REVIEW OF RESIDUAL RADIOACTIVITY AT THE VELSICOL CHEMICAL COMPANY SITE IN ST. LOUIS, MICHIGAN

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INTRODUCTION

This report was developed in response to an email submitted to the U.S. Nuclear Regulatory Commission (NRC) Region III Office of Public Affairs by James Hall on behalf of the Pine River Superfund Citizen Task Force. The email inquired about the status of radioactive waste remaining at the Velsicol Chemical Corporation (Velsicol), formerly the Michigan Chemical Corporation, in St. Louis, Michigan. Specific concerns focused on whether radioactive waste remained on the main site in St. Louis, Michigan, and, if so, whether it possesses a risk to public health and the environment, could impact future site redevelopment, and whether text incorporated into the site's deed and granite marker accurately reflects the radioactive conditions on the site.

The NRC staff reviewed historical documents, including inspection reports, letters, and assorted technical reports to identify past actions performed by the licensee and NRC staff to assess the current status of the site with regards to radioactive waste. Details provided below focus on NRC-related activities and findings related to radioactive material associated with the site. Although some overlap is considered, this review does not address other cleanup activities being performed by the U.S. Environmental Protection Agency (EPA), the State of Michigan, and others focused on other contaminants that may be found on the site.

During the review NRC staff noted that documents associated with these activities were filed under multiple licenses (STC-0833, SMB-0833, and 21-14973-01) and used multiple docket numbers (030-08339 and 040-06264). To ensure that the findings of this review are easily accessible in the future, NRC staff filed this report in both dockets and included the Agencywide Documents Access and Management System (ADAMS) accession numbers (ML#s) for the specific documents referenced in this report.

BACKGROUND INFORMATION ON THE VELSICOL CHEMICAL COMPANY

The Velsicol Chemical Company (formerly the Michigan Chemical Company) site in St. Louis, Michigan, manufactured a variety of chemical products and produced rare earth oxides. Activities associated with the production of rare earth oxides required extracting licensable quantities of rare earth materials. The site initially obtained a possession only license (STC-0833) authorizing the possession of thorium on the site. The license was later amended to SMB-0833, which authorized possession and use of thorium and uranium on the site. This license was terminated in 1971. There is no evidence that radiological surveys were performed by the Michigan Chemical Company or the Atomic Energy Commission, the predecessor to the NRC, prior to license termination (ML20056A303). Many of the documents reviewed, including the inspections performed by the NRC, refer to the license 21-14973-01 for the Velsicol site. Although specific documentation was not found, NRC staff assume that this is the license number that was assigned to the site following the merger of the Michigan Chemical Company and the Velsicol Chemical Company in 1976 (ML20070N267).

Following license termination, NRC's Region III was contacted by the Michigan Department of Natural Resources (DNR) and the U.S. EPA concerning the radiological status of the site, specifically whether radioactive materials were present at levels of concern. Given the lack of information available, NRC staff performed confirmatory inspections of the site to assess current radiological conditions on the site. These inspections are summarized below.

Considering the extensive chemical contamination at site, Michigan DNR required Velsicol to develop an environmental security plan that included demolishing all on-site structures, installing a slurry wall, installing an upgradient groundwater interceptor drain, installing a clay cap, and surrounding the site with a fence. Velsicol was also directed to install a granite marker identifying the existence of the various materials left on the site and incorporate text regarding site conditions in its deed. These requirements were ultimately imposed on Velsicol through a Consent Judgement issued by the U.S. District Court on December 27, 1982 (ML20079R944). Specifics related to the NRC and radioactive waste being included in these directions are provided below.

VELSICOL DECONTAMINATION AND SURVEY PLAN

Velsicol submitted the "Decontamination & Survey Plan for Velsicol Chemical Corporation Plant Site in St. Louis, Michigan," (ML20009C509), dated July 15, 1980, to the NRC in response to previous correspondences regarding efforts to identify radioactive waste remaining on the site since the site's NRC license was terminated. The decontamination and survey plan divided the site into three areas (Area A, Area B, and Area C) based on known plant operations. Maps of the areas are included in the report. The plan also discusses the likely extent of radioactive waste existing in each area and the survey and sampling approaches used to identify radioactive waste remaining in each area. For example, emphasis was placed on Area C since that was the area where operations involving radioactive material as well as storage were known to occur.

The decontamination and survey plan also provides the cleanup standards used to evaluate the soil (Table A) and smear (Table B) samples collected on the site. These tables are included below. The values included in these tables were established screening values used by the NRC to confirm that sites were acceptable for license termination at the time these activities were performed. The specific guidance documents discussing these values are provided in the footnotes to each table. Even though both documents have been rescinded, decisions made based on these values and the guidance provided are still applicable.

In addition to the values provided in the tables, the decontamination and survey report also notes that survey readings of material in excess of 20 μ R/hr above background at one meter above the surface were considered contaminated and decontamination of the area would need to be performed.

Radionuclide	Soil Concentration (pCi/g)		
U-238	35.0		
U-235	32.5		
U-234	30.3		
Th-232	23.1		
Th-230	31.0		
Th-228	10.4		
Ra-228	a-228 12.4		
Ra-226	5.0		

Table A. Release Levels for Soil in Picocuries Per Gram¹

¹ Table A from the "Decontamination & Survey Plan for Velsicol Chemical Corporation Plant Site at St. Louis, Michigan," (ML20009C509); values associated with guidance were provided in "SECY 81-576, Disposal or Onsite Storage of Residual Thorium or Uranium (Either as Natural Ores or Without Daughters Present) from past Operations" (ML19363A009)

Table B. Acceptable Surface Contamination Levels¹

Radionuclide	Average	Maximum	Removable
U-nat, U-235, U-238, and associated decay products	5,000 dpm a/100 cm ²	15,000 dpm a/100 cm²	1,000 dpm a/100 cm ²
Transuranics, Ra-226, Ra-228, Th-230, Th- 228, Pa-231, Ac-227, I- 125, I-129	100 dpm/100 cm ²	300 dpm/100 cm ²	20 dpm/100 cm ²
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm by/100 cm ²	3,000 dpm/100 cm ²	200 dpm/100 cm ²
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000 dpm By/100 cm ²	15,000 dpm By/100 cm ²	1,000 dpm By/100 cm ²

dpm a/100 cm² = alpha dpm /100 cm²

dpm By/100 cm² = Beta/gamma dpm/100 cm²

¹ Table B from the "Decontamination & Survey Plan for Velsicol Chemical Corporation Plant Site at St. Louis, Michigan," (ML20009C509); values associated with guidance were provided in "Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors" (ML003740243)

CONFIRMATORY SURVEY RESULTS

As part of the follow-up activities, NRC staff performed confirmatory surveys for each section of the site as part of multiple inspections prior to approving demolition and other decommissioningrelated activities. Findings from these inspections are summarized below. The analyses and conclusions made through these inspections confirm that the quantities of radioactive waste remaining on the site prior to the implementation of decommissioning and remediation activities performed by the other regulatory agencies involved were acceptable and in accordance with NRC regulations.

April 1981 NRC Inspection

A complete summary of the findings from the April 1981 inspection of the site can be found in NRC inspection report 30-8339/81-01 (ML20004C899). Confirmatory surveys were performed for Areas A and portions of Area B, designated B-1 and B-2, to verify measurements taken by two independent licensee contractors. The inspection included collecting on-site and control samples for analysis. Specific findings included:

- Direct surveys for alpha contamination were less than 100 dpm/100 cm².
- Smear surveys for removable alpha contamination were less than 10 dpm/100 cm².
- Direct surveys for beta-gamma contamination were less than 20 µR/hr at one meter.
- Smear surveys for removable beta-gamma contamination were less than 100 dpm/100 cm².
- One hot spot was located adjacent to Area A (in Area C). The hot spot was previously identified and reported. The licensee agreed to isolate the area to prevent the spread of contamination before decommissioning activities in Area A could begin.
- Eight soil samples were collected from Area B-2, the hot spot, and from two control areas in proximity of the site. The hot spot sample contained 3 pCi/g of Ra-226 and 1 pCi/g of Ra-228; the other samples contained activities comparable to a background sample from Illinois.

Based on the survey findings, NRC staff confirmed the findings previously reported by the licensee. Maps noting the locations where surveys were performed and where samples were collected as well as the results are provided in the attachments to the inspection report. NRC staff, in a letter dated May 5, 1981 (ML20126K762), granted Velsicol permission to initiate decommissioning activities for Areas A, B-1, and B-2 provided that actions are taken to isolate the hot spot.

August 1981 Inspection

A complete summary of the findings from the August 1981 inspection of the site can be found in NRC inspection report 30-8339/81-02 (ML20030D997). Direct radiation and contamination surveys were performed in Areas B and C. Results of the surveys confirmed the licensee's findings, including verifying the location and extent of licensee-identified ground contamination. The inspection also confirmed that contaminated soil from the Creamery Warehouse area was disposed of in Area C and that caps applied to contaminated areas reduced direct gamma readings to below 20 μ R/hr. Specific findings included:

- Exposure rates were less than 20 uR/hr, including all hot spots covered with caps.
- Contaminated building areas had been cleaned sufficiently to permit demolition workers to proceed.
- Direct gamma readings taken in buildings were less than 20 μ R/hr at one meter above the surface.
- Smear surveys for removable alpha and beta-gamma contamination were less than 100 dpm/100 cm² and 100 dpm/100 cm², respectively, except for a ceramic column in the Bromine Storage Building 207 and the northeast corner of the first floor of Building 305.

The ceramic column was drummed for offsite shipment to an approved burial site at the end of August 1981.

- Direct gamma readings taken over the caps were less than 20 μ R/hr at one meter above the surface.
- Soil samples collected on the site were comparable to samples collected from control areas located on and off the site.

Specific details regarding the surveying and removal of contamination associated with buildings are discussed in the inspection report. Based on the survey findings, the licensee was approved to proceed with demolition and decommissioning on the site. Maps noting the locations where surveys were performed and where samples were collected as well as the results are provided in the attachments to the inspection report.

The Creamery Warehouse area, which is located adjacent to the main plant site, was not included in the Consent Judgement. Therefore, the NRC expected contamination in that area to meet the guidelines for unrestricted release. Analyses performed in accordance with the inspection confirmed that these guidelines were met by removing radioactive waste and placing it in a capped area in Area C.

July 1997 Inspection

In July 1997, NRC inspectors performed an additional inspection to confirm previous findings associated with the Creamery Warehouse as no records of a final survey of the area could be located. This inspection would provide confidence that the area met applicable requirements and was suitable for unrestricted use. The Michigan Department of Environmental Quality also indicated that members of the public expressed concern regarding possible groundwater contamination associated with the site. A complete summary of the findings from the inspection can be found in NRC inspection report 040-06264/97002 (ML20217Q168). Specific findings from the inspection included:

- Groundwater samples did not reveal any radiological materials greater than what normally exists in nature.
- A small area (approximately 4-6 feet in diameter) was found to contain radiological material at levels greater than what normally exists in the local environment but was found to meet NRC requirements for unrestricted use and did not pose a threat to the public or the environment.

Current Status Report Formerly Licensed Site Decontamination Program, Volume 1

Staff noted in this July 1988 report (ML20056A303), which evaluates the status of multiple sites, that the disposal, stabilization, and monitoring requirements imposed by the Consent Judgement were adequate to protect the public and environment from any adverse impacts associated with radiological contamination. The report also notes that based on prior arrangements dictated that despite containing acceptable levels of radioactive material, Velsicol noted the existence of radioactive material on the site in the deed and on the granite marker.

<u>2006 "Remedial Investigation Report for Operable Unit One, Velsicol Chemical Corporation</u> <u>Superfund Site, St. Louis, Gratiot County, Michigan"</u>

The 2006 "Remedial Investigation Report for Operable Unit One, Velsicol Chemical Corporation Superfund Site, St. Louis, Gratiot County, Michigan"¹ published by Weston Solutions of Michigan, Inc., included sampling results from various media around the former plant site. Isotopic uranium and thorium samples were collected from select locations based on their proximity to facilities known to have used radioactive material. None of the uranium and thorium results measured in groundwater samples exceeded U.S. EPA National Primary Drinking Water Standards and the uranium and thorium concentrations evaluated in nine soil samples were well below the established criteria. No radionuclides were detected in samples collected from the onsite monitoring wells.

POST WASTE CLEANUP AND REGULATORY ACTIONS

Dames and Moore prepared a Conceptual Environmental Security Plan, dated January 25, 1980, outlining plans for site preparation and proposing control and monitoring measures. These plans including groundwater remediation measures and the installation of surface caps to seal off the entire plant area, minimize infiltration, and prevent erosion of surficial soils. The Michigan DNR and the U.S. EPA reviewed the report and provided concerns from both agencies, noting the need for additional details to be incorporated into the plan. Both the initial environmental security plan and the letter are included in the EPA's "Velsicol Chemical Corporation Case Development Plan."² Dames and Moore addressed these concerns and provided updates to the plan in the "Clarification of Environmental Security Plan, St. Louis, Michigan Plant Site for Velsicol Chemical Corporation" (ML20009D404). These actions were managed through the Consent Judgement. NRC staff were not involved with the review of the environmental security plan, the updated security plan, or the Consent Judgement associated with the site. Although the Consent Judgement between Velsicol, U.S. EPA, and the State of Michigan, only focused on chemical contamination, NRC staff noted that the requirements and specific land use restrictions being implemented satisfied the requirements in Option 4 of SECY 81-576, "Disposal or Onsite Storage of Residual Thorium or Uranium (Either as Natural Ores or Without Daughters Present) From Past Operations" (ML19363A009). Therefore, NRC staff requested a commitment from Velsicol to include a notation on the granite markers and in the land deed for the site. NRC staff found the draft text for the granite marker and the deed provided to the NRC in a September 29, 1982, letter (ML20079R944) to be acceptable. The NRC noted in the June 9, 1983, docket closeout file that Consent Judgement requirements along with the proposed notations on the granite marker and in the land deed that radioactive material is also present were adequate to protect the public and environment from radioactive contaminants on the site (ML20024A631).

¹ The 2006 Remedial Investigation Report can be found on the U.S. EPA website at <u>https://semspub.epa.gov/work/05/346170.pdf</u>

² The Velsicol Chemical Corporation Case Development Plan can be found on the U.S. EPA website at <u>https://semspub.epa.gov/work/05/83240.pdf</u>