070-00139

ENGELHARD

ENGELHARD CORPORATION
ENGINEERED MATERIALS GROUP
30 TAUNTON STREET
PLAINVILLE, MASSACHUSETTS 02762
(508) 695-7812

September 19, 1996

Mr. Richard H. Turtil
Project Manager
Low-Level Waste and Decommissioning Projects Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-001

Re: Response to Comments on "Final Status Survey Plan"
Docket No. 070-00139

Dear Mr. Turtil,

Engelhard has reviewed the NRC's comments on the Final Status Survey Plan for the building interior decontamination. Our response is enclosed.

I trust that our prior conversations and this submittal have satisfied the issues raised by your comments.

Please consider our response to be an amendment to the original Plan. The Final Status Report (FSR) will reflect the commitments and information included in the responses.

Sincerely,

Donald P. Chabot
Senior Environmental Engineer

cc: Jeffrey Barrett, Plainville Toxic Waste and Radiation Watch Group
Robert W. Brackett, EPA
William Burt, Plainville Board of Health
Jeffrey Chormann, DEP
Jonathan Hobill, DEP
Plainville Public Library
Thomas S. Brown, Engelhard

NL10

070039

C

NRC COMMENTS AND ENGELHARD RESPONSES

FINAL STATUS SURVEY PLAN OF JUNE 7, 1996

Comment: 1.0 Page 1, Section 3.1 - Sample Locations

As discussed during a teleconference on August 20, 1996, the Final Status Survey Plan will be revised to include Room 2B of Building 2 as an affected area.

Response: 1.0. Room 2B has been treated as an affected area. While the characterization survey showed that only the expansion joint in this room contained contaminated material, the entire floor area in this room has been scabbled, and the expansion joint removed. The Final Status Survey Report (FSR) will reflect this effort.

Comment: 2.0 Page 2, Section 3.1 - Sample Locations (Sixth and Seventh Paragraph)

Please present calculations demonstrating the estimated minimum detectable activity for the instruments used to conduct the survey, particularly surface scan sensitivity.

Response: 2.0. Table A.1 in Attachment A to this document provides the estimated MDA for each instrument used to conduct the final status survey. The FSR will include the MDA's for the actual measurements.

Comment: 3.0 Page 3, Section 3.1 - Sample Locations (First Paragraph)

Please change "Gamma dose rate measurements" to "Gamma exposure rate measurements." NUREG/CR-5849 states that, "If potential contaminants did not include gamma emitters, exposure rate measurements should be performed at a minimum spacing of 1 measurement per $10m^2$. Please justify why one gamma exposure rate measurement per 10 x 10 meter grid block ($100\ m^2$) is sufficient.

Response: 3.0. The term "exposure rate" will be used instead of "dose rate" where appropriate in the FSR and in any other subsequent documentation. Exposure rate measurements were established at one measurement per 10 x 10 meter grid block ($100\ m^2$) based on the results of the characterization survey and periodic measurements during the remediation control survey which consistently showed average exposure rates in even the most contaminated rooms to be either at or slightly above background and well below the 5 μr/hr (above background) limit. However, to be consistent with NUREG/CR-5849 requirements, the exposure rates for the final survey will be measured at a minimum spacing of one measurement per $10m^2$ at 1m above the surface.

Comment: 4.0 Page 3, Section 3.1 - Sample Locations (Third Paragraph)

This section states that the characterization survey data as given in BERLIN et al (1994) will serve as the final survey data for these areas classified as unaffected. NRC staff has identified a few irregularities in the Radiological

Characterization Survey data which are presented below. These concerns must be addressed before the characterization data will be accepted as final survey data.

4.1 page 10, Radiological Characterization Survey

The average total beta activity for background measurements is 1300 ± 322 dpm/100 cm,^{2}. The highest background measurement reported in Table 4.2, Characterization Survey Summary - Background, is 1125. Why is the average background measurement greater than the maximum reported background measurement? What background will be applied to final survey data?

4.2. NRC staff is concerned with the measurement frequency in the characterization surveys which are used to both classify certain areas as unaffected and serve as the final survey data for unaffected areas. For example, 2 to 6 direct and removable measurements were reported per room for rooms 1E through 1L of Building 1. The direct and smear measurements were selected "based on the results of a prior scan." The Radiological Characterization Survey Report does not specify the percent of scan coverage in each survey area or specify the detection sensitivity of the instrumentation used to conduct the survey. Please describe the sampling frequency for final survey in all unaffected rooms. Will the results for unaffected areas be included in the Final Status Report? Will the conversion factors given in Attachment A of the Final Status Survey Plan be applied to the measured beta results form unaffected areas in order to estimate the respective alpha

activity? The alpha to beta ratio of the measured results form the characterization survey is much lower than anticipated for natural and enriched uranium. The Final Survey Report should demonstrate that the survey results for unaffected areas were not contaminated during decommissioning.

Response: 4.1. The average total background beta activity as measured during the characterization survey is 1380 ± 322 dpm/100cm^2 (see Attachment A of Radiological Characterization Survey Report). The individual background activity values in Table 4.2 of the Report which were separately converted from the measured counts are incorrect, since a 45 sec. count time was used rather than the actual 30 sec. count time. The corrected Table is included in Attachment B to this submittal. Additional background measurements have been made with the instruments to be used in the final survey. These background measurements will be applied to the final survey data.

4.2. Buildings 1 and 2 were the only buildings in existence when the nuclear fuel fabrication work was performed. A prior 1988 scoping survey had indicated that building 1 was not contaminated, and a preliminary classification of unaffected area was applied to building 1. The characterization survey was designed, in part, to confirm that building 1 was unaffected. As discussed in Section 4.2 and 4.3 of the Characterization Report, a 7m x 7m grid was used in the larger open room in building 1 (ie), and 24 locations were selected in the small rooms (1E - 1L) (<10m^2) on the

east side of the building. After approximately 50-60 percent of the floor and wall surface in all of building 1 were scanned, alpha beta and gamma measurements and smears were taken at 93 floor and wall locations in the unaffected area; all of which confirmed that building 1 was not contaminated and was properly classified as unaffected.

Engelhard intends to use the measurements compiled in building 1 during the characterization survey in the final survey and in the FSR. Since the 93 measurements locations exceeds the 60 measurements required to cover the approximate 3000m^2 floor and lower wall area of building 1 and the scan coverage exceeds 10 percent of the floor and lower wall area, as required by NUREG/CR-5849 (page 4.15) the data base collected in building 1 satisfies the requirements for the unaffected area and is suitable for use in the final survey. We will provide MDAs with this data in the FSR, and will use the beta to alpha conversion factors discussed in the response to Comment 8 to estimate the alpha activity in building 1 and 2.

Additional surface measurements will be made of the floor area in the unaffected area adjacent to the entry to building 2 to validate that no contamination was tracked from the affected area during decommissioning and that the unaffected area survey results have not changed.

Beta radiation surface measurements are being used as the primary indicator of true activity levels because the alpha radiation is attenuated by varying

thicknesses of overlying dirt and grease and because in locations the material is embedded in the porous concrete surfaces. Thus, the alpha measurements in the building are an unreliable indicator, and the alpha to beta ratio would not be representative of uncovered enriched uranium.

Comment: 5.0 Page 3, Table 3.1 - Radiation Survey Instruments

Since direct measurements will be obtained using a 425 cm^2 gas flow proportional counter, it is inappropriate to use equations 8-1 and 8-2 as stated in NUREG/CR-5849 to convert cpm to dpm/100 cm^2. The surface contamination values may be underestimated if 425 cm^2 is used as the active surface area of the probe to calculate dpm/100 cm^2. The (100 cm^2/A) factor in equations 8-1 and 8-2 is specific to detection probes with areas less than or equal to 100 cm^2.

Response: 5.0 NUREG/CR-5849, in a number of places in the text, clearly recognizes the acceptability of using detectors with large probe areas. In fact, Table 5-1 and 5-2 in this document describe gas proportional counters with probe face areas up to 1000 cm^2 for use in similar applications as at the Plainville facility, while Tables 5-4 and 5-5 give detection sensitivities for 500 cm^2 probe area detectors. Furthermore, the surface activity guidelines permit the use of a 1m^2 area to calculate average levels when evaluating the acceptability of elevated areas within the region.

At the Plainville facility, the 425 cm^2 gas flow proportional counters are being used to both scan the remediated surfaces and take direct measurements of

the floor and wall surfaces in the final survey. If there are any indications of elevated surface activity that could be reflecting "hot spots" within the 425 cm^2 area measured, additional measurements will be made within the area using a probe with a smaller face (<100 cm^2) to determine the location and level of the "hot spot." We do not intend to leave any hot spots exceeding the remedial contamination criteria. In addition, an independent QA survey of 25 -30% of the direct measurement locations will be subsequently performed using a probe with an area less than 100cm^2. In the FSR, we will differentiate the measurements made with the large area detectors from those made with detectors having probe areas less than 100 cm^2.

Comment: 6.0 Page 4, Section 3.4 - Remediation Control Surveys

This section states that "final remediation control surveys that demonstrate compliance with the remediation guideline values may be used as the final status survey measurements." Remediation control surveys that are used to guide remediation efforts should not be used as final survey data to support site release. All remedial activities within a survey area or unit should be complete prior to obtaining final survey measurements.

Response: 6.0. The ongoing remediation control surveys used to guide the remediation efforts will not be used as final survey data. When the remedial activities in the area are complete,final survey measurements will be made. The final survey will be accomplished by taking floor, wall, and overhead measurements referenced to the grid in the room upon completion of

scabbling operations. Verification soil samples will be collected and analyzed after the piping and expansion joints have been cut out and removed from the floor. Any loose dirt particles will be removed from the remaining floor surfaces, and they will be scanned to verify that levels continue to be acceptable.

Comments: 7.0. During the teleconference on August 20, 1996, Engelhard contractors briefly discussed the implementation of Quality Assurance measures to ensure the validity of the survey data generated. Please describe all Quality Assurance procedures in the final Status Survey Plan.

Response: 7.0. The Quality Assurance (QA) program has been implemented since initiation of onsite decommissioning activities. The QA program is described in Section 4.0 of the Final Status Survey Plan. Foster Wheeler, the decommissioning contractor, provides ongoing QA throughout the program adhering to both internal company guidelines and NRC requirements in NUREG/CR-5849 and supporting documents. The survey and health physics programs are audited by independent Foster Wheeler QA personnel, the independent health physics consultant (Hilbert Associates), and alson independently by Engelhard's radiological consultant. The results of these audits are documented, and action taken in response to the action items. In addition, independent QA measurements will be conducted of the fiscal survey measurements as follows:

After the decommissioning contractor performs the verification surface

measurements on the floor and wall grid intersections, independent measurements will be made on 25-30% randomly selected grid intersection locations by an outside radiological consultant. Beta levels and exposure rates will be measured.

The QA results obtained will be statistically compared with the verification surface measurements using approaches described in NUREG/CR-5849 to validate that the surface measurements are representative of actual conditions at the 95 percent confidence level. (See Attachment C)

In addition, ten percent of all soil samples collected around the piping and under the expansion joints are being independently analyzed for uranium content by an outside laboratory.

Comment: 8.0. Please provide the exact equation to be used to convert instrument counts to beta contamination dpm. Also provide the correction factor to be used to convert beta contamination to alpha contamination to demonstrate compliance with the 5,000 dpm/cm^2 guideline.

Response: 8.0. Instrument counts will be converted to beta contamination (dpm) using:

$$\text{Average Beta Activity } \left(\frac{\text{dpm}}{100\text{cm}^2}\right) = \frac{\text{c/m}}{\text{E}} \frac{(100)}{\text{A}}$$

where c/m = net counts per minute

E = instrument detection efficiency

A = active surface area of detector

(also see the response to comment 5)

As suggested by the NRC during the teleconference of August 20, 1996, we have reviewed the material in the draft NUREG-1507, "Minimum Detectable

Concentrations with Typical Radiation Survey Instruments for Various Field Conditions" of August 1995 as it relates to surface material effects on source efficiency (Table 5.4 and text). Using the alpha source efficiency of 0.276 (converted to 0.25) for scabbled concrete in Table 5.4 of NUREG-1507 in conjunction with the methodology and data discussed in Attachment A of the Final Status Survey Plan, results in multiplication factors of 2.5 for the gas flow proportional detector and 3.2 for the thin window GM pancake detector to be used in converting the beta contamination measurement to equivalent alpha contamination. While we are not convinced that the NUREG-1507 values provide a more relevant approach than that in Attachment A to our Plan, we plan to use the highly conservative alpha surface criteria limits resulting from applying the above noted factors as a basis for assessing that the residual contaminations guidelines have been met.

Comment: 9.0. Please address at what frequency measurements will be made for removable contamination.

Response: 9.0. During the remediation control survey smears are being taken at locations where scabbling passes reduced the surface activity to below the fixed (average) limit but over the removable limit. The results of the smear analysis provide the basis for determining if additional decontamination is required. After decontamination is completed, a smear will be taken as part of the final survey at these locations to validate that both fixed and removable limits have been met.

ATTACHMENT A

RADIOLOGICAL FIELD INSTRUMENTATION SENSITIVITIES

Table A-1.
Minimum Detectable Activities for Instruments
Used at the Engelhard Project Site

Instrument	*MDA, dpm/100 cm²*
Gas-flow Proportional Counter, 425 cm² probe, 0.5 min. count	260
Gas-flow Proportional Counter, 425 cm² probe, scanning	670
G-M detector, 15.5 cm² probe, 1 min. count	1280

ATTACHMENT B

CORRECTED TABLE 4.2

CHARACTERIZATION SURVEY SUMMARY BACKGROUND

TABLE 4.2
CHARACTERIZATION SURVEY SUMMARY
BACKGROUND

	DIRECT PROBE MEASUREMENTS						SMEAR #	REMOVABLE CONTAMINATION			
	ALPHA		BETA		GAMMA IN Ur/hr			ALPHA		BETA-GAMMA	
	c/30 sec.	d/m/100cm 2	c/30 sec.	d/m/100cm 2	Total	Above Bkg.		c/30 sec.	d/m/100cm 2	c/45 sec.	d/m/100cm 2
Bkg. 1	2	23	37	1836	7	-	1	0	0	25	128
Bkg. 2	3	34	31	1538	6	-	2	0	0	23	118
Bkg. 3	1	11	32	1588	6	-	3	0	0	34	174
Bkg. 4	2	23	19	943	7	-	4	0	0	13	67
Bkg. 5	4	45	23	1141	6	-	5	0	0	30	154
Bkg. 6	2	23	34	1687	7	-	6	0	0	24	123
Bkg. 7	4	23	30	1489	9	-	7	0	0	30	154
Bkg. 8	4	45	23	1141	6	-	8	0	0	38	195
Bkg. 9	4	45	31	1538	6	-	9	0	0	27	138
Bkg. 10	1	11	18	893	8	-	10	0	0	24	123
Bkg. 11	1	11	-	-	-	-	12	0	0	25	128
Bkg. 12	2	23	-	-	-	-	13	0	0	15	77
Bkg. 13	4	45	-	-	-	-	14	0	0	26	133
Bkg. 14	2	23	-	-	-	-	15	0	0	32	164
Bkg. 15	3	34	-	-	-	-	16	0	0	29	149
Bkg. 16	2	23	-	-	-	-	-	-	-	-	-
Bkg. 17	4	45	-	-	-	-	-	-	-	-	-
Bkg. 18	1	11	-	-	-	-	-	-	-	-	-
Bkg. 19	4	45	-	-	-	-	-	-	-	-	-
Bkg. 20	2	23	-	-	-	-	-	-	-	-	-
Bkg. 21	2	23	-	-	-	-	-	-	-	-	-

ATTACHMENT C

QA SURVEY ACCEPTANCE BASIS

QA SURVEY

The post-remediation surveys conducted by the remedial action team will be verified with a follow-on survey checking approximately 25% of the survey points. The acceptance basis for these quality assurance surveys will be that the measurements of the remediation team and the QA team do not show statistical differences at the 95% confidence level. This can be quantified by use of the following equation:

$$t = \frac{\bar{x}_a - \bar{x}_b}{\sigma_{\bar{x}_a - \bar{x}_b}}$$

where:

t	=	t-test value for comparison at 95% Confidence Level
$\bar{x}_a$, $\bar{x}_b$	=	means of the two sets of measurements
σ	=	standard deviation of the difference of the means

This equation to test the difference of the means can also be expressed as:

$$t = \frac{\bar{x}_a - \bar{x}_b}{\left[s_a^2 + s_b^2\right]^{1/2}}$$

where s_a and s_b are the standard deviations for the two measurement sets, or as:

$$t = (\bar{x}_a - \bar{x}_b)\left[\left(\frac{n_a n_b}{n_a + n_b}\right)\left(\frac{v}{n_a s_a^2 + n_b s_b^2}\right)\right]^{1/2}$$

where n_a and n_b are the number of measurements in each sample and v is the number of degrees of freedom ($n_a + n_b - 2$).