U.S. NUCLEAR REGULATORY COMMISSION
REGION I

INSPECTION REPORT

Inspection No.	04008610/2010001
Docket No.	04008610
License No.	STC-1333
Licensee:	Stepan Company
Location:	100 West Hunter Avenue Maywood, NJ 07607
Inspection Dates:	June 15, 2010 and August 17, 2010
Dates additional Information provided:	July 16, 2010 and August 2, 2010
Inspector:	Mark C. Roberts Senior Health Physicist Decommissioning Branch Division of Nuclear Materials Safety
Approved By:	Judith A. Joustra, Chief Decommissioning Branch Division of Nuclear Materials Safety

EXECUTIVE SUMMARY

Stepan Company
NRC Inspection Report No. 04008610/2010001

In accordance with the Memorandum of Understanding (MOU) between the U.S. Army Corps of Engineers (USACE) and the Nuclear Regulatory Commission (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 obtain 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 representatives of the USACE and their contractor, Shaw Environmental Incorporated (Shaw) and their sub-contractors. This report summarizes the observations made during visits to the Stepan Company site conducted June 15 and August 17, 2010 and the data from the sample analyses provided on July 15 and August 2, 2010.

During the June 15, 2010 site visit, the NRC inspector observed Final Status Survey (FSS) activities, including the collection of soil samples for gamma spectrometry analysis. 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. Samples were also analyzed by the USACE onsite laboratory. In a July 15, 2010 letter report to the NRC, ORISE provided their results from the analysis of the soil samples. Data for the USACE sample analysis were provided by electronic mail. All data were then compared to the cleanup criteria established for the site.

During the August 17, 2010 site visit, the inspector reviewed ongoing remediation activities, with a focus on control of water in excavations and treatment, analysis of samples, and discharge of the water collected from excavations.

The inspector interviewed cognizant personnel, performed field observations, and reviewed documentation during the visits. 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 # 3 met the cleanup criteria established in the Record of Decision (ROD).

Water collected from excavations was appropriately collected, treated, analyzed, and discharged in accordance with permitted activities.

Remediation activities for burial pit # 1 were progressing in accordance with routine operating procedures.

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 NRC. Stepan currently conducts chemical processing activities at its Maywood, NJ site that 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. 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 that were 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) along with the other 87 radiologically contaminated properties. 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 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. The ROD is a public document that explains which cleanup alternatives will be used to clean up a Superfund site. 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) combined Ra-226 and Th-232 activity above background, with an as low as is 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. 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 # 2, # 3, and # 1, respectively.

II. Final Status Survey Activities and Analysis of Confirmatory Soil Samples

a. Inspection Scope

During the June 15, 2010 site visit, the inspector observed technicians performing walkover gamma radiation surveys and collecting soil samples in survey unit 10A-23, one of the four 2000 m^2 survey units in the burial pit #3 excavation. Aliquots from five soil samples were provided to the inspector as split samples to be sent to the NRC's independent laboratory, the ORISE, for radiological analysis. The samples were also analyzed in the USACE onsite analytical laboratory. All samples were analyzed by high-resolution gamma spectrometry. The results are presented in the table below and compared to the cleanup criteria established in the ROD.

b. Observations and Findings

The FSSs were conducted in accordance with a Master FSS Plan and implementing procedures. The FSS plans and procedures were, in part, developed using protocols from the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575. The burial pits are classified as Class 1 Areas under MARSSIM because the areas had to be remediated to meet the cleanup criteria. The recommended MARSSIM survey methodology for Class 1 land areas includes a 100% surface scan using suitable radiation survey instrumentation and collection of a pre-determined number of soil samples that is based on the parameters of the statistical test to be used to demonstrate that the remediation criteria has been met. Because the primary contaminant at the site is Th-232, and Th-232 is also present in the background at the site, the Wilcoxon Rank Sum (WRS) Test is the statistical test used to demonstrate compliance with the cleanup criteria.

The inspector observed technicians performing surface scans in the survey unit using a lead-collimated, 3" x 3" sodium iodide gamma scintillation detector and data-logging rate-meter. In addition, technicians were equipped with Global Positioning Satellite (GPS) units that were integrated with the radiation detection equipment. The survey unit was marked in a grid pattern and technicians scan the soil surface with the detector in a serpentine pattern in order to completely cover the survey area. Technicians indicated that they made 3-4 survey passes to cover each width of approximately one meter. Data from the radiation survey meter and the GPS system are automatically data-logged each second. The resulting information is downloaded to a computer system following completion of the survey. A color-coded map is then generated to visually display survey results for the areas. Technicians also use visual and audio indications from the radiation survey equipment to identify areas of potential localized contamination. Additional evaluations, remediation, and/or surveys are performed as needed based on the survey results. Technicians made daily performance checks of the radiation survey equipment and GPS units before and after each set of measurements. The inspector confirmed that each radiation survey meter had been calibrated within the last year as required by operating procedures.

Based on the size of the survey unit and the parameters from the statistical test, the FSS lead engineer develops a sampling plan to collect the required number of samples in the survey unit. Using a map of the survey unit, the sampling points are positioned

throughout the survey unit by first selecting a random start point and then establishing a systematic pattern for sampling. Technicians use the GPS unit to locate each sample point and collect a sample. Samples are collected to a depth of six inches. Technicians were observed to be using clean sampling equipment and containers for each sample and legibly marking sample location on each sample container. Field duplicates (10 %), quality assurance duplicates (5%), and special split samples (e. g. NRC split samples) are collected by excavating a sufficient quantity of soil for the split samples, mixing the soil within the sample hole, and parceling out the aliquots to the sample containers.

The NRC split samples were sent to the NRC's confirmatory laboratory contractor, ORISE, for radiological analysis. Since these samples were actual FSS samples for USACE, the samples were also submitted to the USACE onsite laboratory. Each laboratory processed the samples in accordance with their procedures for high-resolution gamma spectrometry. Results from ORISE were transmitted via a letter report to the NRC. The USACE data were provided to the NRC by electronic mail because the final report will not be prepared until site remediation is complete. The results from the analysis of the soil samples from the Stepan site, burial pit # 3 are tabulated in the table below. Results are provided for both the ORISE and the USACE onsite laboratories.

Gamma Spectrometry of Soil Samples – Stepan Burial Pit # 3
(Results in units of picocuries/gram (pCi/g))

Sample Location	Analytical Laboratory	Ra-226	Th-232	U-238
10A-590	USACE (1)	1.09 ± 0.08 (3)	0.82 ± 0.12	0.82 ± 0.39
	ORISE (2)	1.52 ± 0.28	0.91 ± 0.14	0.80 ± 0.26
10A-591	USACE	1.13 ± 0.11	0.99 ± 0.17	0.56 ± 0.41
	ORISE	1.52 ± 0.30	0.92 ± 0.15	< 0.92
10A-594	USACE	1.04 ± 0.08	0.77 ± 0.11	0.68 ± 0.38
	ORISE	1.11 ± 0.20	0.72 ± 0.11	0.73 ± 0.20
10A-595	USACE	1.04 ± 0.09	0.78 ± 0.14	0.74 ± 0.31
	ORISE	1.13 ± 0.24	0.78 ± 0.12	< 0.77
10A-596	USACE	0.98 ± 0.09	0.64 ± 0.12	0.68 ± 0.32
	ORISE	1.24 ± 0.24	0.57 ± 0.10	< 0.62

(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 derived factor of 1.66 to the initial Ra-226 counting result to account for incomplete radon-222 (Rn-222) progeny in-growth following sample preparation since Rn-222 progeny are used in the quantitative determination of the Ra-226 concentration.

Although no specific statistical comparison was performed, the data from the two laboratories are in general good agreement with each other. All results are well below the cleanup criteria established in the ROD. As indicated above, the FSS report for the site will be issued for the entire site once remediation and FSS activities are completed.

c. Conclusions

The inspector observed technicians performing walkover gamma radiation surveys and soil sample collection in accordance with established procedures. The USACE and the NRC coordinated splitting soil samples at the completion of remediation activities for one of the survey units at Stepan Burial Pit # 3. Samples were analyzed for Ra-226, Th-232, and U-238 by the NRC's contractor ORISE and the USACE onsite laboratory. Data for each of the samples were in general agreement and all results were well below the cleanup criteria established in the ROD.

III. Burial Pit Remediation Activities for Pit #1

a. Inspection Scope

The inspector reviewed ongoing remediation activities in Burial Pit #1, with a focus on de-watering in the excavation, and the subsequent treatment, analysis of samples, and discharge of the water collected from the excavation. The inspector discussed the water treatment equipment and analytical methodologies of the USACE onsite radiological laboratory with cognizant personnel. Information was obtained through tours of the remediation area, water collection and treatment facilities, and the onsite laboratory.

b. Observations and Findings

The inspector observed ongoing remediation activities in Burial Pit #1, which is located immediately adjacent to Hunter Avenue. Radiation protection technicians were observed performing in process radiation surveys to indentify residual contamination areas and marking the areas so that the soil could be removed by the operators of the excavation equipment. Excavated soil was loaded into dump trucks and re-located to the staging area adjacent to the railroad line that is used for offsite shipments of contaminated soil to a licensed disposal facility.

Due to the depth of the excavation (down to approximately 18-20 feet), groundwater infiltration, as well as rainwater runoff, has to be controlled to allow excavation and subsequent FSS activities. Water in the excavation is collected in a series of 20,000 gallon tanks. After allowing for dirt in the water to settle out, the water is directed through a series of particulate filters, activated carbon filters, and cation and anion exchange resins for removal of suspended solids, organic materials and dissolved solids, respectively. Because USACE was able to previously demonstrate that the water effluent is well below the radiological criteria for release, the local water authority (Bergen County Utility Authority (BCUA)) has authorized a continuous discharge of the water effluent from the site. Technicians collect representative water samples for every 125,000 gallons of water that is released and perform gross alpha and gross beta

analyses on the samples and provides monthly reports to the BCUA. The USACE onsite laboratory is certified by the State of New Jersey for radioactivity analyses. Filter and resin exchanges are performed as needed. The USACE representatives indicated that the exchanges have been based on filter or ion exchange media performance and has not been required due to any elevated radiation dose rates on the media.

c. Conclusions

Water in excavations is controlled for the purpose of removing contaminated soil and subsequently performing FSS measurements in the remediated pit. Water is treated and released in accordance with an agreement with the local water authority. Analytical results from samples of the effluent water indicate that the criteria for discharge is being met. Monthly reports are sent to the local water authority.

IV. Exit Meeting

The inspector discussed his observations during the June 15, 2010 visit with the site health physicist and the Stepan Plant Manager. The inspector held exit meetings with the Stepan Plant Manager and the Shaw site RSO on August 17, 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
Thomas Kelley, USACE, Project Engineer
David Lawrence, SEC, Site Health Physicist
Brian Miller, SEC, FSS Lead Enginner
James Moore, USACE, Project Manager
Scott Walnicki, SEC, Radiological Engineer
Michael Winters, Shaw, Site Radiation Safety Officer

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
BCUA	Bergen County Utility Authority
CFR	Code of Federal Regulations
DOE	Department of Energy
EPA	U.S. Environmental Protection Agency
FSS	Final Status Surveys
FUSRAP	Formerly Utilized Sites Remedial Action Program
GPS	Global Positioning Satellite
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
Th-232	Thorium-232
U-238	Uranium-238
USACE	U.S. Army Corps of Engineers
WRS	Wilcoxon Rank Sum (Test)

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.

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, July 15 2010.

Split Sample Analysis Results for FSS at Stepan Burial Pit # 3, Electronic Mail from M. Winters, Shaw Environmental, Inc. to M. Roberts, USNRC, Region I, August 2, 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.

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