Niagara Falls Storage Site
Radon Flux Monitoring
Lewiston, NY

U.S. Army Corps of Engineers
Buffalo District
October 2020

Building Strong ®

Purpose: This fact sheet summarizes the radon flux monitoring measurements from the most recent annual environmental surveillance activities for the Niagara Falls Storage Site (NFSS).

Summary: The 2019 environmental surveillance analytical results confirm that site controls continue to perform as designed, and are fully protective of human health and the environment. Overall results of the 2019 surveillance program are consistent with previous years. The average of site radon-222 flux measurements taken across the Interim Waste Containment Structure (IWCS) is less than the U.S. Environmental Protection Agency (EPA) flux compliance criterion of 20 picocuries per square meter per second ($pCi/m^2/s$).

The 2018 report described one sampling location where radon flux was elevated over prior year measurements. Another data point collected in 2019 shows a similar elevated measurement from an adjacent location approximately 50 feet away. The IWCS remains protective of human health and the environment and our team of experts is taking action on site to better understand these new results.

Background: The Formerly Utilized Sites Remedial Action Program (FUSRAP) was initiated in 1974 to identify, investigate, and if necessary, clean up or control sites throughout the United States that were contaminated by activities related to the nation's early atomic energy program. Congress transferred execution of FUSRAP from the U.S. Department of Energy (DOE) to the U.S. Army Corps of Engineers in 1997. When implementing FUSRAP, the Corps of Engineers follows the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan.

The NFSS is a 191-acre federal property located in Lewiston, New York. The Manhattan Engineer District and Atomic Energy Commission brought radioactive materials to the site during the 1940s and 1950s. During the 1980s, the DOE consolidated the wastes on NFSS and many of the vicinity properties into the structure which is located in the southwest portion of the site (Figure 1). The IWCS is a 10-acre landfill that contains radiologically contaminated materials from cleanup actions the DOE conducted more than 20 years ago.

Figure 1: NFSS Interim Waste Containment Structure

Materials stored in the IWCS are uranium ore processing residues or "byproduct material" as defined by Section 11e.(2) of the Atomic Energy

Act of 1954, as amended. They include the K-65 residues that contain high concentrations of radium-226, which is the main contaminant associated with uranium ore processing residues. Radium-226 undergoes radioactive decay to produce radon gas. The IWCS was engineered to inhibit radon gas emissions (notably radon-222), infiltration of precipitation, and contaminant migration to groundwater.

Overview of the Environmental Surveillance Program

The Corps of Engineers Buffalo District conducts the NFSS Environmental Surveillance Program (ESP); it performs site operations, maintenance, and monitoring to ensure protection of human health and the environment. These activities are ongoing across the site, including at the IWCS. The DOE initiated the ESP at the NFSS in 1979, before the construction of the IWCS, to monitor air, water, and external gamma radiation (and later streambed sediments) to ensure protection of human health and the environment from radioactive residues and wastes later buried in the IWCS. In 1997, when responsibility for FUSRAP transferred to the Corps of Engineers, the Corps of Engineers Buffalo District continued to follow the DOE ESP, with some revisions over the years. The Corps of Engineers reports its findings annually in the form of a technical memorandum, which is posted to the NFSS website at https://www.lrb.usace.army.mil/Missions/HTRW/FUSRAP/Niagara-Falls-Storage-Site/ in the Environmental Monitoring section.

The surveillance program is designed to achieve the following objectives:

- Ensure protection of human health and the environment
- Verify compliance with environmental regulatory standards
- Verify the IWCS is performing as designed

Radon Flux Monitoring

The Corps of Engineers measures radon flux at the NFSS once a year in the summer. Measurement of radon flux provides an indication of the rate of radon-222 emission from a surface. Radon flux is measured with activated charcoal canisters, as shown in Figure 2, placed on a grid spaced 15 meters (49.2 feet) on center across the surface of the IWCS for a 24-hour exposure period. A total of 180 canisters are placed on the IWCS for an annual measurement of radon flux. Sample locations are shown on Figure 5. The pink outlines in Figure 5 depict the outlines of the building foundations buried within the IWCS. Portions of the former Building 411 foundation contain the high activity K-65 residues.

Figure 2: Activated charcoal canister being placed on the IWCS to measure radon flux

The activated charcoal in the canister adsorbs the radon gas emanating from the surface over which the canister is placed. The charcoal holds the radon, which subsequently decays until equilibrium between radon and its short-lived daughters is established. The radon flux is calculated in the laboratory through gamma spectroscopy using the area of canister exposed to the radon flux and the time that exposure took place. The average of all 180 radon flux results is compared against the EPA site wide compliance criterion of 20 $pCi/m^2/s$ specified in Title 40 of the Code of Federal Regulations, Part 61 (40 CFR 61), Subpart Q.

Radon Flux Observations

The average radon flux measurement for all 180 locations across the IWCS is typically less than 0.1 pCi/m^2/s. In July 2018, the Corps of Engineers performed annual radon flux sampling and a few locations exhibited elevated results compared to past results, but the average of all data from the 180 sampling points (0.1576 pCi/m^2/s) remained well below the site-wide limit of 20 pCi/m^2/s specified in 40 CFR 61, Subpart Q. The highest sample result was 19.278 pCi/m^2/s at location #62 (Figure 5), which is located above the eastern wall of the former Building 411. The Corps of Engineers resampled the area surrounding location #62 in the fall of 2018 at the 16 locations shown in the inset on Figure 5, and all resampling results came back typical of historical levels.

Figure 3: 2019 and 2020 biased sampling locations on the IWCS

In July 2019, the Corps of Engineers performed the annual radon flux sampling and the results showed an elevated radon flux measurement of 23.050 pCi/m^2/s at another location (#65), north of location #62. The average radon flux measurement for 2019 for all 180 locations over the entire IWCS of 0.1968 pCi/m^2/s was still well below the compliance limit, of 20 pCi/m^2/s.

The Corps of Engineers performed a follow-up gamma walkover survey over the southern portion of the IWCS in the fall of 2019 to identify areas suspected to produce elevated flux. Based on this gamma walkover survey, a series of biased radon flux measurements were conducted with results ranging from 0.11 to 243.07 pCi/m^2/s. An additional confirmatory gamma walkover survey was performed in the spring of 2020, and reproducible biased radon flux measurements from these same locations ranged from 8.23 to 508.39 pCi/m^2/s in May 2020.

The Corps of Engineers responded with an iterative approach, beginning in June 2020 with a non-invasive topsoil enhancement, consisting of adding approximately 6 to 8 inches of topsoil over and around areas known to have produced elevated flux (Figure 4). The new topsoil was reseeded, and the grass is now established. The intent of this action was to maintain optimal moisture in the surface layer of the IWCS to both minimize gas transport and ensure the protectiveness of the underlying clay cap.

Figure 4: Topsoil enhancement on the IWCS

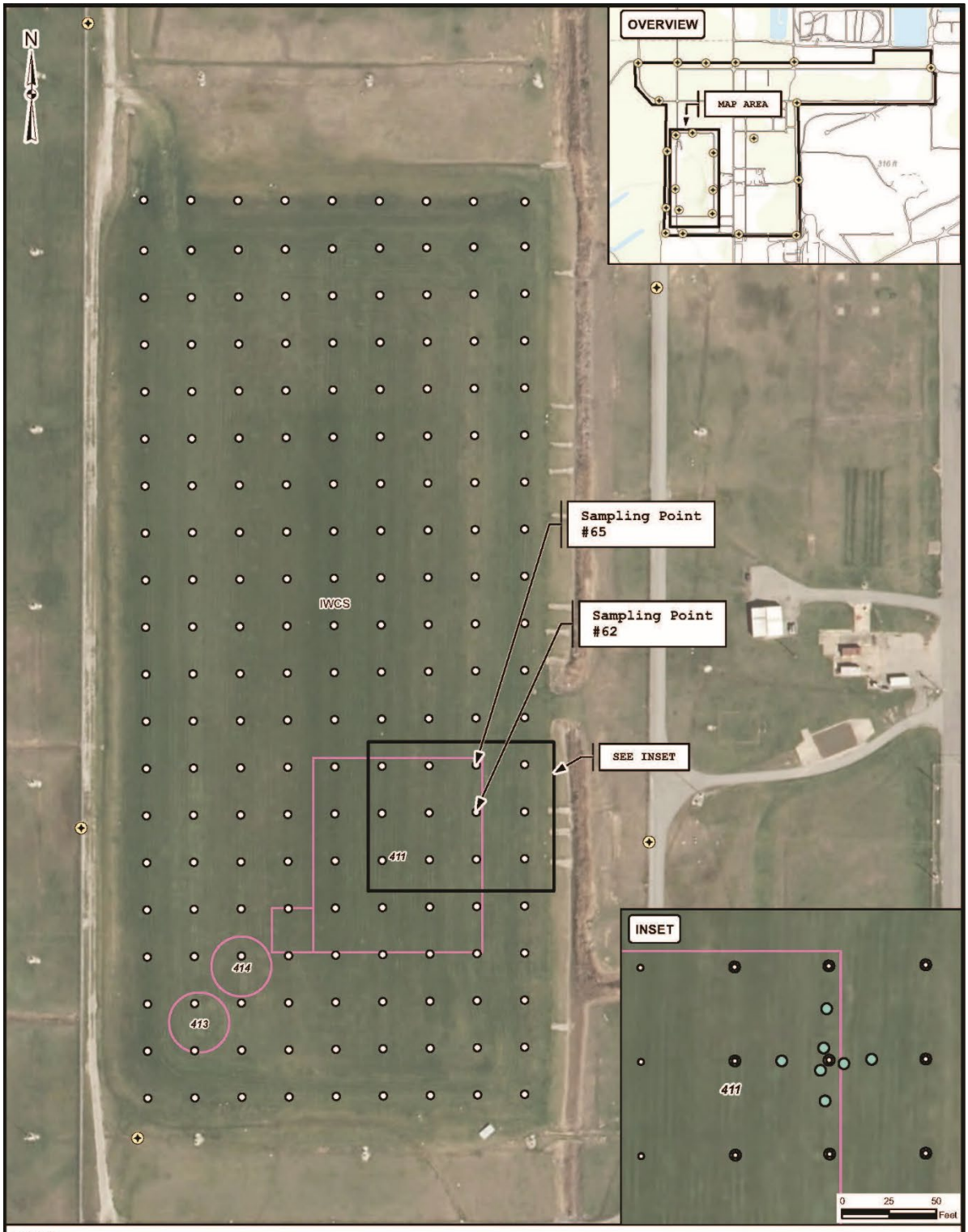
Following the topsoil enhancement, the Corps of Engineers completed additional testing over the IWCS to evaluate the effectiveness of the action. The annual radon flux monitoring event was performed in July 2020. The result for location #62 was 0.041 pCi/m^2/s, the result for location #65 was 0.030 pCi/m^2/s, and the results from select biased locations were all less than 0.08 pCi/m^2/s. The average measurement over all 180 locations for the entire IWCS was 0.0585 pCi/m^2/s (Figure 6). Additional gamma walkover surveys conducted following the topsoil enhancement have also not identified the continuation of elevated radon flux indicators.

Path Forward

The Corps of Engineers will continue to monitor the two previously identified elevated radon areas by completing gamma walkover surveys and additional radon flux sampling. This continual monitoring will evaluate the effectiveness of the initial action and determine if additional measures are warranted. The results of the monitoring will be included in the 2020 Environmental Surveillance Program Technical Memorandum. As we continue to investigate this area we are committed to keeping you informed.

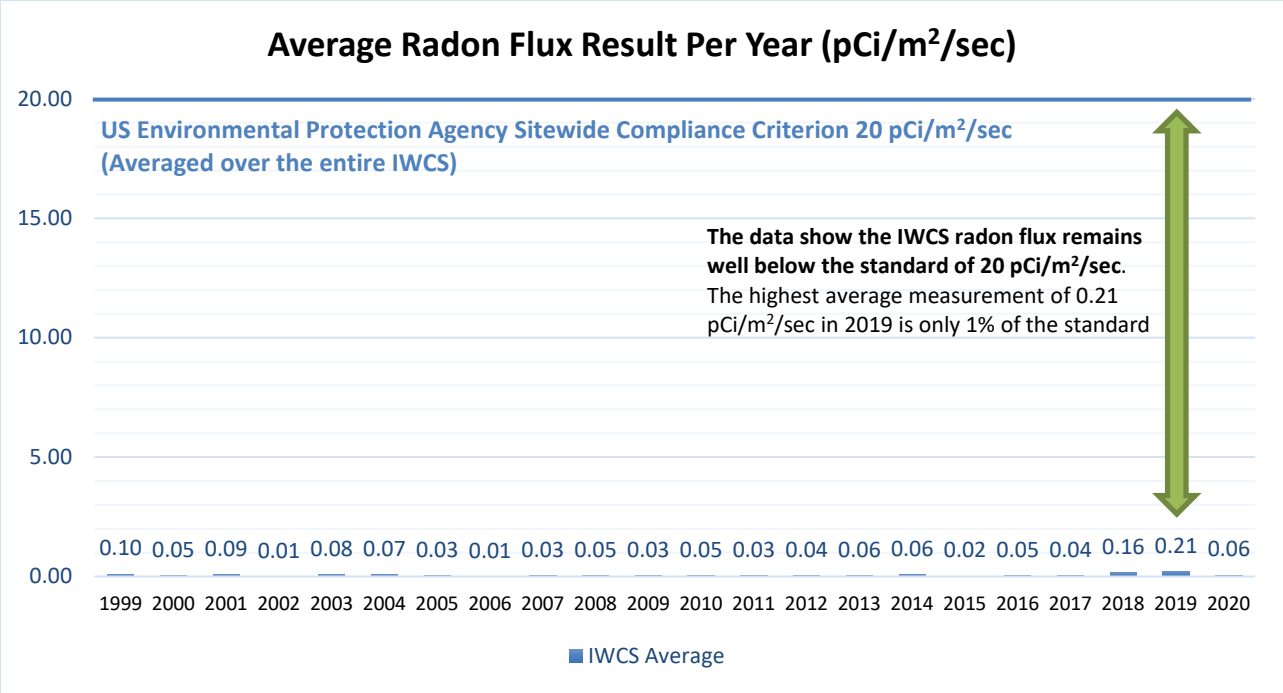
Corps of Engineers Commitment

The Corps of Engineers' highest priority under the authority of FUSRAP at the NFSS is to be protective of human health and the environment, to ensure that work is conducted in a safe and efficient manner, and to prevent the spread of contamination.



US Army Corps of Engineers. Buffalo District — U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS BUFFALO, NY	EXTERNAL GAMMA RADIATION/RADON MONITORING AND RADON FLUX SAMPLING LOCATION MAP	
Document Name: 191007_IWCSRadonFlux.mxd Drawn By: H5TDESPM Date Saved: 21 Sep 2020 Time Saved: 8:03:25 AM	NIAGARA FALLS STORAGE SITE LEWISTON, NEW YORK	FIGURE 5

Figure 6: Average radon flux result per year



Description: This chart shows the overall radon gas flow (called "radon flux") for the entire Interim Waste Containment Structure (IWCS) and compares it against the U.S. Environmental Protection Agency Compliance Criterion of 20 pCi/m²/sec. The chart shows the average values of 180 measurement points across the IWCS over the timeframe 1999-2020.

The IWCS cap remains protective of human health regarding radon flux.