

## INTRODUCTION

The St. Louis Downtown Site (SLDS) is an active chemical plant owned by Mallinckrodt Specialty Chemical Company (MSCC). From 1942 to 1957, the facility manufactured various uranium compounds under contract to the Manhattan Engineer District (MED) and Atomic Energy Commission (AEC), predecessor organizations to the U.S. Department of Energy (DOE). The activities carried out for the MED and AEC resulted in the contamination of site soils and structures and the site was therefore included in the Formerly Utilized Sites Remedial Action Program (FUSRAP). The major radioactive contaminants identified were uranium-238, radium-226, thorium-230, and lesser quantities of thorium-232.

The site is located in the downtown area of St. Louis adjacent to the Mississippi River (Figure 1). There are ten (10) designated operating plants on the 18.2 ha site (Figure 2). Mallinckrodt intended to construct a bermed concrete pad within the Plant 7S portion of the MSCC. The plant 7S area contains areas where radionuclide soil concentration levels exceed the allowable DOE residual contamination limits; therefore, Bechtel National Inc. (BNI) the Project Management Contractor for FUSRAP conducted a response action in support of Mallinckrodt. The response action was confined to the pad construction area and included sampling and analyzing soils; excavating, packaging, and storage of contaminated soil; direct radiation scans and measurements; and post-remedial action sampling and analysis.

It is the policy of DOE to perform independent verifications of remedial actions conducted within FUSRAP. ESSAP has been selected as the organization responsible for this task at SLDS. Remedial actions were not completed during the September 17, 1992 site visit; therefore, ESSAP performed a Type A survey of the area.

## DOCUMENT REVIEW

ESSAP reviewed both the RCRA Pad work plan and the post-remedial action letter report prepared by BNI.<sup>1,2</sup>

Document reviews indicated that the area had been adequately characterized, remedial actions were accurately described, and post-remedial action measurements and sampling were compared to the appropriate DOE guidelines.

## CONFIRMATORY ANALYSES

ESSAP performed independent analyses of the post-remedial action soil samples collected, and analyzed by BNI's radiological contractor Thermo Analytical Inc./Eberline (TMA/E). Independent analyses of the three composite post-remedial action soil samples were performed at ESSAP's Oak Ridge Laboratory. Soil samples were analyzed by gamma spectrometry, for U-238, Ra-226, and any other identifiable photopeaks, and analyzed by alpha spectrometry for isotopic thorium. The comparative analytical results for the post-remedial action samples are

provided in Table 1 and indicate acceptable agreement between ESSAP and TMA/E analyses for each radionuclide. The maximum concentration levels determined by ESSAP analyses, for each radionuclide of concern were as follows: U-238, 8.8 pCi/g; Ra-226, 3.1 pCi/g; Th-232, 1.05 pCi/g; Th-230, 3.25 pCi/g.

### SUMMARY

The analytical results were compared with the guidelines for residual radionuclides in soil.<sup>3</sup> The generic guidelines for Ra-226, Ra-228, Th-232, and Th-230 are as follows:

5 pCi/g      Averaged over the first 15 cm of soil below the surface.

15 pCi/g      Averaged over 15 cm thick layers of soil more than 15 below the surface.

Final site status following backfill and pad construction will result in the impacted soils being at a depth greater than 15 cm below the surface. Therefore the 15 pCi/g residual contamination levels for radium-226 and thorium would be applicable.

Guidelines for uranium are developed on a site specific basis. The uranium guideline developed for SLDS is 50 pCi/g of U-238.

It is ESSAP's opinion that the guidelines have been met and the area satisfies the requirements for release without radiological restrictions. This opinion is based on ESSAP's review of pertinent documents and data, and independent sample analyses.

**TABLE 1**  
**RADIONUCLIDE CONCENTRATIONS IN SOIL**  
**COMPARISON OF POST-REMEDIAL ACTION SAMPLE RESULTS**  
**ST. LOUIS DOWNTOWN SITE**  
**ST. LOUIS, MISSOURI**

Sample ID. No.	Radionuclide Concentration pCi/g							
	TMA/E				ESSAP			
	U-238	Ra-226	Th-232	Th-230	U-238 <sup>a</sup>	Ra-226 <sup>a</sup>	Th-232 <sup>b</sup>	Th-230 <sup>b</sup>
116V9201	<5.0	3.1 ± 0.2	1.2 ± 0.1	2.0 ± 0.7	4.8 ± 1.0	3.1 ± 0.5	1.02 ± 0.14	3.00 ± 0.24
116V9202	6.9 ± 3.0	3.2 ± 0.2	1.0 ± 0.1	2.1 ± 0.7	8.8 ± 2.8	2.4 ± 0.4	1.05 ± 0.14	3.22 ± 0.25
116V9203	6.6 ± 2.9	3.6 ± 0.1	1.2 ± 0.2	1.9 ± 0.7	7.1 ± 2.5	2.9 ± 0.5	1.01 ± 0.16	3.25 ± 0.28

<sup>a</sup>Analyzed by Gamma Spectrometry

<sup>b</sup>Analyzed by Alpha Spectrometry

<sup>c</sup>Uncertainties represent the 95% confidence level based only on counting statistics.

References

1. Bechtel National, Inc., FUSRAP Communication, E. Newberry to T. Vitkus, Oak Ridge Institute for Science and Education, Mallinckrodt RCRA Pad Verification Plan, September 9, 1992.
2. Bechtel National, Inc., "Post-Remedial Action Letter-Report for New RCRA Pad Area at St. Louis Downtown Site, St. Louis, Missouri," May 1993.
3. U.S. Department of Energy, DOE Order 5400.5, "Radiation Protection of the Public and Environment", February 1990.