system. Alternative 4 is protective because it safely removes all waste in the IWCS for disposal off-site.

### Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 2, 3A, 3B, and 4 have all been designed to comply with the requirements of 10 Code of Federal Regulations 40 and 40 Code of Federal Regulations 61 and, thus, are considered compliant with ARARs.

**Long-term Effectiveness and Permanence**

The long-term effectiveness and permanence of Alternative 2 is considered effective and permanent because exposure and risk will be prevented by maintaining perpetual active site control, including maintaining the integrity of the enhanced containment system (i.e., multi-layer cap). Thus, Alternative 2 receives a "moderate" ranking. Alternatives 3A, 3B, and 4 would result in removal and treatment of the K-65 residues by cement stabilization, which reduces contaminant mobility and radon emanation. The treated waste also is placed in steel containers, which provide shielding during both transport and final disposal. The K-65 residues represent only 1 percent of the total volume of waste but about 90 percent of the radium-226 content in the IWCS. As a result, the treating and containerizing of the K-65 residues improves the overall permanent protectiveness of Alternatives 3A, 3B, and 4 with regard to the K-65 residues, so these alternatives receive a ranking of "high" for long-term effectiveness and permanence.

**Reduction of Toxicity, Mobility and Volume through Treatment**

Rankings applied to this criterion are degrees of reduction in toxicity, mobility, or volume to be achieved through treatment of IWCS wastes. No waste is treated under Alternative 2 so this alternative receives a "low" ranking for this criterion. Alternatives 3A, 3B, and 4 have a "moderate" ranking because treatment is used to reduce the toxic effect and mobility of the highest-activity material (K-65 and commingled residues); these materials are disposed of off-site. The remaining IWCS materials will not require treatment.

**Short-term Effectiveness**

Alternative 2 receives a "high" ranking for short-term effectiveness because it does not involve opening the IWCS cap or processing the wastes and therefore, poses the lowest probability of potential impacts.

Alternatives 3A, 3B, and 4 each involve opening the IWCS cap and handling and transporting the IWCS wastes, including the residues, and would be completed in 7.5 years, 8 years, and 8 years, respectively. The activities associated with implementing these alternatives present potential short-term impacts to the community, workers, and the environment. To address these issues, controls have been included and added to the cost of the alternatives to minimize potential impacts. Alternatives 3A and 3B receive a "moderate" ranking because of the use of controls to minimize potential short-term impacts. The volume of Subunit C is approximately twice that of Subunits A and B, so there will be greater truck traffic as well as a greater potential for construction-type accidents for Alternative 4 compared to Alternatives 3A and 3B. As a result, Alternative 4 is ranked lower than Alternatives 3A and 3B.

**Implementability**

Each of the identified alternatives has proven to be implementable; therefore, none of them receives a "low" ranking for implementability. The alternative that is the most proven to be implementable is Alternative 2 because it uses standard capping construction practices and readily available resources. Thus, Alternative 2 receives a "high" ranking for implementability.

Alternatives 3A, 3B, and 4 are rated as "moderate" and are assumed to be equally implementable.

**Cost**

For the comparative summary of the costs of the alternatives, discounted (or present value) costs were reviewed. Discounted costs represent the current worth of a future sum of money given a specified rate of return (the discount rate). In other words, the discounted value is the amount of money that would need to be invested today to cover costs over the life of the project. The discount rate used for the IWCS feasibility study is 3.5 percent. The life of the project for Alternatives 2, 3A, and 3B is assumed to be 1,000 years, commensurate with the identified ARARs for the project.

**Summary of Comparative Analysis**

A tabulated comparative analysis of alternatives is presented below:

**Comparative Analysis of Alternatives for the IWCS Feasibility Study**

| Criterion | Alternative 2 - Enhanced containment of Subunits A, B, and C with land-use controls and monitoring | Alternative 3A - Excavation, treatment, and off-site disposal of Subunit A; enhanced containment of Subunits B and C with land-use controls and monitoring | Alternative 3B - Excavation, treatment, and off-site disposal of Subunit A; excavation and off-site disposal of Subunit B; enhanced containment of Subunit C with land-use controls and monitoring | Alternative 4 - Excavation, treatment, and off-site disposal of Subunit A; excavation and off-site disposal of Subunits B and C |
|---|---|---|---|---|
| Overall protection of human health and the environment | Yes | Yes | Yes | Yes |
| Compliance with ARARs | Yes | Yes | Yes | Yes |
| Long-term effectiveness and permanence | Moderate | High | High | High |
| Reduction of toxicity, mobility, and volume through treatment | Low | Moderate | Moderate | Moderate |
| Short-term effectiveness | High | Moderate | Moderate | Low |
| Implementability | High | Moderate | Moderate | Moderate |
| Cost (capital) | $23.4M | $259.6M | $318.4M | $490.6M |
| Cost (O&M[1] discounted) | $44.0M | $44.0M | $44.0M | $0 |
| Total Cost | $67.4M | $303.6M | $362.4M | $490.6M |

O&M – operation and maintenance

[1]O&M costs are assumed for a period of 1,000 years and are discounted

**Support Agency Coordination**

The New York State Department of Environmental Conservation participated in the development of the IWCS feasibility study by issuing comments on the technical memoranda and attending public workshops and community meetings, as well as participating in monthly telephone calls with the Corps of Engineers in support of the 2002 Cooperative Agreement.[4]

Correspondence issued over the years to the Corps of Engineers by the New York State Department of Environmental Conservation consistently stated the agency's position that shallow land burial of the residues in the IWCS is not an appropriate long-term solution. Similarly, the U.S. Environmental Protection Agency expressed their support for "off-site disposal at a facility that is equipped to handle the high-activity residues and wastes contained in the IWCS." Letters issued by the New York State Department of Environmental Conservation and the U.S. Environmental Protection Agency are presented in Attachment A.

## SUMMARY OF PREFERRED ALTERNATIVE

The preferred alternative for the IWCS is Alternative 4, excavation, treatment, and off-site disposal of Subunit A and excavation and off-site disposal of Subunits B and C. This alternative satisfies the CERCLA threshold criteria and reduces risk through treatment of a portion of the Subunit A residues, thereby providing increased long-term protectiveness. The discounted cost of Alternative 4, however, is the greatest among the four remedial actions evaluated.

Like Alternative 4, Alternatives 3A and 3B also include treatment of Subunit A residues but overall, remove less IWCS material than Alternative 4. Despite the fact that more IWCS material is removed under Alternative 4, the long-term effectiveness and permanence of Alternatives 3A, 3B, and 4 are the same, with only cost increasing as additional material is removed. No improvement in the long-term effectiveness and permanence is realized because the IWCS materials that remain in-place under Alternatives 3A and 3B would be contained in an enhanced IWCS, which would offer the same level of protection as a permitted off-site disposal facility provided by Alternative 4. Among the remedial alternatives considered for the IWCS, Alternative 2 is the only remedial option that does not include treatment of waste, and as stated in Section 300.430(f)(1)(ii)(E) of the National Contingency Plan, special emphasis is placed on long-term effectiveness and reduction of toxicity, mobility, or volume through treatment:

> *Each remedial action shall utilize permanent solutions and alternate treatment technologies…to the maximum extent possible…The balancing shall emphasize long-term effectiveness and reduction of toxicity, mobility or volume through treatment. The balancing shall also consider the preference for treatment as a principle element and the bias against off-site land disposal of untreated waste.*

[4] The purpose of the 2002 Cooperative Agreement was to establish a mechanism that allowed the federal government to reimburse New York State Department of Environmental Conservation for technical review and other services related to the Corps of Engineers' investigation and remediation of Formerly Utilized Sites Remedial Action Program (FUSRAP) sites within New York State. The Corps of Engineers, Buffalo District, holds monthly conference calls with New York State Department of Environmental Conservation to discuss the status of all FUSRAP projects within New York State that are managed by the Buffalo District, including the NFSS.

Although Alternative 4 costs 38 percent more ($187M) than Alternative 3A and 26 percent more ($128.2M) than Alternative 3B, there are long-term benefits that should be considered when all material is removed from the IWCS. The benefits of Alternative 4 are appreciated from a long-term risk management perspective.

Under Alternative 4, the 11e.(2) byproduct waste in the IWCS would be consolidated with similar waste at an off-site government-owned or appropriately-licensed 11e.(2) disposal facility. Under current regulation, post-operational long-term care following closure of 11e.(2) disposal facilities becomes the responsibility of either the state or the federal government (USDOE). While removing and consolidating the IWCS waste would require increased upfront capital costs, decreasing the overall number of 11e.(2) disposal facilities would reduce future spending on post-closure care of these facilities. It is also one of the stated goals of the Uranium Mill Tailings Radiation Control Act (UMTRCA) regulations, which discourages the "proliferation of small waste disposal sites," such as the IWCS, and encourages the reduction of "perpetual surveillance obligations." Consolidation of disposal sites also reduces the potential risk to the public from government-owned wastes.

Another significant benefit of the removal of all of the material in the IWCS under Alternative 4 is the opportunity to excess the NFSS property for beneficial re-use. The USDOE's Office of Legacy Management is the agency that will ultimately be responsible for the operation and maintenance of the IWCS two years after completion of CERCLA activities. Optimizing the use of land and assets is Goal 4 of USDOE's Legacy Management 2011-2020 Strategic Plan and is considered a national priority (USDOE 2011). The selection of Alternative 4 is the necessary first step towards achieving this goal.

## REFERENCES


BNI 1986. *Design Report for the Interim Waste Containment Facility at the Niagara Falls Storage Site*, Lewiston, New York.

BNI 1991. *Geotechnical Post-Construction Report for the NFSS Waste Pile Consolidation July-October 1991*.

Hora et al. 1991. Expert Judgment on the Inadvertent Human Intrusion into the Waste Isolation Pilot Plant, Sandia Report No. SAND90-3063, Prepared for the U. S. Department of Energy, December.

USDOE 1986. *Environmental Impact Statement, Long-Term Management of the Existing Radioactive Wastes and Residues at the Niagara Falls Storage Site*, Final, April.

USDOE 2011. *Legacy Management 2011-2020 Strategic Plan*, January, Available at: <http://www.lm.doe.gov/LM_Program/strategic_plan.aspx >.

USACE (U. S. Army Corps of Engineers) 2007. *Remedial Investigation Report for the Niagara Falls Storage Site*, Prepared by Science Applications International Corporation, December.

USACE 2011. *Remedial Investigation Report Addendum for the Niagara Falls Storage Site*, Prepared by Science Applications International Corporation, April.

USACE 2012. *Preliminary Health Effects for Hypothetical Exposures to Contaminants from the Interim Waste Containment Structure Technical Memorandum*, February.

USACE 2015. *Feasibility Study for the Interim Waste Containment Structure at the Niagara Falls Storage Site in Lewiston, New York*, June.

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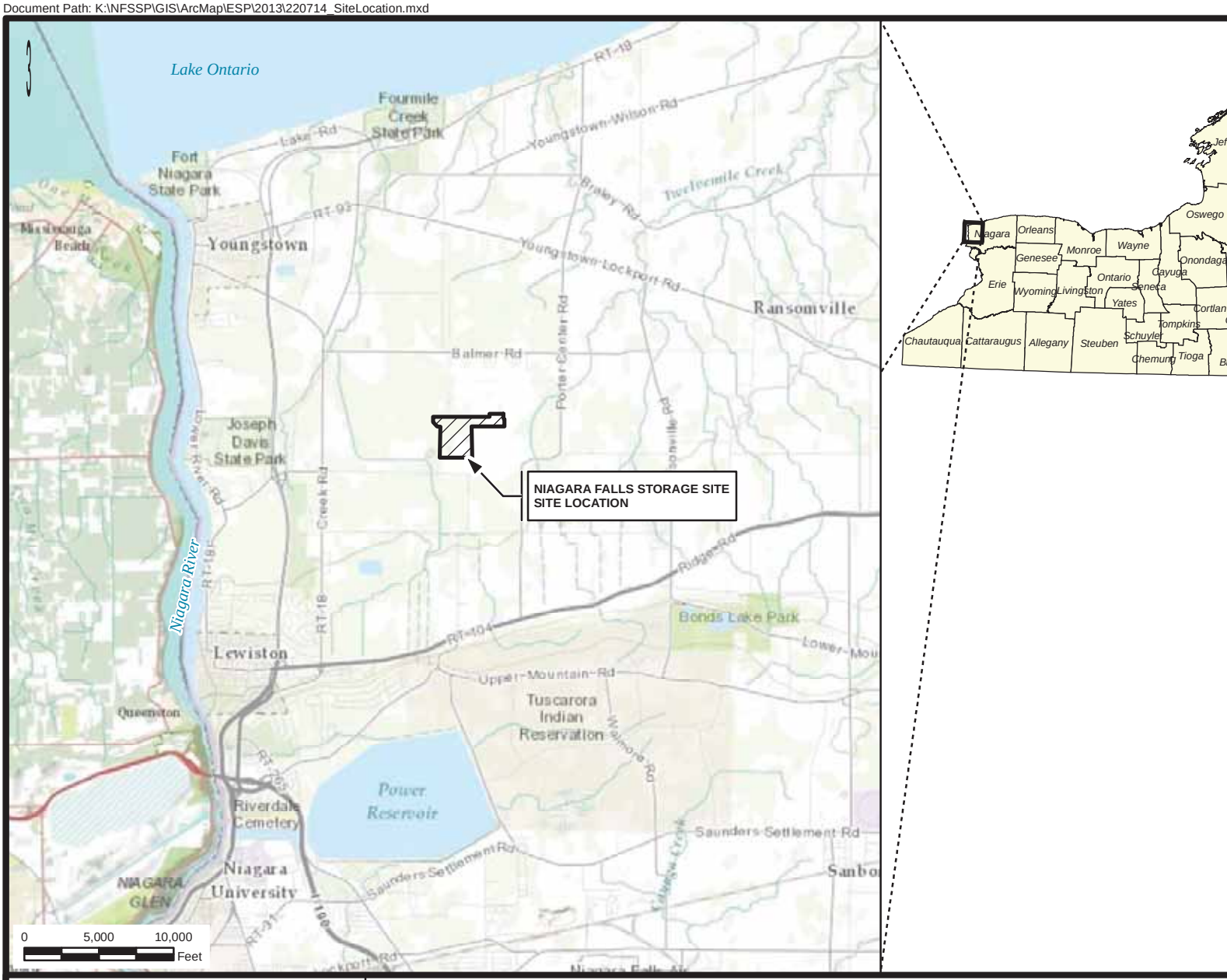


U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

SITE LOCATION MAP

Document Name: 220714_SiteLocation.mxd
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Date Saved: 23 Jul 2014
Time Saved: 11:04:05 AM

NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

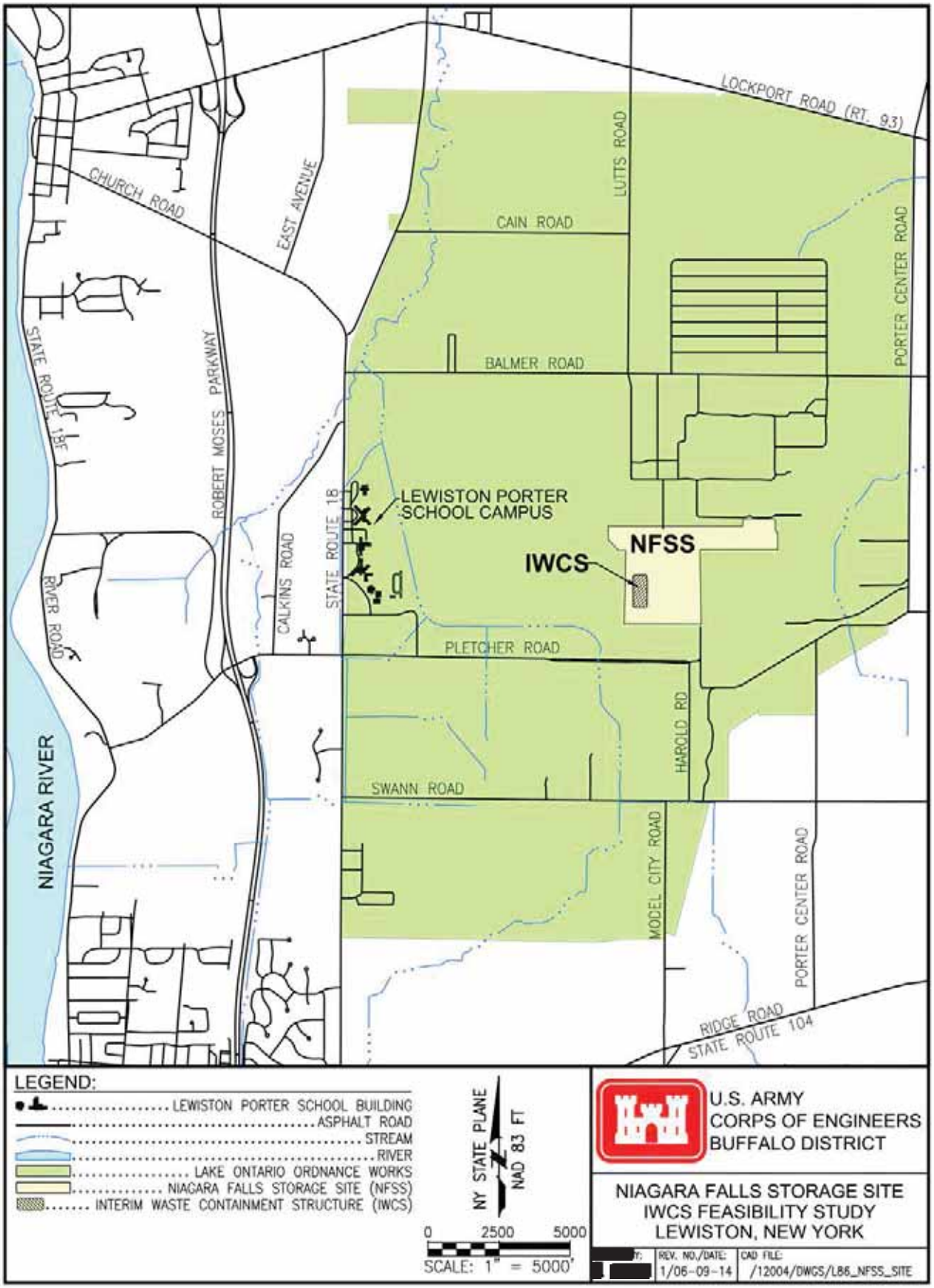
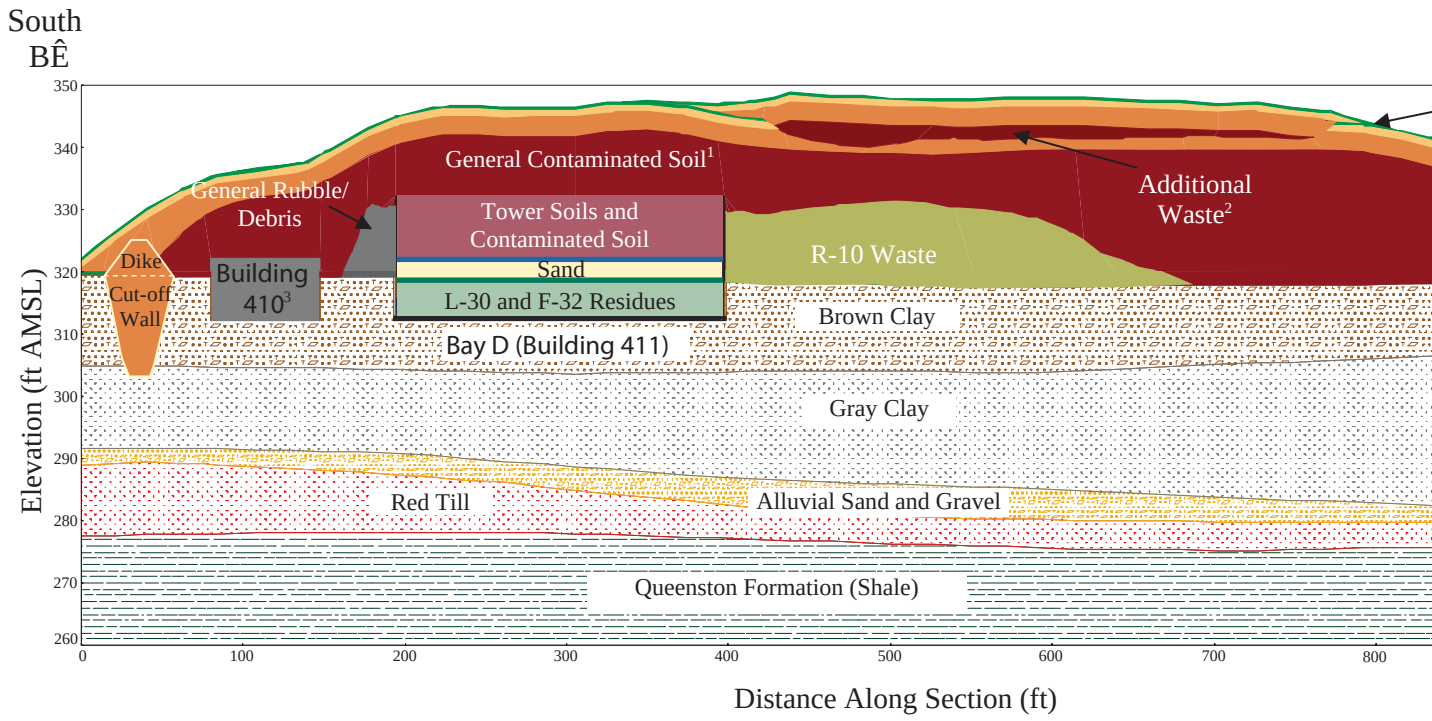



**Figure 2. Relationship of the LOOW and the NFSS**




*Note: Not to Scale (Approximate Vertical Exaggeration is 4:1)*

1 - Contaminated soil consists predominantly of waste clay.
2 - Thickness is estimated. No documentation is available on depth of layer. 3,500 cubic yards of contaminated soil and materia
by 192-ft waste containment cell that was excavated in 1991.
3 - Building 410 contains assorted rubble and debris and 230 cubic yards of the Middlesex Sands.

Figure 3: IWCS and Waste Placement North-South Cross-Section

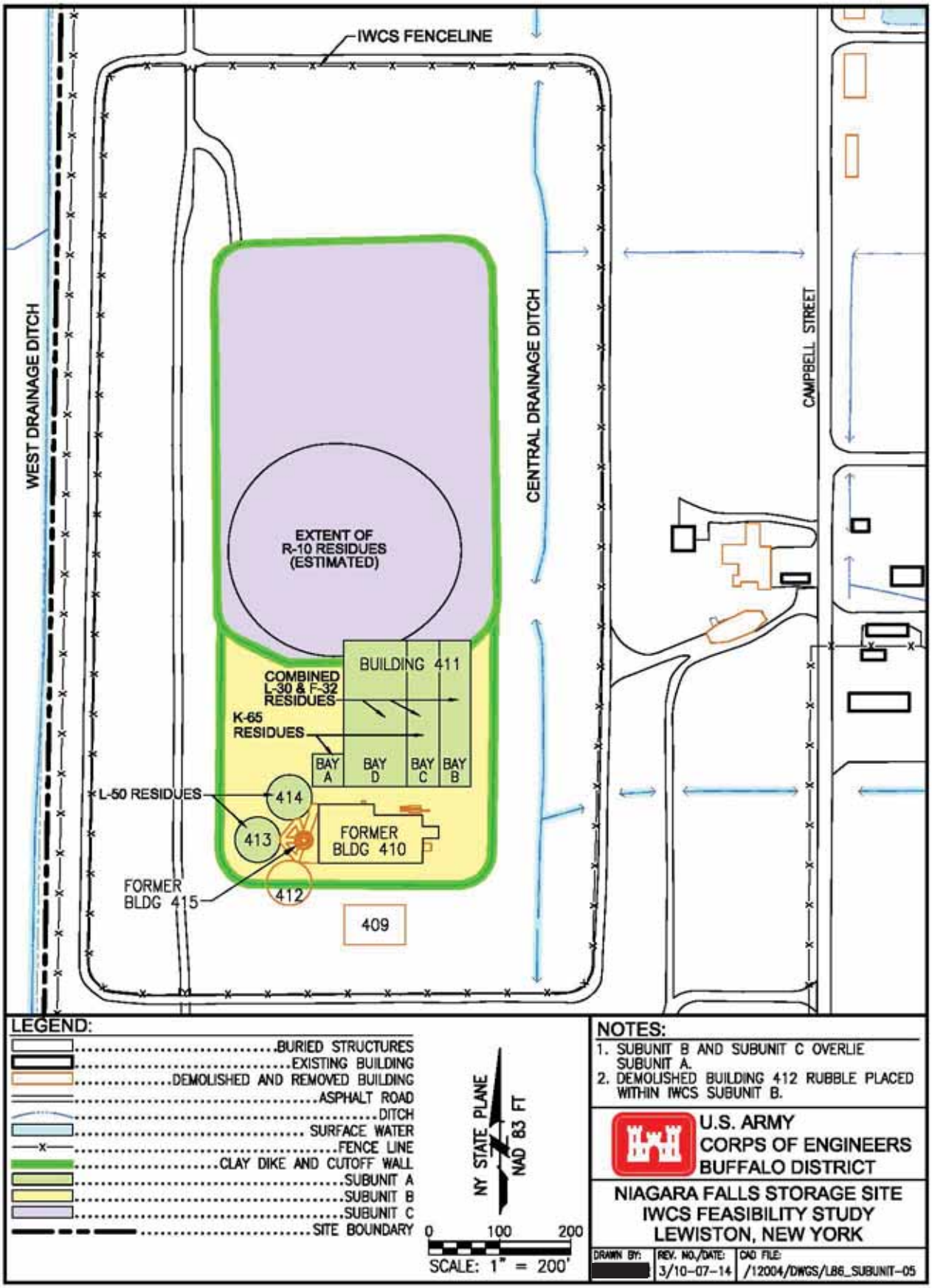



Figure 4: IWCS Subunits

## ATTACHMENT A

## LETTERS FROM THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION AND THE U.S. ENVIRONMENTAL PROTECTION AGENCY

**New York State Department of Environmental Conservation**
**Division of Environmental Remediation**
Remedial Bureau A, 11th Floor
625 Broadway, Albany, New York 12233-7015
**Phone:** [redacted] • **Fax:** [redacted]
Website: www.dec.ny.gov

[redacted]
Acting Commissioner

January 25, 2011

[redacted]
Department of the Army
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207-3199

Dear [redacted]:

Re: Niagara Falls Storage Site
RAOs and ARARs Technical Memorandum Objective

This responds to the Corps December 2010 fact sheet which solicited input from the public on the objective of the technical memorandum addressing the Remedial Action Objectives (RAOs) and Applicable or Relevant and Appropriate Requirements (ARARs) to be used in conducting the Feasibility Studies (FSs) for the Interim Waste Containment Structure (IWCS) and Balance of Plant (BOP) Operable Units (OUs) at the Niagara Falls Storage Site (NFSS).

Enclosed you will find a listing of State ARARs along with a justification for each one. They are available on the NYSDECwebsite at http://www.dec.ny.gov/regs/2491.html and http://www.dec.ny.gov/docs/remediation_hudson_pdf/cpsoil.pdf.

As you know, the Department does not consider shallow land burial of these waste materials as an appropriate long-term solution. In fact in a September 28, 1993 letter from former Commissioner [redacted] to [redacted]; then Secretary of the United Sates Department of Energy, we stated that "we believe the 40 CFR Part 192 uranium mill tailings standard established by the United States Environmental Protection Agency was never intended to regulate such high activity wastes as the K-65 residues contain, and that the most applicable standard would be those of 40 CFR Part 191 requiring deep mine repository disposal and assurance of over 10,000 years of isolation from humankind." This position has continued to be reiterated in various correspondences with the Corp including a September 10, 2008 letter from [redacted] to [redacted].

With regard to RAO's, particularly in relation to the second bullet beneath preliminary RAOs, in keeping with the Corp's conformance with the CERCLA process, the clean-up should achieve an EPA risk level in the $10^{-4}$ to $10^{-6}$ range (and the goal of 15 mrem annual Total Effective Dose Equivalent).

If you have any questions or need further information, please contact [redacted], of the Radiological Sites Section within this Bureau, at [redacted] or by email at [redacted].

Sincerely,

[redacted]
Director
Remedial Bureau A

Enclosure

cc w/enc: [redacted] USACE
[redacted], USEPA
[redacted], NYSDOH

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

JAN 2 3 2012

[redacted], PE, PMP, FUSRAP Program Manager
U.S. Army Corps of Engineers, Buffalo District
1776 Niagara Street
Buffalo, NY 14207-3199

Dear [redacted]:

EPA has completed its review of the Waste Disposal Options and Lessons Learned Technical Memorandum for the Niagara Falls Storage Site, Lewiston NY, dated July 2011. This document provides a detailed evaluation and correlation between the Fernald Site and the Niagara Falls Storage Site (NFSS) with the associated disposition options, including the possibility for an On-Site Disposal Facility (OSDF). While an OSDF was a viable option at Fernald, this may not be a viable and/or cost effective option at the NFSS.

As you are aware from previous discussions and previous correspondence dating back to the time period when the NFSS Interim Waste Containment Structure (IWCS) was first constructed, EPA believes the best alternative would be off-site disposal at a facility that is equipped to handle the high activity residues and wastes contained in the IWCS. EPA has in the past corresponded with the U.S. Department of Energy (DOE) on this Formerly Utilized Remedial Action Program (FUSRAP) site, as well as the U.S. Army Corps of Engineers (USACE). DOE originally had responsibility for FUSRAP before it was transferred to the USACE.

I have enclosed three letters which I believe give the historical perspective of our position regarding a possible OSDF: (1) June 25, 1986 letter from EPA Regional Administrator [redacted] to [redacted], Manager Oak Ridge Operations, DOE; (2) May 1, 1987 letter from [redacted] EPA Region 2 Federal Facilities Coordinator to [redacted], Office of Nuclear Energy DOE; and (3) my letter to [redacted] on September 8, 2009. To summarize our position, 40 CFR 191, *Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes*, should apply to the NFSS as an Applicable or Relevant and Appropriate Requirements (ARAR). Additionally and as you know from you continued compliance, the 40 CFR 61, *National Emission Standards for Hazardous Air Pollutants ( Rad NESHAP),* also apply to the NFSS IWCS. Such CFRs are considered Relevant and Appropriate (R&A) ARARs for the current status of the NFSS and during the site remediation phase. While there may be radioactive wastes that have radioactivity levels consistent with EPA's 40 CFR 192 *Uranium Mill Tailings Radiation Control Act Standards* and these may also be considered as an ARAR as such, we do not believe that most radioactive wastes or residues can be effectively handled long term using 40 CFR

192 as an ARAR. We also would point out that the UMTRCA standards were designed for land use far different from that currently in the Lewiston area.

Should you have any questions or would like to discuss the content of this letter in more detail, do not hesitate to contact me at [redacted].

Sincerely,

[redacted]
Radiation and Indoor Air Branch

Cc: [redacted] – EPA Western NY Public Information Office
[redacted], Ph. D.

Enclosures [3]

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION II
26 FEDERAL PLAZA
NEW YORK, NEW YORK 10278

JUN 25 1986

[redacted], Manager
Oak Ridge Operations
Department of Energy
P.O. Box E
Oak Ridge, Tennessee 37831

Dear [redacted]

The Environmental Protection Agency (EPA) has reviewed the final environmental impact statement (EIS) for the Long-Term Management of Existing Radioactive Wastes and Residues at the Niagara Falls Storage Site (NFSS), located near Lewiston, New York. This review was conducted in accordance with Section 309 of the Clean Air Act, as amended (42 U.S.C. 7606, PL 91-6040 12(a) 84 Stat. 1709).

The final EIS defines and analyzes nine generic alternatives for the long-term management of 11,000 $m^3$ of radioactive residues (produced from the processing of uranium ores) and 180,000 $m^3$ of radioactive wastes (primarily existing in the form of contaminated soils). The residues have an average radium-226 concentration of 67,000 pCi/g (870 Ci of radium-226); the wastes have an average radium-226 concentration of 36 pCi/g (7.8 Ci of radium-226). By comparison, uranium mill tailings have an activity of about 200 to 500 pCi/g.

The generic goal of the management scheme would be to assure that the material complies with Uranium Mill Tailings Radiation Control Act (UMTRCA) Standards (40 CFR 192). The document indicates that the Department of Energy's (DOE) preferred generic alternative is long-term management at NFSS (alternative 2). There are two options indicated for alternative 2: alternative 2a, which is referred to as modified containment, and consists of the construction of a "long-term" cap; and alternative 2b, which is referred to as modified containment plus modified form, and consists of both the construction of a long-term cap and the physical and/or chemical modification of the residues. The preferred option is not identified.

DOE has used EPA's UMTRCA Standards time frames for its assessment of environmental radiation risk and consequences (pp. 4-2, 4-3). This analysis is appropriate for the 180,000 $m^3$ of wastes which have an activity below the range of uranium mill tailings. The radioactive residues, however, have an activity level that is 100 to 400 times higher than mill tailings, and must be

managed, stored or disposed of in a manner that provides for greater protection than under UMTRCA. In previous correspondence (letter of May 24, 1985), EPA identified substantial concerns about the need to assure an adequate level of protection for the residues, and also raised concerns about potential groundwater impacts through contamination of recharge water in and around NFSS. Several containment options were suggested for review, including matrix stabilization, and use of concrete vaults and/or concrete capping material to decrease infiltration and leaching.

The 2b alternative identified in the EIS proposes on-site management using some form of matrix enhancement for the residues. Four such methods are reviewed in Appendix C of the EIS: vitrification, asphalt/bitumen, cement and urea-formaldehyde. None of these are described in sufficient detail to provide a positive indication of their feasibility or workability, although conceptually, some version of the 2b alternative may be acceptable. It is our judgement, however, that the 2a alternative will not provide an adequate level of protection for the residues and is, therefore, environmentally unacceptable.

Given the lack of detailed technical, engineering/design, and groundwater data available at this time, we find the EIS inadequate for the purposes of determining the environmental acceptability of the selected generic alternative of on-site management (with the caveat stated above that 2a is unacceptable for the residue material). This is consistent with our May 24, 1985, correspondence in which we indicated that more detailed technical and design information was needed to complete our review of the project, and that the residue material would require a higher level of protection.

EPA's Office of Radiation Protection (ORP) currently has underway an extensive rule-making effort for low-level wastes, and has recently promulgated final standards for high-level radioactive wastes. The NFSS residues pose hazards just short of those considered by the high-level standard, and therefore fall within the scope of the low-level waste standards program. EPA is prepared, within the context of the ORP standards setting program, to advise DOE of the radiation protection requirements for the residue material.

In addition, EPA has determined that the NFSS is subject to the requirements of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). We propose to use the framework of a CERCLA Federal Facilities Agreement (to be negotiated between our respective agencies) to assure that appropriate levels of protection will be provided at NFSS. It is our understanding that the anticipated time frame for selection and development of the preferred containment scheme by DOE is several years away. We suggest that an initial, conceptual agreement be negotiated with EPA, leading to a more detailed agreement at a later date. We also strongly recommend that the DOE consider issuing supplemental NEPA documentation (possibly a supplemental EIS) on the selection of the specific on-site containment option.

A meeting between EPA and DOE to discuss the residue material, and agree upon a time frame for future coordination is recommended. [redacted], the Region II Federal Facilities Coordinator, will be contacting your office shortly to arrange for such a meeting. In the interim, he may be reached at [redacted] if there are any questions about our comments.

Sincerely,

[redacted]

Regional Administrator

cc: [redacted], Commissioner
New York State Department of Environmental Conservation

[redacted]

MAY 1 1987

[redacted]
Division of Facility and Site
Decommissioning Projects
Office of Nuclear Energy
U.S. Department of Energy
Washington, D.C. 20545

Dear [redacted]:

The Environmental Protection Agency (EPA) has reviewed the additional information regarding the environmental acceptability of the interim storage of the K-65 residues at the Niagara Falls Storage Site (NFSS), submitted with your letter dated March 13, 1987.

As was agreed in the meeting between our respective agencies held in Washington on January 21, 1987, the K-65 residues are not covered by any Federal regulations because the residues result from naturally occurring radioactive materials. However, the appropriate level of protection appears to be to consider the K-65 residues as transuranic or transuranic-like waste and to use 40 CFR 191 (Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Wastes), Subpart A as the bench mark from which to determine environmental acceptability. The specific standard is contained in 40 CFR 191.03(b) which calls for reasonable assurance that the combined annual dose equivalent to any member of the public in the general environment, resulting from discharges of radioactive material and direct radiation from management and storage of transuranic waste at facilities operated by the DOE and not regulated by the U.S. Nuclear Regulatory Commission (NRC) or an Agreement State, shall not exceed 25 millirems to the whole body and 75 millirems to any critical organ.

The DOE published the final environmental impact statement (EIS), "Long-Term Management of the Existing Radioactive Wastes and Residues at the Niagara Falls Storage Site" (DOE/EIS-0109F) on April 1986. Table 4.10 of the EIS entitled, "Radiological Doses to Nearby Individuals During the Action Period," shows that the dose for Alternative 1, the alternative being utilized for the management and storage of the K-65 residues, will be less than 0.001 mrem/yr to the whole body and to the bone, the lung, and the bronchial epithelium. This is shown in footnote 4 of that Table. In the additional information presented, it is indicated that dose levels will remain below 0.001 mrem/yr even though the activity of the K-65 residues has been re-estimated to be 520,000 pCi/g instead of 200,000 pCi/g. This contention is supported by the analysis done as part of the EIS and we concur with DOE. In light of this analysis, we believe dose levels will be below 0.001 mrem/yr for the ten years projected for interim storage, and these doses are below the 25 mrem and 75 mrem dose limitations contained in 40 CFR 191.03(b).

Based on the above analysis, EPA finds that DOE has offered reasonable assurance that the management and storage of the K-65 residues at the NFSS storage site for the next ten years will be in compliance with 10 CFR 191.03(b) and, therefore, we concur with the action.

If you have any questions regarding this matter, please contact [redacted] of my staff or [redacted] our Regional Radiation Representative at [redacted] and [redacted], respectively.

Sincerely yours,

[redacted]
Federal Facilities Coordinator
Environmental Impacts Branch

bcc: [redacted], 2AWM-RAD
[redacted], 2EERD-PS
[redacted], ORP/ANR-458
[redacted], ORP/ANR-460

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

SEP 0 8 2009

[redacted]
U.S. Army Corps of Engineers, Buffalo District
1776 Niagara Street
Buffalo, NY 14207

Dear [redacted]:

The purpose of this letter is to provide an update to my original letter dated July 27, 2009, concerning EPA's input on Applicable or Relevant and Appropriate Requirements (ARARs) for the Niagara Falls Storage Site (NFSS).

Upon further consideration we would modify our ARAR recommendation contained in Recommendation 1 in that letter as follows:

> The U.S. Army Corps of Engineers (USACE) should evaluate and implement radiation protection criteria for the NFSS. Radioactive wastes located at the site require a level of protection equivalent to that which would have been provided at a designated storage or disposal site for spent nuclear fuel and high-level radioactive waste. For wastes remaining on the site for periods longer than 10,000 years, the only precedent is the standard mandated by Congress through the Energy Policy Act of 1992, developed by the EPA pursuant to the Act, and documented in 40 CFR Part 197. The 40 CFR Part 197 standards are site-specific and are applicable solely to the proposed Yucca Mountain Geologic Repository. As such, we recommend that 40 CFR Part 191 now be considered as the equivalent of ARARs for the NFSS site and that further studies contain a discussion of this standard.

We would also modify Recommendation 2 in that letter as follows:
Similar to 40 CFR Part 191 ground water protection requirements, the USACE should consider the Safe Drinking Water Act when evaluating contamination in on-site and off-site groundwater.

Should you have any questions or would like to discuss the content of this or the previous July 27, 2009 letter in more detail, do not hesitate to contact me at [redacted].

[redacted]
Radiation and Indoor Air Branch