Mark Roberts

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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MEMORANDUM TO: Ronald R. Bellamy, Chief
Decommissioning and Laboratory Branch, DNMS
Region I

FROM: John W. N. Hickey, Chief
Low-Level Waste and Decommissioning
Projects Branch
Division of Waste Management, NMSS

SUBJECT: REGIONAL TECHNICAL ASSISTANCE REQUEST REGARDING WESTINGHOUSE DOSE ASSESSMENT

As requested in the aforementioned technical assistance request, we have completed our review of the licensee's request to leave residual contamination in place in three locations where contamination levels exceed the NRC criteria for release for unrestricted use as specified in the 1981 NRC Branch Technical Position (BTP) "Disposal or Onsite Storage of Thorium or Uranium Waste from Past Operations" and Regulatory Guide 1.89. The three locations include 10,000 ft^3 of soil under Building 7, 950 feet of storm drain pipe (Pipe A) along site roadways, and 110 feet of storm drain pipe (Pipe B) under Building 7. The licensee provided dose assessments to illustrate that the remaining contamination will not result in estimated public doses in excess of 15 mrem/yr.

Our review focused on the appropriateness of the dose assessments and whether or not the decontamination effort applied to these three areas resulted in residual contamination that was as low as reasonably achievable (ALARA). From our review, we concluded that the remediation efforts were not ALARA and that the information and dose assessments provided were not sufficient to allow unrestricted release of these areas. Specific comments, questions, and recommendations based on our review of the Westinghouse Dose Assessment are provided in the attachment. If you have questions or comments, please contact Donna Moser of my staff on (301) 415-6753.

Docket No. ~~SMN-770~~ SMB-1527
License No. ~~70-600~~ 000-05976

Attachments: As stated

SECTION COPY

U.S. NUCLEAR REGULATORY COMMISSION REVIEW OF RADIOLOGICAL DOSE ASSESSMENTS FOR WESTINGHOUSE ELECTRIC CORPORATION

BACKGROUND

Westinghouse Electric Corporation (licensee) has completed remediation and final survey activities at its license facility in Bloomfield, New Jersey. The licensee has determined that NRC unrestricted release criteria has been met in all but three specific cases. Dose assessments were provided for each of the three cases to illustrate that the remaining contamination will not result in estimated public doses in excess of 15 mrem/yr. The dose assessments for each scenario are described and addressed below.

Case #1 - Soil and Bedrock Beneath Building 7

Based on the licensee's dose assessment, approximately 10,000 ft^3 of uranium contaminated soil remains beneath the basement of Building 7 with an average concentration of 154 pCi/g and a maximum concentration of 779 pCi/g. The licensee has removed 150 feet of pipes and 800 ft^3 of soil and concrete and the existing excavated trenches extends to the bedrock. Remaining contamination is estimated to extend 3 to 6 feet horizontally from each trench and 18 inches vertically into the bedrock. Levels of thorium measured under Building 7 average 1 pCi/g and are assumed to be background. The licensee estimates that the additional cost to remediate the soil to BTP Option 1 releases levels would be $1,051,862.

The licensee performed two dose calculations to demonstrate that the remaining contaminated soil does not result in a significant dose to the public. The first dose calculation was performed using the computer modeling code MICROSHIELD to evaluate the external dose rate, assuming the material is left in place approximately 10 feet below grade. The second dose calculation was performed using RESRAD to evaluate the dose, if the material were brought to the surface.

Case #2 - Storm Drain (Pipe A)

Storm drain (Pipe A) is described as approximately 950 feet of subsurface storm drain piping routed 3 to 12 feet beneath public roadways. The average surface contamination levels of the pipe interior ranged between 1,327 and 29,855 dpm/100 cm^2 with a maximum surface contamination level of 181,918 dpm/100 cm^2. Remediation of the Pipe A storm drain system involved several passes of high pressure water wash (2000 psi at 65-80 GPM). Survey measurements obtained at the end of each pipe section after the wash indicated no appreciable decrease in contamination. The resulting water from the high pressure wash was below release limits and discharged to the local sanitary sewer authority. The licensee estimates that the additional cost to remediate Pipe A to Regulatory Guide 1.86 surface limits would be $333,747. The licensee performed two MICROSHIELD calculations to evaluate the dose rate, if the pipes were left in place, and if they were brought to the surface.

Case #3 - Storm Drain Beneath Building 7 (Pipe B)

Storm drain (Pipe B), assumed to be associated with a roof drainage system, is 110 feet of pipe buried approximately 10 feet beneath the section of Building 7 that has no basement. Surveys conducted similar to Pipe A resulted in a mean contamination level of 17,200 dpm/100 cm^2 and a maximum of 19,000 dpm/100 cm^2. Due to the limited success of the pressure wash technique to remediate Pipe A, a high pressure wash of this pipe was not conducted. The licensee estimates that the additional cost to remediate Pipe B to Regulatory Guide 1.86 surface limits would be $74,467. The licensee performed two MICROSHIELD calculations to evaluate the dose rate, if the pipes were left in place, and if they were brought to the surface.

DISCUSSION

The licensee primarily used MICROSHIELD calculations to illustrate that the uranium and thorium contamination present in the soil and storm drains would not result in an external dose in excess of 15 mrem/yr. Uranium and thorium contamination is more an internal dose concern than an external dose concern. Unless the dose assessments are unrealistically conservative, the resulting external dose calculated using the soil and pipe source terms will not exceed 15 mR/yr. Therefore, the licensee's MICROSHIELD calculations only illustrate that the uranium and thorium contamination in the soil and storm drain pipe is not an external dose hazard. To demonstrate acceptability of the proposal, the licensee must also evaluate the potential for internal exposure.

Case #1 - Soil and Bedrock Beneath Building 7

The licensee did not sufficiently demonstrate that the remediation efforts and the potential public dose from the residual soil contamination were as low as reasonably achievable (ALARA). It is not clear to NRC staff why the licensee used the external dose modeling code MICROSHILED to evaluate external dose from the subsurface scenario whereas an environmental transportation modeling code was used by the licensee to evaluate dose from the surface scenario. It would seem more appropriate to use RESRAD to estimate dose from subsurface contamination and MICROSHEILD for external exposure from a surface scenario.

The licensee should explain why the RESRAD analysis for Case #1 suppressed the drinking water pathway and used a distribution coefficient of 0 for the saturated zone, whereas the RESRAD analysis for the consolidated source term was calculated with the drinking water pathway active and RESRAD default distribution coefficients.

Considering the high levels of contamination under Building 7 relative to the BTP Option 1 limits, the release limits of BTP Option 2 may apply in this case. BTP Option 2 limits are applicable for "disposal of certain low concentrations of . . . depleted or enriched uranium with no daughters present when buried under prescribed conditions with no subsequent land use restriction and no continuing NRC licensing of the material." Acceptability under BTP Option 2 requires that:

(1) solubility tests be conducted to demonstrate the solubility or insolubility of the contamination;

(2) the site can be shown to be acceptable in its topographical, geological, hydrological, and meteorological characteristics;
(3) the contaminated soil be buried at least 1.2 meters (4 feet) below the surface;
(4) the disposal site be selected to minimize the likelihood of intrusion; and
(5) it can be shown that the buried materials will be stabilized in place and not transported away from the site.

The last sentence of the last paragraph on page 4 states that "removal of the soil from the basement would also result in significant concerns related to safety." NRC staff does not understand why additional remediation of the soil under Building 7 would be a significant safety concern since the building will be demolished and the site restored to grade. Furthermore, assuming the licensee has an adequate health and safety plan, additional remediation of the soil should not pose a significant radiological risk.

Case #2 & #3 - Storm Drain (Pipe A) - Storm Drain Beneath Building 7 (Pipe B)

The surface contamination limits of Regulatory Guide 1.86 are intended for surface contamination of building and equipment surfaces and assumes contamination is resuspendable and available for inhalation or ingestion. Although the residual contamination in the storm drain pipe is not readily available for inhalation or ingestion, internal exposure is reasonable in a excavation scenario. Excavation activities, such as cutting and drilling, would produce loose contamination available for ingestion or inhalation, particularly by workers. Internal dose from future excavation of the buried pipe is a concern and should be evaluated since (1) there exists evidence of high levels of contamination in the pipe, (2) future excavation activities would be conducted in the absence of a radiation protection plan, and (3) public dose limits (i.e., 0.1 rem) and the ALARA concept apply. Furthermore, disposal in a municipal disposal facility may be prohibited for certain sections of the pipe, given the elevated levels of contamination (i.e., 181,918 dpm/100 cm^2).

NRC staff questions how representative the data is of the contamination present throughout the entire length of each pipe section, since measurements were only obtained inside the end of each pipe section (with the exception of measurements obtained using robotics in pipe MH-2, Pipe P2 and STD-1, Pipe P2). If both ends of a pipe section were surveyed, the average surface contamination level (dpm/100 cm^2) for each end of the pipe was used to calculate the activity (Ci) for half the length of the pipe section, respectively. For the dose assessment, the activity calculated for each pipe end were added together to obtain the total activity (Ci) for the entire length of the pipe. If only one end of a pipe section was surveyed, the average surface contamination level for that end of the pipe was used to calculate the activity (Ci) for the entire pipe section. Calculating the total activity of the entire pipe in this manner, artificially lowers the dose consequence from the highly elevated measurements on one end of the pipe by averaging them with lower measurements from the opposite end of the pipe. The distance between these average measurements were as great as 339 feet.

The dose assessment and the justification provided lacks certain information which prevents a thorough understanding and evaluation of the radiological

status of the buried pipe and raises a number of questions. The licensee should address the following issues:

(1) How far inside the pipes were the measurements obtained? What is the distribution or the standard deviation of the data? Is it possible that measurements obtained further into STD-2, Pipe P2 could exceed 181,918 dpm/100 cm^2? The licensee should illustrate the location of each pipe measurement and evaluate the representativeness of the data for the remaining unsurveyed pipe area.

(2) NRC staff also questions the basis for the relative fraction of uranium and thorium given in Table 2-3? For certain pipe sections, the relative fraction is 0.97 for thorium and 0.03 for uranium, whereas in other pipes the relative fraction is 0.03 thorium and 0.97 uranium. Were pipe sediment measurements collected prior to the pressurized water wash? Without sufficient data to justify the relative fraction of uranium versus thorium, it is conservative to assume the contamination is primarily thorium which will increase the dose assessment.

(3) The evidence of elevated contamination in the pipe suggests that these pipes have transported contaminated waste and water runoff to sewage treatment facilities. Has the potential for uranium and thorium reconcentration been investigated at the local sewer authority?

NRC staff also observed that the licensee did not divide the estimated interior area of the pipes by 100 cm^2 when calculating the total activity (in curies) from the average surface measurements (in dpm/100 cm^2). Dividing by 100 cm^2 in calculating the total activity of each pipe section will reduce the resulting dose rate by two orders of magnitude.

CONCLUSIONS

The licensee should provide sufficient information and technical justification to demonstrate that the remediation efforts were adequate to reduce the residual contamination and the potential public dose to levels that are ALARA considering removal scenarios.

NRC staff recommends that consideration be given to the applicability of BTP Option 2 release criteria to the soil contamination under Building 7. Release under BTP Option 2 requires a more thorough evaluation of site characteristics, such as contaminate solubility and the geological characteristics which address environmental transportation.

NRC staff recommends that the licensee prescribe average and maximum surface release limits for the buried storm drain pipe. Alternative release limits should be derived based on conservative dose analysis that evaluates all possible exposure paths, including internal exposure. Furthermore, surface measurements should be averaged within a defined area (i.e., 1 m^2) to demonstrate compliance with the average surface contamination release criteria. This approach requires remediation of unacceptably high activity

and prevents localized highly elevated levels from being averaged with measurements from non-adjacent areas.

The licensee should also address the issues and questions identified above for each case.