



Niagara Falls Storage Site

Lewiston, New York

Feasibility Study Technical Report Overview:

Evaluation of Meteorological Data and Modeling
Approaches to Assess the Dispersion of Airborne Releases from the NFSS

**U.S. Army Corps of Engineers
Buffalo District**

Building Strong®

Formerly Utilized Sites Remedial Action Program (FUSRAP)

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Scope and Objective

The U.S. Army Corps of Engineers (USACE) prepared this Technical Report (TR) as part of developing information for the upcoming Feasibility Study (FS) for the Interim Waste Containment Structure (IWCS) at the NFSS. This TR evaluates the meteorological data to be used and the dispersion modeling approach to support the IWCS Operable Unit (OU) FS. The purpose of this TR is as follows:

- Determine the appropriate meteorological data to use in modeling the dispersion of airborne contaminants from the site to support the evaluation of potential remedial alternatives in the IWCS OU FS.
- Determine basic concepts of standard air quality analyses and assess the effect of using different models and input data to assess the dispersion of airborne contaminants.

The TR provides information on available meteorological data in the vicinity of NFSS and evaluates these data to identify the impacts in assessing dispersion of contaminants from the IWCS. This TR also describes two dispersion models used to assess air dispersion and the applications for which they are designed, and compares example dispersion estimates using different meteorological data.

Project Background

The NFSS is a 191-acre Federal property in Lewiston, New York, with the IWCS occupying approximately 10 acres in the southwest portion of the site. The IWCS holds radioactive residues and wastes brought to the site by the Manhattan Engineer District and the Atomic Energy Commission during the 1940s and 1950s. During the 1980s, the U.S. Department of Energy consolidated the radioactive wastes and contaminated materials into the IWCS. The IWCS was engineered to inhibit radon emissions, infiltration from precipitation, and migration of contamination to groundwater. Radioactive wastes stored within the IWCS include residues containing high concentrations of radium-226.

**Interim Waste Containment Structure at the
NFSS (looking south).**



The Corps completed the NFSS Remedial Investigation Report (2007) and Remedial Investigation Report Addendum (2011) and the NFSS is now in the FS phase of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. The site has been divided into three OUs for this phase: IWCS, which is being addressed first, Balance of Plant (BOP), and Groundwater.

Candidate Meteorological Data for Use in Modeling Air Dispersion for NFSS

For many years, the dispersion analyses for NFSS have relied on historical data from the Niagara Falls airport (from 1955-1959). As part of FS planning, the USACE Buffalo District coordinated with the two adjacent landfills regarding potential availability of recent data from those facilities. Other stations in the general area were also considered. In all, nine meteorological stations in the vicinity of NFSS were identified as candidates for meteorological data potentially relevant to dispersion analyses for the IWCS (Table 1).

| Meteorological Station | Location <i>(ordered by distance from NFSS)</i> |
|--|---|
| 1. Modern Landfill: Landfill Station | Adjacent to NFSS, to the east-southeast |
| 2. Modern Landfill: Greenhouse Station | Adjacent to NFSS, to the south |
| 3. CWM Landfill | Adjacent to NFSS, to the north-northeast |
| 4. U.S. Coast Guard Station at Ft. Niagara | 5 miles northwest of NFSS on Lake Ontario |
| 5. Niagara Falls International Airport | 7 miles south-southeast of NFSS in Niagara Falls, NY |
| 6. Somerset Power Generating Station | 21 miles east-northeast of NFSS on Lake Ontario in Barker, NY |
| 7. Greater Buffalo International Airport | 22 miles southeast of NFSS in Buffalo, NY |
| 8. Hamilton Airport | 47 miles west of NFSS in Ontario, Canada |
| 9. Greater Rochester International Airport | 66 miles east of NFSS in Rochester, NY |

Table 1: Candidate Stations for Meteorological Data

Wind patterns can be affected by the local setting, including land use and cover, terrain, and proximity to large bodies of water. The settings of these candidate stations were evaluated as part of assessing data representativeness for conditions at NFSS. For non-airport data, factors considered included the nature of collection and reporting, time period covered, and degree of quality assurance/quality control.

From this review, data from the Niagara Falls airport and adjacent CWM landfill were found to be most appropriate for detailed analysis to assess representativeness for conditions at NFSS. Two data sets were evaluated from the airport: historical data and recent data (2005-2009). The CWM data set is from 2005-2008.

The main findings of the comparisons across these three meteorological data sets are:

- Data from the Niagara Falls airport are spatially and temporally representative of regional wind patterns, but these differ somewhat from the local patterns at the CWM landfill and NFSS.
- Prevailing winds differ slightly between the airport and the NFSS area; these winds are from the southwest at the airport but from the west-southwest at the CWM landfill and NFSS.
- Average wind speed in the NFSS area (about 6.7 mph) is nearly 30% lower than at the airport. This likely reflects differences in local features compared to those at the airport (about 9.8 mph), where the elevation is higher and the land is more open (with fewer trees).

In spring 2011, the USACE Buffalo District installed an onsite meteorological tower to start collecting data for use in future analyses. Conclusions from the evaluation of currently available data are:

- Recent data (2005-2008) from the CWM landfill are well suited for use in current dispersion modeling for NFSS.
- Data from the new meteorological tower at NFSS will be used for future dispersion modeling once a sufficient period of collection is achieved and the data have undergone standard quality reviews.

Modeling Approaches for Estimating Dispersion of Airborne Contaminants from the IWCS

Two EPA models are commonly used to assess the dispersion of airborne releases from radioactively and chemically contaminated sites. Information about these two models is presented in Table 2.

| Dispersion Model | Date Established | Purpose | Application |
|------------------|-------------------------|---|---|
| AERMOD | 2006 (updates, 2011) | Demonstrate compliance with the National Ambient Air Quality Standards and other requirements under the Clean Air Act (CAA). | Both chronic and shorter-term releases. |
| CAP88-PC | 1988 (updates, 2007) | Demonstrate compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAPs) under the CAA for radon and other radionuclides released from specific facilities. | Chronic, routine releases of radionuclides. |

Table 2: Air Dispersion Models

These models were used to estimate dispersion from a hypothetical unit release from the IWCS using the three sets of meteorological data evaluated in detail to determine representativeness for NFSS. Results are highlighted in Table 3.

| Place-Time Comparisons | Meteorological Data | Dispersion Model | Relative Air Concentrations at Nearby Offsite Receptors |
|---|---|---|--|
| 1. Same place <i>(regional)</i> different times <i>(recent + historical)</i> | Airport: 2005-2009 vs. 1955-1959 | AERMOD for recent data CAP88-PC for 1950s data | Recent airport data: 0.4 to 1.3 times historical airport data <i>(average 20% lower)</i> |
| 2. Different places <i>(local/regional)</i> different times <i>(recent/historical)</i> | CWM 2005-2008 vs. Airport 1955-1959 | AERMOD for recent data CAP88-PC for 1950s data | Recent CWM data: 0.9 to 3.6 times historical airport data <i>(average 1.7 times higher)</i> |
| 3. Different places <i>(local/ regional)</i> same time <i>(recent)</i> | CWM 2005-2008 vs. Airport 2005-2009 | AERMOD (both data are recent) | Recent CWM data: 1.4 to 3.9 times recent airport data <i>(average 2.1 times higher)</i> |

Table 3: AERMOD and CAP88-PC Comparisons with Different Meteorological Data

Regarding the dispersion modeling, both CAP88-PC and AERMOD are considered appropriate for NFSS evaluations with each model serving the purpose for which it was developed. The main findings are as follows:

- The local setting has a greater impact on dispersion estimates than when the data were collected.
- Predicted dispersion at NFSS is less than at the airport, as a reflection of the lower wind speed. Less dispersion translates to higher airborne concentrations. Using local rather than regional meteorological data in dispersion modeling for NFSS helps avoid the potential to underpredict airborne concentrations.
- The AERMOD system is well suited for assessing short-term to longer-term releases associated with potential remedial activities at NFSS. AERMOD also provides user-defined (e.g., hourly to annual) estimates of airborne concentrations and associated deposition.

- Concentrations predicted by AERMOD using local meteorological data from the CWM facility are higher than those predicted by CAP88-PC. Contributing factors include a more sophisticated dispersion algorithm in AERMOD compared with earlier models.
- CAP88-PC is useful for assessing chronic radionuclide releases to estimate annual doses for NESHAPs compliance. CAP88-PC is also useful for assessing the ingrowth of radon-222 progeny as a complement to AERMOD (e.g., linked to the AERMOD dispersion estimate for a radon gas release).
- Both indirect and direct conversion approaches can be applied to recent meteorological data to estimate the form of the stability parameter used in CAP88-PC. Thus, recent data from the CWM landfill could be used with CAP88-PC for the annual NESHAPs compliance evaluations.
- Differences in air concentrations estimated by the indirect and direct methods are small. General agreement among results of substantially different approaches supports the interpretations presented in this TR.

Public Input Regarding the Technical Report

The Corps is preparing a number of TMs which will be made available to the public prior to the development and release of the IWCS OU FS Report. The Corps encourages input from the public regarding the conclusions of each TM and this TR. Public response to this document should be provided to the Corps by April 28, 2012, to allow the Corps to consider the input during development of the IWCS OU FS Report. Responses to public comments on the TR will be made available on the project website. Input can be sent via e-mail to fusrap@usace.army.mil (please be sure to note "Evaluation of Meteorological Data and Modeling Approaches Technical Report" in the subject of the e-mail) or mail your comments to the FUSRAP Team at the address noted below.

Public Workshop for the Technical Report

In addition to the opportunity to provide written comments, the Corps is hosting a public workshop on **March 28, 2012**, beginning at **6 pm** to present and discuss the results of this TR with the community. The workshop will be held at the **Lewiston Senior Center** located at **4361 Lower River Road, Youngstown, NY 14174**. The Corps will send out a '*News from the Corps*' and post a notice in the local newspapers detailing the agenda for this public workshop by the end of February.

Administrative Record File

The Administrative Record File for the NFSS FUSRAP Site contains the RIR, RIR Addendum, Baseline Risk Assessment, Waste Disposal Options and Fernald Lessons Learned Technical Memorandum, Radon Assessment Technical Memorandum, Evaluation of Meteorological Data and Modeling Approaches to Assess the Dispersion of Airborne Releases Technical Report, and other CERCLA-related documentation for the NFSS. Reports and documents in the Administrative Record may be viewed at the following locations:

Electronic and Paper Versions

Town of Lewiston Public Library
305 South 8th Street
Lewiston, NY 14092
Phone: (716) 754-4720

US Army Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207
(by appointment only)

Electronic Version

Youngstown Free Library
240 Lockport Street
Youngstown, NY 14174
Phone: (716) 745-3555

U.S. ARMY CORPS OF ENGINEERS – BUFFALO DISTRICT FUSRAP TEAM

1776 NIAGARA STREET, BUFFALO, N.Y. 14207

Phone: 800-833-6390 (Option 4)

Email: fusrap@usace.army.mil

Website: www.lrb.usace.army.mil/fusrap/nfss/index.htm