

U.S. NUCLEAR REGULATORY COMMISSION  
REGION I

INSPECTION REPORT

Inspection No. 04008610/2009001

Docket No. 04008610

License No. STC-1333

Licensee: Stepan Company

Location: 100 West Hunter Avenue  
Maywood, NJ 07607

Inspection Dates: December 8, 2009 and March 2, 2010

Dates additional  
Information provided: February 4, 2010, February 23, 2010,  
and March 23, 2010

Inspector:    /RA/       4/20/10     
Mark Roberts date  
Senior Health Physicist  
Decommissioning Branch  
Division of Nuclear Materials Safety

Approved By:    /RA/       4/20/10     
Judith A. Joustra, Chief date  
Decommissioning Branch  
Division of Nuclear Materials Safety

## EXECUTIVE SUMMARY

Stepan Company  
NRC Inspection Report No. 04008610/2009001

In accordance with the Memorandum of Understanding between the U.S. Army Corps of Engineers (USACE) and the NRC for Coordination on Cleanup & Decommissioning of the Formerly Utilized Sites Remedial Action Program (FUSRAP) Sites with NRC-Licensed Facilities, NRC Region I staff conducted visits to the Stepan Company Maywood, New Jersey site to observe in-process remediation activities and collect soil samples for confirmatory radiological analysis. Although this is an inspection report for the above referenced license, most of the information in this report was obtained from the USACE and their contractor staff, Shaw Environmental Incorporated (Shaw). This report summarizes the information collected during the visits to the Stepan Company site conducted December 8, 2009 and March 2, 2010, the data from the confirmatory sample analyses provided on February 4, 2010, and the review of additional information that was provided by the Shaw Radiation Safety Officer (RSO) on February 23, and March 23, 2010.

During the December 8, 2009 site visit, the NRC inspector observed the collection of Final Status Survey (FSS) samples. Aliquots of five samples were provided to the inspector who then submitted the samples to the NRC's contractor, the Oak Ridge Institute for Science and Education (ORISE), for radiological analysis. In a February 4, 2010 letter report, ORISE provided their results from the analysis of the soil samples. During the March 2, 2010 site visit, the inspector was provided with the USACE data for the split samples. All the data were then compared to the cleanup criteria established in the Record of Decision (ROD).

The inspector interviewed cognizant personnel, performed field observations, and examined documentation during the visit. Based on this review, the inspector noted the following:

Both the licensee's results and the NRC confirmatory results from the split soil samples from Pit No. 3 met the cleanup criteria established in the ROD.

## **REPORT DETAILS**

### **I. INTRODUCTION**

Thorium ore was processed from 1916 to 1956 by the Maywood Chemical Works at its Maywood facility in northeastern New Jersey. Radioactive contamination resulted from these processing operations and associated material storage and waste disposal practices. In 1959, Stepan Chemical Company (now Stepan Company) purchased the Maywood Facility. In the late 1960s, Stepan Company (Stepan) took corrective measures at some of the former disposal areas by re-locating approximately 19,000 cubic yards of thorium wastes and consolidating the wastes into three onsite pits. The three onsite burial pits were subsequently licensed by the Nuclear Regulatory Commission (NRC). Stepan performs manufacturing activities at its Maywood, NJ site, which do not include the use of any licensed radioactive materials.

In 1983, the U.S. Environmental Protection Agency (EPA) included the site on its National Priority List for cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In 1984, the U.S. Department of Energy (DOE) assumed responsibility for remediating the Stepan, Maywood facility (including the burial pits) and 87 other designated industrial, residential, commercial, and government properties contaminated by the thorium processing activities at the former Maywood Chemical Works. The Stepan, Maywood site was included in the DOE's Formerly Utilized Sites Remedial Action Program (FUSRAP). The Stepan site and the additional properties discussed above are collectively known as the FUSRAP Maywood Superfund Site. In October 1997, the management and administration of FUSRAP was transferred to the U.S. Army Corps of Engineers (USACE). In July 2001, a Memorandum of Understanding (MOU) was executed between the NRC and the USACE to facilitate remediation of NRC-licensed sites (including the Stepan facility) that were to be remediated under FUSRAP. The purpose of the MOU was to minimize dual regulation and coordinate activities of the two agencies under their respective programs.

In September 2003, the ROD for Soils and Buildings at the FUSRAP Maywood Superfund Site was issued. Included in this decision document were the criteria to be used for cleanup of the burial pits on the Stepan site. On October 21, 2008, the NRC executed a Confirmatory Order to suspend Stepan's License, contingent upon USACE notifying the NRC of their intent to take physical possession of all, or part, of the licensed site. The Order provides the USACE with the mechanism to request that the NRC suspend (put into abeyance) the NRC license for the Stepan burial pits. Upon taking physical possession of the burial pits to conduct remediation activities, the USACE assumes responsibility for the public health and safety for these materials, consistent with the requirements of 10 CFR 20. In December 2008, August 2009, and January 2010, USACE notified the NRC that it had taken physical possession of Burial Pits No. 3, No. 2, and No. 1, respectively.

### **II. Organization, Scope, and Oversight of the Remediation Program**

#### **a. Inspection Scope**

The inspector discussed the organization and scope of the remediation project with representatives from Stepan, USACE, and the USACE contractor, Shaw. The inspector also reviewed relevant documents relating to the project.

b. Observations and Findings

The USACE has the delegated authority for cleanup of the FUSRAP wastes associated with the thorium ore processing activities conducted at the former Maywood Chemical Works. This authority includes not only the Stepan property and associated burial pits, but also the other designated industrial, residential, commercial, and government properties that were contaminated during the thorium processing activities at the Maywood Chemical Works site. The NRC only licenses the Stepan burial pits and not any of the other properties that make up the Maywood Superfund Site. Remediation activities at all the remaining areas are also the responsibility of the USACE.

The USACE, New York District Office, manages the remediation project and receives technical support from the USACE, Kansas City District Office. This technical support includes a project health physicist. Shaw is contracted to the USACE to provide remediation services to the project. Shaw also provides a site RSO for the project. The qualifications of this individual include being a Certified Health Physicist (CHP). Radiation protection, final status survey, and radiological laboratory staff are provided by Safety and Ecology Corporation (SEC) as a sub-contractor of Shaw with the Shaw site RSO directing the activities of the SEC staff. The onsite laboratory is the property of USACE, but is operated and staffed by the Shaw and SEC personnel. The USACE project health physicist and the Shaw site RSO communicate many times each week on radiological matters relevant to the project.

The remediation activities on the site can impact the routine manufacturing operations conducted by Stepan. These impacts have included movement of onsite utilities and closures of onsite trucking pathways in order to conduct excavation activities. The Stepan plant manager, USACE, and Shaw representatives routinely meet to discuss and schedule actions to minimize the impact to the routine Stepan operations

c. Conclusions

The U.S. Army Corps of Engineers and their contractors coordinate the remediation project for the Maywood Superfund site, which includes the licensed burial pits on the Stepan site and interface well with the routine Stepan operations.

### **III. Site-Specific Cleanup Criteria**

a. Inspection Scope

The inspector discussed the site-specific cleanup criteria being used for the site with the site radiation safety officer and also held a discussion with a representative from the State of New Jersey regarding the applicable criteria. The inspector also reviewed relevant documents related to the site-specific cleanup criteria.

b. Observations and Findings

The site-specific cleanup criteria were developed for the Maywood Superfund Site through discussions with the EPA, USACE, and DOE, with input from the State of New Jersey, and documented in the September, 2003 ROD. New Jersey; however, has not signed their approval for the criteria developed in the ROD. In the ROD, the applicable or relevant and appropriate requirement (ARAR) for the NRC-licensed burial pits is the criteria found in New Jersey Administrative Code (NJAC) 7:28-12.8(a)1 (15 mrem/year), thus meeting the NRC criteria of 25 mrem/year in 10 CFR 20.1402. In the ROD, the specific concentration-based cleanup criteria for the radioactive contamination for commercial properties (relevant to the Stepan burial pits) is an average of 15 picocuries/gram (pCi/g) Ra-226 and Th-232 combined above background with an as low as reasonably achievable (ALARA) goal of 5 pCi/g. The ROD also includes a criterion of 100 pCi/g above background for total uranium, which equates to approximately 50 pCi/g of U-238. Discussions with a representative from NJDEP indicates that although they have not signed off on the ROD, it is their belief that if these concentration-based criteria are met, the resulting dose will also meet the radiation dose-based requirements in NJAC 7:28-12.8(a)1. Through discussions with the USACE contractor, the concentration-based criteria is used to make decisions regarding meeting the criteria in the ROD.

c. Conclusions

The ROD for the cleanup of the NRC-licensed burial pits at the Stepan site lists both dose-based and concentration based criteria and includes an ALARA goal. Although New Jersey has not specifically approved the ROD, utilizing the concentration-based criteria should meet the specific dose-based criteria in the New Jersey regulations.

#### **IV. Facilities and Equipment**

a. Inspection Scope

The inspector discussed the capabilities of the USACE onsite radiological laboratory, laboratory procedures and methodology, laboratory certification, and analytical data review with the laboratory manager, the site radiation safety officer, the project health physicist, and laboratory staff. The NRC inspector interviewed cognizant personnel, conducted a tour of the laboratory facilities with the laboratory manager, and examined selected documentation.

b. Observations and Findings

The Shaw site radiation safety officer has the responsibility for the onsite radiological laboratory; however, day-to-day operations are directly managed by the laboratory manager. The laboratory has the capability for gamma spectrometry, alpha spectrometry, gross alpha activity, and gross beta activity measurements on a variety of sample media, including soil, water, air particulate filters, and smears for removable contamination. The laboratory provides the analytical support for the entire Maywood Superfund Site Project. Laboratory support for the remediation activities of the Stepan

burial pits is essentially limited to gamma spectrometry measurements of final status survey and selected in-process soil samples. The laboratory employs EPA or other documented standard procedures and methods in the analyses of samples.

Soil samples are analyzed on one of three gamma spectrometry systems that each utilizes a high-purity germanium gamma detector. The calibration standard used for the gamma detection systems is a soil matrix with known amounts of radionuclides and approximates the density of actual samples. The quality assurance measurements performed include measurements of background, duplicate sample analysis, analysis of method blank samples, and laboratory control standards as appropriate for each detection system.

Samples for radiological analyses are collected by the project health physics technicians who record relevant sample information on standard project forms. The technicians deliver the samples directly to the laboratory where sample custody is acknowledged by a laboratory representative. Samples are then assigned a unique identification number and then prepared as needed for the type of analysis to be performed. Soil samples are typically dried, then pulverized, and placed into standard counting containers. The mass of the sample aliquot used is recorded for subsequent determination of the concentration of each relevant radionuclide. Data are reviewed by the laboratory staff, the laboratory manager, and verified again by an outside third-party reviewer.

The onsite laboratory is certified by the State of New Jersey for radiological analyses. Validation samples were previously provided by the state. The onsite laboratory now participates in an independent commercial blind sample testing program. The laboratory manager reported that they have very good performance in their annual testing program. Laboratory audits have been historically performed by New Jersey, USACE, and Shaw representatives and have not identified any quality problems.

c. Conclusions

Laboratory sample analysis is performed using technically appropriate equipment that has been properly calibrated. Analyses and laboratory protocols are performed in accordance with standard written procedures. Replicate data validation is performed to ensure analytical results are of very high quality. The laboratory is certified by the State of New Jersey and historical audits performed by the state, USACE, and Shaw and have not identified any quality problems.

## **V. Analysis of Confirmatory Soil Samples**

a. Inspection Scope

In December 2009, Shaw notified the inspector that final status surveys (FSS), including direct measurements and collection of FSS soil samples, were essentially complete for Burial Pit No. 3. The inspector visited the site on December 8, 2009, and observed health physics technicians collecting soil samples at four locations that had been selected in accordance with protocols established in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). One additional biased soil sample was taken

in an area where direct measurements indicated a slightly elevated reading. The Final Status Survey plan directs biased sampling to resolve questions concerning elevated gamma walkover measurements. An aliquot of each of the soil samples was provided to the inspector, who then shipped the samples to the ORISE laboratory for independent radiological analysis. The samples were also analyzed in the onsite USACE laboratory. All samples were analyzed by high-resolution gamma spectrometry and the results compared to the cleanup criteria established in the ROD.

b. Observations and Findings

The results from the analysis of the soil samples obtained from the Stepan site, burial pit No. 3, are tabulated in the table below. Results are provided for both the USACE onsite laboratory and the ORISE laboratory.

Gamma Spectrometry of Soil Samples – Stepan Burial Pit No. 3  
(Results in Units of picocuries/gram (pCi/g))

Sample Location	Analytical Laboratory	Ra-226	Th-232	U-238
10A-446	USACE <sup>(1)</sup>	1.00 ± 0.06 <sup>(3)</sup>	1.01 ± 0.13	0.84 ± 0.36
	ORISE <sup>(2)</sup>	1.25 ± 0.27	0.93 ± 0.16	0.64 ± 0.29
10A-451	USACE	0.91 ± 0.06	0.92 ± 0.11	0.66 ± 0.32
	ORISE	1.50 ± 0.30	0.89 ± 0.14	0.86 ± 0.31
10A-453	USACE	0.85 ± 0.06	0.99 ± 0.14	0.42 ± 0.29
	ORISE	1.06 ± 0.22	1.07 ± 0.15	0.65 ± 0.24
10A-455	USACE	1.08 ± 0.06	1.11 ± 0.12	0.96 ± 0.26
	ORISE	1.52 ± 0.27	1.32 ± 0.18	0.62 ± 0.41
10A-459 (biased sample)	USACE	0.56 ± 0.07	1.21 ± 0.14	1.20 ± 0.32
	ORISE	1.50 ± 0.27	1.98 ± 0.24	0.74 ± 0.26

- (1) Uncertainties represent the 95% confidence level, based on counting uncertainty
- (2) Uncertainties represent the 95% confidence level, based on total propagated uncertainties
- (3) The USACE laboratory applies a factor of 1.66 to the original Ra-226 result to account for incomplete radon-222 (Rn-222) progeny in-growth following sample preparation

c. Conclusions

The USACE and the NRC coordinated splitting soil samples at the completion of remediation activities for Stepan Burial Pit No. 3. Samples were analyzed for Ra-226, Th-232, and U-238 by each of the laboratories. Data for each of the samples were in general agreement and all results were below the cleanup criteria established in the ROD.

**VI. Exit Meeting**

The inspector discussed his observations during the site visits with the Shaw site RSO at the conclusion of each of the visits to the site and also discussed his observations with the Stepan Plant Manager during the March 2, 2010 site visit. The inspector held telephone exit meetings with the Stepan Plant Manager and the Shaw site RSO on March 23, 2010.

ATTACHMENT: SUPPLEMENTAL INFORMATION

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**PARTIAL LIST OF PERSONS CONTACTED**

Licensee

Mark Stanek, Plant Manager

USACE and Contractors

Jack Bills, SEC, Laboratory Manager  
David Hays, USACE, Project Health Physicist (via phone)  
Michael Winters, Shaw, Site Radiation Safety Officer

State of New Jersey

Jennifer Goodman, NJDEP, Supervisor, (via phone)

Oak Ridge Institute for Science and Education

Dale Condra, Laboratory Manager (via phone)

**LIST OF ACRONYMS**

ADAMS	Agencywide Documents Access and Management System
ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHP	Certified Health Physicist
DOE	Department of Energy
EPA	U.S. Environmental Protection Agency
FSS	Final Status Surveys
FSME	Office of Federal and State Materials and Environmental Management Programs
FUSRAP	Formerly Utilized Sites Remedial Action Program
NJARC	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NRC	Nuclear Regulatory Commission
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MOU	Memorandum of Understanding
ORISE	Oak Ridge Institute for Science and Education
pCi/g	picocuries/gram
Ra-226	Radium-226
ROD	Record of Decision

Rn-222	Radon-222
RSO	Radiation Safety Officer
SEC	Safety and Ecology Corporation
Th-232	Thorium-232
U-238	Uranium-238
USACE	U.S. Army Corps of Engineers

**PARTIAL LIST OF DOCUMENTS REVIEWED**

Record of Decision for Soils and Buildings at the FUSRAP Maywood Superfund Site, Maywood, New Jersey, U.S. Army Corps of Engineers, September 22, 2003.

Draft Final Background Study Investigation Report, FUSRAP Maywood Superfund Site, Maywood, New Jersey, Prepared by Shaw Environmental, Inc. for the U.S. Army Corps of Engineers, May 2004, Revision 1.

Master Final Status Survey Plan, FUSRAP Maywood Superfund Site, Maywood, New Jersey, Prepared by Stone & Webster, Inc. for the U.S. Army Corps of Engineers, November, 2001, Revision 1.

ORISE Letter Report for Analytical Results for Five Soil Samples from Stepan Company, Maywood, New Jersey, February 4, 2010.

Memorandum of Understanding Between the U.S. Nuclear Regulatory Commission and the U.S. Army Corps of Engineers for Coordination on Cleanup & Decommissioning of the Formerly Utilized Sites Remedial Action Program (FUSRAP) Sites with NRC-Licensed Facilities, 66 FR 36607-36609, July 12, 2001.

Chemical Data Quality Management Plan for the FUSRAP Maywood Superfund Site, Volume 1 – Quality Assurance Project Plan, Shaw Environmental, Inc. for the U.S. Army Corps of Engineers, June 2009, Rev. 2

Chemical Data Quality Management Plan for the FUSRAP Maywood Superfund Site, Volume 2 – Field Sampling Plan, Shaw Environmental, Inc. for the U.S. Army Corps of Engineers, June 2009, Rev. 2

Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575, Rev. 1, August 2000.