U.S. NUCLEAR REGULATORY COMMISSION
REGION I

INSPECTION REPORT

Report No. 070-00139/96-003

Docket No. 070-00139

License No. SNM-185 (Retired)

Licensee: Engelhard Corporation
Route 152
Plainville, Massachusetts 02762

Facility Name: Engelhard Corporation

Inspection At: Route 152
Plainville, Massachusetts 02762

Inspection Conducted: November 6, 1996

Inspectors: Mark Roberts 12-20-96
Mark C. Roberts date
Senior Health Physicist

Approved By: Ronald R. Bellamy December 20, 1996
Ronald R. Bellamy, Ph. D., Chief date
Decommissioning and Laboratory Branch

Inspection Summary: Routine, announced safety inspection of remediation activities (NRC Inspection No. 070-00139/96-003).

Areas Inspected: Project Management, Radiation Protection, Remediation of interior areas, Instrumentation and radiation surveys.

Results: No violations or safety concerns were identified.

DETAILS

1.0 Persons Contacted

* Donald Chabot, Project Manager, Engelhard Corporation
* Steve Graham, Senior Project Manager, Foster Wheeler Environmental Corporation (Foster Wheeler)
* James Mayberry, CHP, Project Radiation Safety Officer, Foster Wheeler
Stephen E. Miller, President, Hilbert Associates Radiological Engineers (by telephone on December 11, 1996).

*Denotes those present at exit interview.

2.0 Background

The site is comprised of eleven buildings on a 10 hectare (25 acre) site, adjacent to a small reservoir in southeastern Massachusetts. From the late 1950's until 1962, a subsidiary of the Engelhard Corporation, D.E. Makepeace, was licensed by the AEC to use enriched uranium in the production of fuel elements. Activities with licensed material were limited to Buildings 1 and 2. A remediation contractor has completed decommissioning the interior contaminated areas in preparation for eventual building demolition. Final surveys have been completed. A Final Status Survey Report was received in the Region I office on November 22, 1996, but was not reviewed for this inspection. The exterior contamination issues will be addressed in a separate phase of the project. The inspector also evaluated the physical condition of the facility for a scheduled confirmatory survey.

3.0 Resolution of Open Items

In the previous inspection on July 30-31, 1996 (NRC Inspection 070-00179/96-002), the NRC inspector identified a minor discrepancy in the calibration records for one of the survey meters used by the contractor. The calibration date on the instrument was different than the calibration date on the instrument calibration record. The project radiation safety officer investigated this issue and determined that the calibration record shown to the inspector was not the most recent one for the instrument. The instrument was not working properly and was returned to the vendor for a minor repair. The repair was performed on the instrument and the instrument returned with a new calibration sticker and calibration record. The latest calibration record had not been filed at the time of the inspection. The contractor also reviewed the calibration records for all remaining instruments and found all records to be in order. This issue is closed.

4.0 Project Management

Remediation of contaminated areas commenced in late June 1996. The remediation activities are being coordinated by a contractor to Engelhard, Foster Wheeler Environmental Corporation (the remediation contractor). A project manager for Foster Wheeler coordinates the project for the contractor and is the primary interface to Engelhard. A project radiation safety officer, certified in comprehensive health physics by the American Board of Health Physics, was in charge of

radiological safety for the project and directed the activities of two radiological technicians. The two radiological technicians, employees of Hilbert Associates, sub-contractor to Foster-Wheeler, performed both the routine radiological surveys and the final surveys reported in the Final Status Survey Report. Each individual had significant previous experience in remediation surveys. Staff from Hilbert Associates also provided technical support in the area of radiological measurements and analyzed soil samples at their laboratory in Sarasota Springs, New York.

No safety concerns were identified.

5.0 Remediation in Interior Areas

The principle remediation activities that were conducted were scabbling surface contamination in the concrete floors and lower walls, excising contamination from joints and seams in the floor, and removing contaminated piping beneath the floor. Concrete chips and dust were captured using filtered vacuum cleaners and stored as radioactive waste in drums. Larger pieces of contaminated concrete are also stored in drums. Metal trenches in the floor were surveyed and not found to be contaminated since they were likely installed following the termination of licensed activities.

Approximately twenty drain lines were identified in the floor of Building 2. Each drain line terminates in the tunnel area of Building 2 or joins one of the lines that terminates in the tunnel. The open end of each line was sealed with a foam sealant to prevent leakage of the contents into the tunnel area. Following the removal of the contamination on the floor surfaces, the concrete slab above each pipe was cut into sections and removed. Each section was surveyed for contamination and clean sections were set aside for later use as fill. In most cases, the concrete slab is six to eight inches thick, but is as thick as 14 inches in some areas. Once the concrete was removed above the piping, the drain lines were excavated and removed. The piping was generally intact and there was no underlying soil contamination. In two cases, contamination of the underlying soil was found where the pipe had been previously cut and modified. Contaminated soil in these locations was excavated and placed in drums. In order to access all of the drain lines under the concrete slab, some of the excavated areas had to be filled in order to provide access for certain remediation equipment. The remediation contractor collected and analyzed soil samples from beneath the areas that were filled. These samples are archived at the site and will be provided to the NRC for confirmatory analysis as necessary.

In area 2M, buried piping on the east side of the room was removed and contamination found in the soil. The piping had apparently been previously cut and reconnected without regard to contamination control. An area approximately eight feet by eight feet was excavated and the contaminated soil removed. A layer of clay soil appeared to stop the vertical migration at about two feet. Contamination was evident on the foundation, along an expansion joint in the floor, and at the base of a girder. These areas were scabbled to remove the contamination. Some soil contamination remains in this area. Because the building is scheduled for demolition and the contamination is below grade, Engelhard intends to consider resolution of the residual contamination in the exterior phase of the remediation project.

The tunnel at the south end of Building 2 received the drain lines from the interior of the building. The floor of the tunnel slopes eastward from ground level to approximately five to six feet below grade. Contamination was removed from the floor in the tunnel by scabbling the concrete floor. A pipe exiting the east end of the tunnel and leading toward the contaminated leach bed has not been removed. A pipe and contaminated soil (uranium concentrations from 200 - 300 pCi/g) near the pipe along the south wall of the tunnel has not been completely remediated. Since these two areas are below grade and will be outside once the building is razed, Engelhard desires to consider these areas in the exterior remediation project.

Because enriched uranium was utilized at the facility, the contractor performed alpha spectrometry analyses on a representative group of contaminated soil samples to establish the approximate enrichment of the uranium and to empirically determine a relative ratio of the concentration of uranium-234 (U-234) to the concentrations of uranium-235 (U-235) and uranium-238 (U-238) in the sample. The average enrichment was determined to be approximately 4% and the empirical ratio of U-234 to U-235 was determined to be 21. During remediation activities, gamma spectrometry was used to identify concentrations of U-235 and U-238 in samples, primarily because it provided more rapid analytical results. The empirical ratio was used to infer the U-234 concentration because U-234 is not detectable in the gamma analysis. The total uranium concentration was then determined for a sample by summing the U-234, U-235, and U-238 concentrations.

In the previous inspection (070-00139/96-002), the capability of the contractor's analytical laboratory was evaluated. Selected soil samples were sent to the Region I office for gamma spectrometry analysis. The results obtained were compared to the contractor's analytical results. The NRC results show very good agreement with the Engelhard values.

No safety concerns were identified.

6.0 Remediation in Elevated Areas

Remediation was necessary in only a few elevated areas. Contamination was present on a series of three electrical ducts that were attached to the ceiling. On two of the three ducts, contamination was limited to oxidation on metal clips that were attached to the duct. Contamination on these two ducts was readily removed by wire brushing and vacuuming. Contamination on the third duct was persistent and necessitated the removal of the duct. Remediation in other elevated areas was only required in isolated areas, which were readily cleaned.

In area 2N, large ventilation ducts (hot air supply) are present on the ceiling and down the north wall. The ducts were likely installed after the completion of licensed activities. No contamination was found on either interior or exterior surfaces. Also in this area, contamination was present at the base of two pipes where they joined the floor; however, the sections of pipe above the floor, up to the ceiling, were not contaminated.

No safety concerns were identified.

7.0 Instrumentation and Radiological Surveys

Post-remediation surveys for most of the open floor and wall areas up to a height of approximately one meter were conducted with a scaler/rate-meter equipped with a 425 cm^2 gas-flow proportional detector. The detector was used in the scanning mode following final remediation. Counts for fixed time periods (typically 30 seconds) were taken at grid intersections and in areas with elevated audible indications. Thin-window GM detectors were also used in the fixed counting time period mode in areas where the large area probe would not fit. The gas-flow proportional detectors were used at a voltage setting where both alpha and beta activity were counted. The contractor developed appropriate correction factors for the two probe sizes used and factored in realistic counting efficiencies into the determination of adjusted count rates (corresponding to the decommissioning values) for the two detector types used in the surveys.

The inspector examined the calculations used by the contractor to develop the adjusted count rates discussed above. A series of computer spread sheets were used in the development and to document target values that were a function of instrument counting efficiency and instrument background. Because the operating voltage used for the gas proportional detector counts is sufficiently high to count both alpha and beta activity, the contractor first used the empirically determined enrichment to compute the fraction of alpha activity and beta activity available for detection. A weighted reference efficiency was then calculated to account for both the alpha and beta contribution to the overall efficiency. The weighted reference efficiency was modified for each of the expected parent and daughter radionuclides by using a combination of empirical and derived efficiencies. The beta efficiency for the detectors for the protactinium-234m (Pa-234m) daughter was determined using a strontium-yttrium-90 (Sr-Y-90) beta standard since the beta energies for Pa-234m and Y-90 are similar. The counting efficiency was then derived for the less energetic beta particles in the expected mix. The alpha efficiency was also empirically determined, but reduced to a factor of 0.25 (from recommendations in draft NUREG-1507, Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions) to account for the expected reduced counting efficiency due to the rough surface of the concrete floor. Because the gas-flow proportional detector is a large area detector, the target value was further reduced to ensure that any small spots of activity would not be missed due to the averaging effect of the large area probe. A similar calculation was performed for the GM detector without the need to account for the large-area probe averaging effect.

The inspector reviewed data from the results of the 30-second counts using the large area probe in remediated floor areas. All results meet the criteria for average contamination over a 1 square meter area (5000 dpm/100 cm^2). In three cases, the results exceed the target values and indicate that a "hot spot" could be present; however, additional surveys with a 16 cm^2 detector did not confirm the presence of any spots that exceeded the 15,000 dpm/100 cm^2 maximum criterion.

The remediation contractor used representative background counts for comparison to results in the remediated area. Background measurements for the gas-flow

proportional detector and other detectors used in post-remediation surveys were made on a test patch of scabbled concrete flooring in an unaffected area. The contractor stated that this was likely a more representative measurement of background for these detectors because a scabbled surface was used. In one area in Building 2, the contractor identified an elevated background from ceramic wall tile. The contractor selected a similar area in an unaffected area in order to make background measurements for comparison to the tiled areas. Soil samples from unaffected areas of the site have also been collected and analyzed as representative background samples. Daily background and check source measurements (Sr-90 source) were performed each day a radiation survey instrument was used. The inspector examined selected records during the inspection conducted in July, 1996 (070-00139/96-002) and found the records to be complete.

Staff from the radiological contractor made duplicate measurements in approximately 25% of the locations as a quality check on a random basis.

No safety concerns were identified.

8.0 Radioactive Waste Storage

Radioactive waste generated during the remediation phase of this project was previously stored in a locked room in Building 2. The waste is comprised primarily of contaminated soil, concrete rubble and lengths of pipe, was stored in approximately 220 7.5 ft^3 (0.21 m^3) drums, 10 B-25 boxes (100 ft^3 (2.83 m^3) each box), and 10 pallets. The pallets hold lengths of pipe (approximately 1.7 meters) that have been wrapped in plastic. Because Building 2 is scheduled to be razed, the waste was moved to Building 11. Building 11 is a locked, secure building, equipped with an alarm system. There is a remote indication of alarms in the security area in the main building. Two of the entrances are also under video surveillance. The inspector entered Building 11 with the radiation safety officer and later confirmed that their entry had caused an indication on the remote alarm indication system in the security area. The site is under 24-hour security coverage.

No safety concerns were identified.

9.0 Conditions for Confirmatory Survey

Electrical power has been shut off in the remediated area in Building 2. Approximately half the area has sufficient natural lighting from windows to perform daytime surveys. The remediation contractor indicated that temporary lighting and electrical power can be made available to the area if arranged with the remediation contractor. There is no direct access to the few elevated areas that may need to be surveyed. However, the remediation contractor may be able to provide access via ladders to the areas that may need to be examined.

As a result of the remediation, numerous trenches have been made in the concrete floor for the removal of contaminated piping. In two or three locations, sections of the pipe were previously cut which caused minor soil contamination. Soil in these areas has been excavated and is stored as radioactive waste. Many of the trenches

have been filled with clean fill so that equipment could be moved in the area. All soil samples analyzed by the contractors have been archived and are available for re-analysis In the previous inspection (070-00139/96-002), the inspector selected ten of these samples for analysis in the Region I analytical laboratory. The results are reported in inspection report 070-00139/96-002 and showed very good agreement with the contractor's results.

10.0 Exit Interview

The results of the inspection were discussed with the individuals identified in Section 1.