

September 26, 2008

Steven W. Doremus, Ph.D., CHP  
Naval Sea Systems Command Detachment  
Radiological Affairs Support Office (RASO)  
Department of the Navy  
NWS P.O. Drawer 260  
Yorktown, VA 23691-0260

SUBJECT: RADIOLOGICAL FINAL STATUS SURVEYS RELATING TO THE FORMER  
STORAGE OF MONAZITE SANDS AT THE NAVAL STATION GREAT LAKES,

Dear Dr. Doremus:

This refers to the NRC review of final status survey reports for areas impacted as a result of radioactive materials used at the Naval Station Great Lakes, Great Lakes, Illinois, under the authority of U.S. Atomic Energy Commission and U.S. Nuclear Regulatory Commission license numbers SMC-01207 and SUC-01332, which were terminated in 1975 and 1983, respectively. Specifically, my staff reviewed final status reports as follows: 1) Radiological Remediation and Final Status Survey, Former Monazite Sand Storage Area, Naval Station Great Lakes, Great Lakes, Illinois, June 2008, and 2) Radiological Remediation and Final Status Survey, Public Private Venture (PPV) Areas, Naval Station Great Lakes, Great Lakes, Illinois, August 2008. Those final status surveys were performed and documented in accordance with Navy technical documents previously evaluated in an NRC Safety Evaluation Report, which was attached to a November 20, 2007, NRC letter (ADAMS Accession No. ML073241088)).

We have concluded, after review of the final status reports, that the results of the radiological surveys are consistent with the provisions of 10 CFR Part 20, Standards for Protection Against Radiation," Section 20.1402, "Radiological Criteria for Unrestricted Use." As such, we have no further questions regarding this site and consider the project closed. We do not propose any further action on our part regarding this decommissioning project, unless new information is identified that would alter our decision. A Safety Evaluation Report documenting our review of the Final Status Survey Reports is attached.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). The NRC's document system is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

S. Doremus

-2-

We appreciate your cooperation and if you have any questions, please do not hesitate to contact me at (630) 829-9834 or Mr. Mike McCann (630) 829-9856.

Sincerely,

*/RA/*

Christine A. Lipa, Chief  
Decommissioning Branch  
Division of Nuclear Materials Safety

Docket Nos.: 040-08306, 040-08680 (terminated)  
License Nos.: SMC-01207, SUC-01332 (terminated)

Enclosure:  
Safety Evaluation Report

cc w/encl: Howard Hickey, Remediation Program Manager,  
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## SAFETY EVALUATION REPORT

FORMER LICENSEE: Engelhard Minerals and Chemicals Corporation (Out of Business)  
LICENSE NO.: SMC-01207 and SUC-01332 (Terminated)  
DOCKET NO.: 040-08306 and 040-08680 (Terminated)  
SUBJECT: SAFETY EVALUATION REPORT - DOCUMENTING THE NRC  
REVIEW OF NAVY DOCUMENTS RELATING TO  
REMEDIACTION ACTIVITIES AT THE NAVAL STATION GREAT  
LAKES, GREAT LAKES, IL

### 1.0 EXECUTIVE SUMMARY

Since the March 2000 discovery of thorium-232 contamination in an industrial area at the Naval Station Great Lakes, the Navy and the NRC have worked cooperatively to characterize and remediate areas impacted by the radiological contamination. This working agreement has involved the Navy providing the NRC Region III Decommissioning Branch documents and procedures for review and included a number of onsite inspections. The documents described how the Navy conducted and documented radiological characterization and final status surveys; establish derived concentration guideline levels (DCGLs) for unrestricted use of the impacted areas; and performed and documented the determination of public dose using the radiological computer dose model (RESRAD). The review of these reports was documented in a Safety Evaluation Report and NRC letter dated November 20, 2007 (ML073241088).

The purpose of this Safety Evaluation Report (SER) is to document the NRC's review of the Navy's final status survey reports for areas impacted as a result of radioactive materials used at the Naval Station Great Lakes, Great Lakes, Illinois under the authority of Atomic Energy Commission and NRC license numbers, SMC-01207 and SUC-01332, which were terminated in 1975 and 1983, respectively. Specifically, staff reviewed final status reports as follows: 1) Radiological Remediation and Final Status Survey, Former Monazite Sand Storage Area, Naval Station Great Lakes, Great Lakes, Illinois, June 2008, and 2) Radiological Remediation and Final Status Survey, Public Private Venture (PPV) Areas, Naval Station Great Lakes, Great Lakes, Illinois, August 2008. The purpose of those reports was to demonstrate that all areas where materials had been stored, shipped and disposed from have been remediated and are suitable for unrestricted use consistent with NRC 10 CFR Part 20 unrestricted use criteria.

### 2.0 FACILITY HISTORY

#### 2.1 License Number/License Activities/Authorized Activities

NRC staff has reviewed its files for Engelhard Minerals and Chemicals (Engelhard), the former licensee, regarding the Naval Station Great Lakes. The review was conducted according to Consolidated Decommissioning Guidance, Volume 1 (NUREG-1757). Based on the review, the staff has determined that the U.S. Atomic Energy Commission (AEC) granted licenses SMC-01207 and SUC-01332 to Engelhard to package and ship a strategic stockpile of monazite sand from the Great Lakes Naval Training Center to

Enclosure

other AEC/NRC licensees. The SMC-01207 license was terminated in 1975 and the SUC-01332 license was terminated 1983. The former licensee was authorized to possess 119,829.33 kilograms of natural thorium (Monazite Sand) under SMC-01207 and 67,965 kilograms under SUC-01332.

## 2.2 Decommissioning Activities/Radiological Status

During a March 2000 NRC radiological scoping survey, radiological concentrations of thorium-232 ranging from 0.93 picocuries per gram (pCi/g) to 64.31 pCi/g, with an average concentration of 17.0 pCi/g, were identified in an industrial park area of the Naval Station's Training Center. The industrial area containing the monazite sand encompassed an area of approximately 90,000 square yards in a former tank farm area.

Between 2000 and 2008, the NRC conducted eight inspections of the Navy contractor's remediation activities at the site. Those inspections included a review of remediation activities including observations of radiological surveys and reviews of work instructions.

On July 7, 2005, the NRC identified additional thorium-232 contamination outside of the former tank farm area along a nearby stream (NRC Inspection Report No. 040-08306/05-001, (ML052560100)). The NRC findings described previously unidentified contamination in a housing area known as the "Public-Private Venture Forrestal Village Area." The Navy, in a September 7, 2006, letter updated its ongoing thorium remediation project (ML062630173). In December 2006, the Navy submitted the "Sampling Plan for Task 3: Coal Ash Determination," (ML070800402) for NRC review. The Navy used this plan to ascertain if the contamination was a result of the migration or deposition of contaminated soils containing monazite sand or a result of past deposition from naturally occurring radioactive materials emitted from local smoke stacks, which would have occurred many years in the past.

On July 12, 2005, U.S. NRC Region III management met with personnel from the Navy's Radiological Affairs Support Organization, Great Lakes Environmental Department, and Cabrera Services (contractor) management to discuss the need to further characterize the site, establish new site boundaries, and develop remediation and final status survey plans for the site. During this meeting the Navy also discussed its plans to develop and submit for NRC review new site-specific DCGLs.

On March 21, 2007, the Navy submitted for NRC review the Coal Ash Determination Sampling Report (ML070810101), which discussed the results of its survey findings and conclusions regarding the source of the thorium-232. On March 22, 2007, the Navy submitted a Site-Specific DCGL Determination Report (ML070860326) which discussed its basis and modeling for revising the site clean-up DGCL. On April 13, 2007, a Final Status Survey Plan to be used for surveying and releasing for unrestricted use Building 3214 and the Vermont Court Housing was provided to the NRC (ML071060175). On August 31, 2007, a Final Site-Specific Derived Concentrations Guideline Level Addendum" Naval Station Great Lakes Radiological Remediation Great Lakes, Illinois (ML072430741, ML072430754), which provided the technical and modeling information for the Navy's proposed RESRAD Resident Gardener Scenario, was also submitted for NRC review. That document was a supplement and revision to the Navy's March 2007 DCGL Report.

Based on the review of the above documents, the NRC staff concluded that the Navy provided sufficient information to evaluate the Navy's determination of the radiological status of the facility and the Navy's remaining decommissioning activities, to ensure that the decommissioning could be conducted in accordance with NRC requirements. The NRC staff findings were documented in Safety Evaluation Report dated November 20, 2007 (ML073241088).

The Navy completed decommissioning activities between April 14, 2008 and June 6, 2008. The NRC conducted an inspection on May 7, 2008, and observed the Navy's contractor's final status survey activities. The NRC also performed independent survey measurements in areas previously surveyed by the contractor. (ML003683396)

### 3.0 FACILITIES DESCRIPTION

#### 3.1 Site Location and Description

The Naval Station Great Lakes Training Site is located in Lake County, Illinois, 36 miles north-northwest of Chicago and slightly west of the Lake Michigan shore, occupying an area of approximately 1,600 acres. The site is located in an urbanized area of the County, on the eastern edge of the Upper Illinois River Basin (UIRB) (USGS 1999). The site is located in an urbanized area of Lake County, used predominantly for single and multi-family residences, as well as industrial use. The Naval Station is currently bounded on three sides by residential areas and industrial properties, and the fourth side (eastern) is bounded by Lake Michigan. The size of residential properties at the site is typical of residential lots, averaging approximately 0.25 acres but not exceeding 0.5 acres. The Great Lakes Naval Training Center is the Navy's only recruit training site and has been in operation since 1911. Since Engelhard is no longer in business, the Navy as site owner, assumed responsibility for the Great Lakes site cleanup.

#### 3.2 Population Distribution

The U.S. Census Bureau estimated the Lake County population in 2005 to be 702,680. Like many urban areas in proximity to Lake Michigan, the Site obtains potable water from a public water supply.

#### 3.3 Current/Future Land Use

The Naval Station is the Navy's only recruit training site, and has been in operation since 1911 with no anticipated changes within the foreseeable future.

#### 3.4 Groundwater and Surface Water Hydrogeology

Due to the relatively insoluble nature of the thorium, groundwater and surface water impacts are not considered to be a concern.

### 4.0 Final Status Survey Reports Review

The Navy's contractor performed the final status surveys (FSS) after the remediation activities were complete. All activities were performed in accordance with the Public Private Venture Area Remediation Addendum to Work Plan for the Remediation of the

Recreation and Center Tank Areas and Site Wide Final Status Survey, which was developed using NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM) guidance.

As part of the FSS activities for the Site, gamma walkover surveys were performed over 100% of the survey units. If remediation of a survey unit was necessary, a gamma walkover survey was performed over the excavation area. Prior gamma walkover surveys from characterizations were also used if the area was determined to be initially clean. In areas where the post-remediation gamma walkover overlapped the pre-remediation data, the two data sets were merged with the post-remediation data given preference.

Systematic surface soil samples (down to one foot) were collected in each of the survey units. The minimum number of systematic soil sample locations required in each of the survey units was established using NUREG-1575, MARSSIM guidelines. Surface soil samples were collected in the survey units using a systematic triangular grid pattern with a random start point. Grid spacing was calculated for each survey unit based on the area of the survey unit. Random start point coordinates were established using a computer-generated random coordinate set. The chain of custody was maintained for the collected soils samples and the samples were transferred to an on-site laboratory. Biased soil samples were also collected to identify potential areas of elevated radioactivity.

On-site gamma spectroscopy analyses were performed following sample collection and logging. The Navy's contractor performed on-site gamma spectroscopy sample analyses on all soil samples utilizing a coaxial HPGe detector. Prior to the performance of project sample analyses, the detector was calibrated using a mixed gamma standard traceable to the National Institute of Standards and Technology (NIST). All final status survey sample results were below the Site DCGL of 4.0 pCi/g. The FSS data indicate that the survey units investigated are suitable for release for unrestricted use.

Soils exceeding the DCGL of 4 pCi/g of thorium-232 were packaged in 10 cubic yard soft-sided containers, (i.e., super-sacks). The super-sacks were temporarily stored on-site, and then transported to a nearby railhead in Kenosha, Wisconsin, where the containers were transloaded into gondola railcars. The waste generated during previous remediation efforts at the Site were profiled as unimportant quantities of source material and shipped to the U.S. Ecology site located near Grand View, Idaho. During the 2007 effort, 1519 tons of impacted material was shipped to the Grand View site. In January 2008, two gondolas were loaded with all of the remaining material generated in 2007 (~170 tons), and shipped to Waste Control Specialist located in Andrews, Texas.

Based on the NRC staff review of the Navy's final status survey reports for the remaining impacted areas at the Naval Station Great Lakes, the NRC has concluded that the radiological surveys and soil sampling data are consistent with the Navy's technical reports. Thus, NRC staff concludes that there is reasonable assurance that the health and safety of the public will not be endangered by the unrestricted use of the formerly impacted areas. Additionally, the staff concludes that the Navy has demonstrated that remaining residual contamination is below a Total Effective Dose Equivalent (TEDE) to an average member of a critical group that does not exceed 25 mrem per year, including

that from groundwater sources of drinking water, as specified in Title 10 of the CFR, Part 20, Section 20.1402, "Radiological Criteria for Unrestricted Use."

#### REFERENCES:

1. Inspection No. 040-08306/00-001 (ML003683391, ML003683396)
2. Inspection Report No. 040-08306/00-002 (ML003746615)
3. Inspection Report No. 040-08306/03-001 (ML032750081)
4. Inspection Report No. 040-08306/03-001 (ML040120893)
5. Inspection Report No. 040-08306/03-002 (ML040120892)
6. Inspection Report No. 040-08306/04-002 (ML050310025)
7. Inspection Report No. 040-08306/05-001 (ML052560100)
8. Inspection Report No. 040-08306/08-001 (ML082600627)
9. Navy letter dated June 13, 2008, "Subject: Radiological Remediation and Final Status Survey, Former Monazite Sand Storage Area, Naval Station Great Lakes, Great Lakes, Illinois, June 2008" (ML081750285).
10. Final Report - Radiological Remediation and Final Status Survey, Former Monazite Sand Storage Area, Naval Station Great Lakes, Great Lakes, IL. (ML082690886)
11. Navy letter dated September 24, 2008, "Subject: Decommissioning Activities at Naval Station Great Lakes." (ML082700068)
12. Final Report - Radiological Remediation and Final Status Survey, Public Private Venture (PPV) Areas, Naval Station Great Lakes, Great Lakes, Illinois, August 2008 (ML082680297)
13. Final - Work Plan for Radiological Remediation and Final Status Survey of the North Fence Area and Soil Pile, Project USN 2000-003, Phase III, Modification I, Revision 3, Dated June 16, 2003 (ML072920104)
14. Final - Work Plan for the Characterization of the Recreation and Center Tank Areas and Radiological Remediation and Final Status Survey of the North Fence Area, Project USN 2000-003, Phase III, Modification I, Revision 2, Dated August 2004 (ML042720159)
15. Work Plan for the Remediation of the Recreation and Center Tank Areas and Site-Wide Final Status Survey, Project USN 2000-003, Phase IV, Modification 1, Cabrera Project No. 05-3060.01, Revision 0, Dated November 2004 (ML072980843)
16. Final Report Remediation and Final Status Survey Former Monazite Sand Storage Area North Fence Area, Recreation Area, and Center Tank Area Naval Station Great Lakes – Great Lakes, Illinois Project USN 2000-003, Phase IV, Modification 4, Cabrera Project No. 05-3060.01, Dated June 2006 (ML072910402)

17. Coal Ash Determination Sampling Report, Naval Station Great Lakes, Great Lakes, Illinois, Dated March 2007 (ML070810101)
18. Final Site-Specific DCGL Determination Report, Naval Station Great Lakes Radiological Remediation, Great Lakes, Illinois, Dated March 2007 (ML070860326)
19. Final Status Survey Plan Building 3214 and Vermont Court Housing Report, Naval Station Great Lakes, Great Lakes, Illinois, Dated April 2007 (ML071060175)
20. Final Site-Specific Derived Concentration Guideline Level Addendum, Naval Station Great Lakes Radiological Remediation, Great Lakes, Illinois, Dated August 2007 (ML072430741, ML072430754)