U.S. NUCLEAR REGULATORY COMMISSION
REGION I

INSPECTION REPORT

Report No.	070-00139/96-002
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:	July 30 - 31, 1996

Inspectors: Mark Roberts 10-4-96
Mark C. Roberts date
Senior Health Physicist

Approved By: Ronald R. Bellamy 10/4/96
Ronald R. Bellamy, Ph. D., Chief date
Decommissioning and Laboratory Branch

Inspection Summary: Routine, announced safety inspection of remediation activities (NRC Inspection No. 070-00139/96-002).

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

Results: No violations or safety concerns were identified. The remediation contractor provided soil samples for analysis by the Region I laboratory. The results obtained were compared to the contractor's analyses and showed very good agreement. The remediation contractor was to examine an apparent discrepancy involving the two different calibration dates for the same radiation survey instrument.

DETAILS

1.0 Persons Contacted

* Donald Chabot, Project Manager, Engelhard Corporation
* Robert Berlin, Radiological Consultant
* Steve Graham, Senior Project Manager, Foster Wheeler Environmental Corporation (Foster Wheeler)
* James Mayberry, CHP, Project Radiation Safety Officer, Foster Wheeler

*Denotes those present at exit interview.

2.0 Background

The site is comprised of ten buildings on a 10 hectare (25 acre) site, adjacent to a small reservoir in southeastern Massachusetts. A subsidiary of the Engelhard Corporation, D.E. Makepeace, was licensed by the AEC to use enriched uranium in the production of fuel elements from the late 1950's until 1962. Activities with licensed material were limited to Buildings 1 and 2 (Attachment 1). Liquid effluent contaminated with uranium was discharged to an on-site septic system. The license also authorized the incineration of uranium wastes in an on-site incinerator.

Exterior uranium contamination was identified during characterization measurements for EPA regulated hazardous materials. Scoping and characterization measurements have identified uranium contamination exceeding the NRC criteria for release for unrestricted use in numerous areas in Building 2. The interior contamination is primarily limited to non-removable contamination on the concrete floors and contamination in floor drains and drain lines. Radiological surveys have not identified contamination in Building 1. The current decommissioning project is limited to the remediation of interior contaminated areas in preparation for eventual building demolition. The exterior contamination issues will be addressed in a separate phase of the project.

3.0 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 is in charge of radiological safety for the project. The remediation contractor also provides staffing for remediation activities, routine radiological surveys and waste handling. A sub-contractor, Hilbert Associates, provides analytical support through an off-site laboratory. Duplicate gamma spectrometry analyses are performed on approximately 10% of the soil samples by another outside laboratory as a quality check. A radiological contractor performed the characterization measurements and provides quality assurance measurements for the final surveys.

No safety concerns were identified.

4.0 Radiation Protection

Work in the radiological controlled area is controlled by a system of radiation work permits (RWPs). Each RWP describes a type of activity and the location where this activity is authorized. The RWP describes the radiological conditions, radiological survey frequency, training required, and protective clothing requirements. As of the date of the inspection, seven active RWPs were in use. The inspector used RWP # ENG-INT-004, a general entry and inspection RWP, for entry to the radiological controlled area during the inspection. The RWP appeared to contain appropriate and sufficiently detailed information for safe work in the radiological controlled area.

Air sampling is performed during remediation activities to monitor airborne concentrations of radioactive contaminants. Sampling is conducted with low-volume samplers (typically 70 liters per minute) for the duration of the work activities. The samples are held for a period 2-3 days prior to counting to allow for the decay of radon decay progeny on the air filter. All sample results available as of the date of the inspection have not indicated any significant airborne activity (<0.1 DAC (Derived Air Concentration)).

Radiation protection surveys are conducted by the remediation contractor as needed to support the remediation activities. In addition, removable contamination surveys are conducted daily in approximately fifteen locations, in areas that are expected to be clean, to ensure that the contamination control program is working effectively. The results of these surveys have not indicated any contamination outside the radiological controlled area.

Individuals exiting the controlled areas are required to perform a self-survey using a pancake GM detector coupled to a rate-meter. Equipment or material removed from the radiological controlled area is also surveyed by the individual removing the material.

No safety concerns were identified.

5.0 Remediation in Interior Areas

Because enriched uranium was utilized at the facility, an important preliminary action by the contractor was to perform 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) or uranium-238 (U-238) in the sample. During remediation activities, gamma spectrometry is used to identify concentrations of U-235 and U-238 in samples, primarily because it provides more rapid analytical results and is considerably less costly to perform. Because U-234 is not detectable in the gamma analysis, the empirically determined ratio is used to infer the U-234 concentration based on the gamma spectrometry results. The total uranium concentration can then be determined for a sample by summing the U-234, U-235, and U-238 concentrations. The average enrichment was

determined to be approximately 4% and the empirical ratio of U-234 to U-235 was determined to be 21.

The principle remediation activities that are being conducted are 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. Mechanical scabbling devices that remove approximately 1/16th of an inch of the concrete surface are used to remediate most areas. These devices are air-operated and are equipped with a vacuum system to reduce potential airborne contaminants. Airborne concentrations of radiological particulates are also controlled by the use of local ventilation systems equipped with HEPA (High-Efficiency Particulate Air) filtration systems. HEPA-filtered vacuum cleaners are also used in coordination with the scabbling devices to remove larger debris pieces. Generally, about half the areas require more than one pass with the scabbling devices to remove contamination to levels that meet the NRC guidelines for release for unrestricted use. Contamination in seams and joints is removed by scabbling, use of jack hammers, or use of concrete saws to cut out portions of the floor. Waste generated by these remediation activities is stored in a locked room outside the radiological controlled area.

Based on a review of historical blueprints and physical observations, approximately twenty drain lines have been 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 has been sealed with a foam sealant to prevent leakage of the contents into the tunnel area. Removal of the contaminated pipes is performed in a multi-step process to reduce the potential for contamination. If necessary, the concrete floor above the pipe is first remediated and surveyed to assure contamination levels meet the release criteria. Cuts are then made into the concrete floor and workers remove sections of the clean floor. Once the concrete is removed above the piping, the drain lines are excavated and removed. When a section of pipe has to be cut, the area beneath the pipe is covered so that the underlying soil is not contaminated by the contents of the pipe. Foam sealant is also used to prevent leakage after a pipe is cut. Contaminated piping is then wrapped in plastic sheets and removed to the locked waste storage area. The integrity of the piping excavated thus far has been good and there has been no soil contamination as a result of leaks or holes in the piping. Contaminated soil was excavated and removed from two locations under drain lines where adequate contamination control measures were not used during earlier modifications to the contaminated piping.

In some locations beneath the floor, drain lines are cross-connected with lateral sections of pipe. In these areas and in some of the locations where the imbedded piping cannot be readily removed, a larger piece of excavation equipment must be brought in to remove the pipe. The Engelhard representative and staff of the remediation contractor discussed the need to back-fill certain areas where piping has been removed with clean soil. This was necessary so that the excavation equipment could be maneuvered. The inspector stated that as long as an adequate number of samples have been collected from beneath the areas to

be back-filled and the analytical results from the samples show that the remaining soil meets the remediation guidelines, then the areas could be back-filled. The samples must also be available for subsequent confirmatory analysis by the NRC.

In order to evaluate the analytical laboratory capabilities of the contractor, the inspector requested that selected soil samples be sent to the Region I office for gamma spectrometry analysis. The results obtained would be compared to the contractor's analytical results. Both the NRC and contractor results from these samples appear in the table in Attachment 2. The NRC results show very good agreement with the Engelhard values. In general, the Engelhard results are slightly higher than the NRC values.

In area 2G of Building 2, contamination was found beneath floor tile. Apparently, the floor tile was installed after the floor became contaminated, because no contamination was found on the tile. In another location, clean pipes that were not part of any of the radiological processes have been removed from the lower wall area to enable scabbling of the floor and the lower wall. Surveys did not identify either internal or external contamination on this piping.

No safety concerns were identified.

6.0 Instrumentation and Radiological Surveys

Post-remediation surveys are conducted with a scaler/rate-meter equipped with a 425 cm^2 gas-flow proportional detector. The detector is used in the scanning mode following remediation to determine if sufficient decontamination has been conducted. Counts for fixed time periods are taken at grid intersections and in areas with elevated audible indications. Thin-window GM detectors are also used in the fixed counting time period mode in areas where the large area probe cannot be used. The gas-flow proportional detectors are used at a voltage setting where the beta particles are counted, because the true counting efficiency can be more reliably measured for beta particles versus alpha particles. Corrections are made for the beta versus alpha ratio.

The remediation contractor uses 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 are 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) are performed each day an instrument is used. The inspector examined selected records for the period June 27, 1996 through July 27, 1996 and found the records to be complete.

In addition to surveys in areas where remediation has taken place, surveys have also been performed in the overhead areas following remediation of the floors. These surveys have measured only very isolated spots of contamination, limited to some of the metal fixtures near the ceiling. The surveys have not identified contamination on the ceiling.

Staff from the radiological contractor make duplicate measurements in approximately 25% of the locations as a quality check. The inspector examined the calibration date on the floor monitor in use by the radiological contractor. The instrument had been calibrated on January 18, 1996 and the calibration due date was listed as April 18, 1996. Because the date of this inspection was later than the calibration due date, it appeared that the instrument in use was beyond the calibration date. Following further review of the radiological contractor's calibration procedure, the inspector determined that the April 18, 1996 date was likely an error because the radiological contractor's calibration frequency listed in their procedure was twelve months. The instrument was not out of calibration. The inspector requested that the proper calibration due date be placed on the instrument to avoid further confusion and voiced concern that this oversight was not previously recognized.

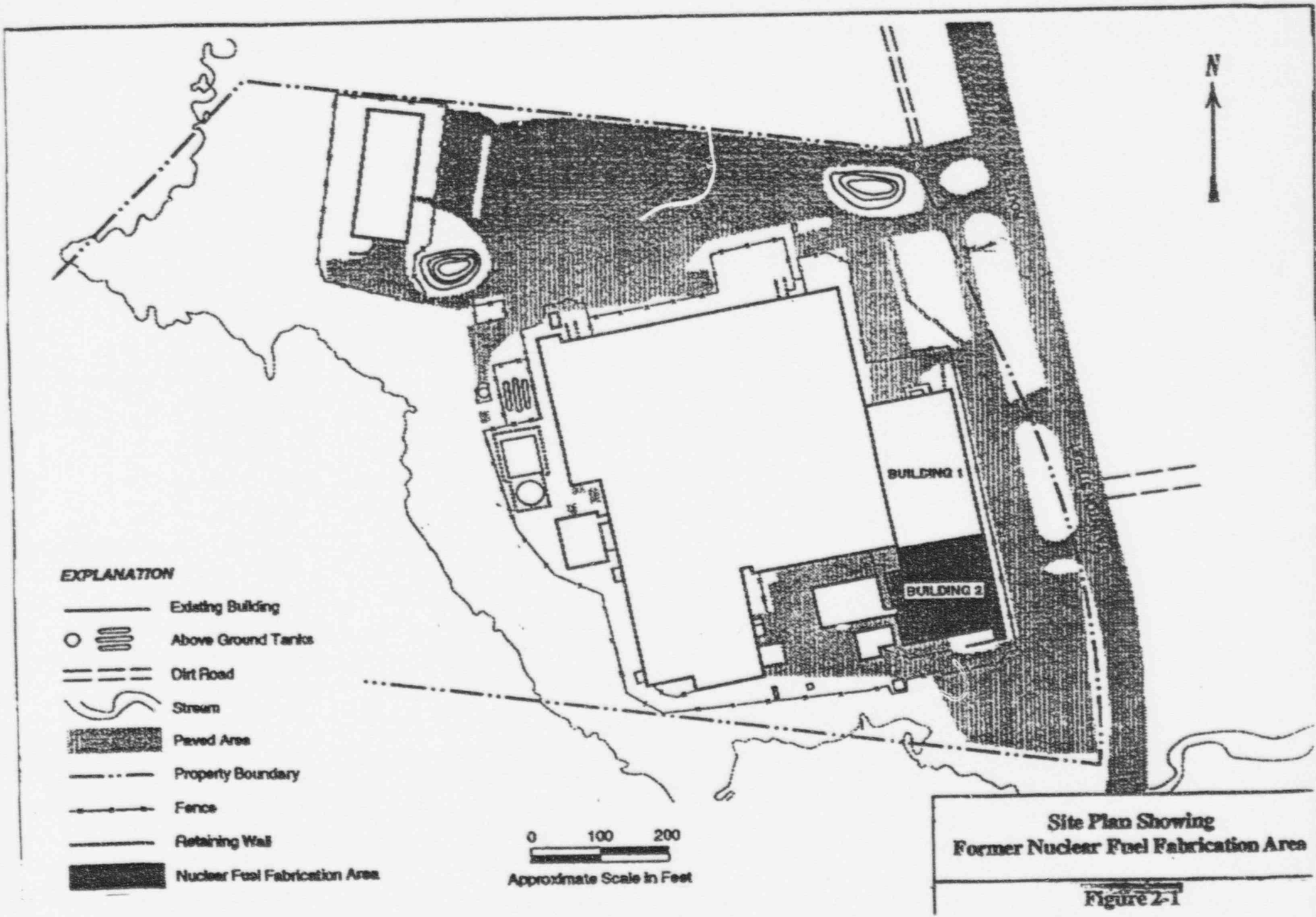
The remediation contractor's survey instruments are calibrated by GTS, Inc., an NRC licensee. Instruments are calibrated at intervals of six months. The inspector examined selected instruments and found all to have been calibrated within the last six months. However, one minor discrepancy was observed in the instrument calibration records for instrument No. 86308. The calibration date listed on the instrument was June 24, 1996. The calibration date for this instrument was listed as June 12, 1996 on the calibration record for the instrument. The project radiation safety officer stated that he would review the calibration records in order to resolve the discrepancy.

No safety concerns were identified.

7.0 Exit Interview

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

ATTACHMENT 1



Site Plan Showing
Former Nuclear Fuel Fabrication Area

Figure 2-1

ATTACHMENT 2

CONCENTRATIONS OF U-235 AND U-238 IN SOIL SAMPLES FROM THE ENGELHARD CORPORATION SITE PLAINVILLE, MASSACHUSETTS

SAMPLE ID NO.	NRC RESULTS (pCi/g ± 2σ) U-235	NRC RESULTS (pCi/g ± 2σ) U-238[1]	ENGELHARD RESULTS (pCi/g[2]) U-235	ENGELHARD RESULTS (pCi/g[3]) U-238[1]
2D-002	0.06 ± 0.03	1.3 ± 0.1	0.13	1.73
2H-001	21.7 ± 0.2	77.5 ± 1.4	24.63	101.05[4]
2H-003	<0.05	0.6 ± 0.3	0.03	0.36
2H-006	3.5 ± 0.1	18.6 ± 0.6	4.5	31.06[5]
2H-010	<0.05	0.2 ± 0.1	0.04	0.71
2H-014	0.09 ± 0.04	0.7 ± 0.2	0.06	0.67
2K-002	0.04 ± 0.03	0.2 ± 0.1	0.02	0.24
2K-004	2.54 ± 0.06	4.1 ± 0.2	3.98	4.9
2K-005	0.03 ± 0.03	0.2 ± 0.1	0.07	0.31
EP-SSRD60	<0.05	0.3 ± 0.1	0.03	1.74

[1]U-238 concentration inferred from Th-234 decay product.

[2]Uncertainty not reported.

[3]Uncertainty not reported.

[4]Engelhard independent laboratory results:
U-235 -- 28.94 pCi/g; U-238 -- 102.6 pCi/g.

[5]Engelhard independent laboratory results - split sample
U-235 -- 0.65 and 3.38 pCi/g; U-238 -- 3.3 and 17.9 pCi/g.