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STATE OF MICHIGAN

JOHN ENGLER, Governor

DEPARTMENT OF PUBLIC HEALTH

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VERNICE DAVIS ANTHONY, MPH, Director

December 2, 1992

Mr. Jack Parrott
Program Manager
Nuclear Material Safety & Safeguards
U.S. Nuclear Regulatory Commission
One White Flint North Building
11555 Rockville Pike
Rockville, Maryland 20852

Dear Mr. Parrott:

The purpose of this letter is to transmit comments of the Michigan Department of Public Health on a document by Dow Chemical Company, entitled "Response to Comments Dated September 18, 1991 on 10CFR20.302 Application for Disposal of Magnesium-Thorium Slag Material at the Salzburg Landfill Disposal Facility." A copy of the document and August 31, 1992 cover letter from Dow were provided to staff of the Division of Radiological Health, Bureau of Environmental and Occupational Health, by Mr. Hayden Schoen of Dow on September 10, 1992.

The enclosed comments by the Division of Radiological Health include general and specific remarks related to Dow responses to the September 18, 1991 collective comments of the Nuclear Regulatory Commission (NRC), Environmental Protection Agency (EPA), and this department.

As noted in the general remarks, staff and time limitations precluded verification of results of the computer codes cited. On the basis that (1) NRC concurs with the conclusions and proposals in the Dow application and associated documents and (2) NRC is satisfied with the resolution of issues raised by the enclosed remarks, this department believes the proposal by Dow for onsite disposal at the Salzburg facility to be feasible. In particular, it is superior to the current storage situation at the Bay City and Midland sites.

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If you have questions concerning the enclosed comments, please contact George Bruchmann or David Minnaar of the Division of Radiological Health at (517)335-8200.

Sincerely,

Vernice Davis Anthony
Director

Enclosure

Michigan Department of Public Health
Bureau of Environmental and Occupational Health
Division of Radiological Health

Remarks on
Response to Comments Dated September 18, 1991 on 10CFR20.302 Application Submitted by Dow Chemical for Disposal of Magnesium-Thorium Slag Material at the Salzburg Landfill, Michigan Disposal Facility

GENERAL REMARKS

1. Staff and time limitations preclude verification of the results of the input and output of the MAXI, RESRAD, COMPLY, and IMPACTS-BRC computer models used in this proposal. However, it is noted that the computer simulations should use site-specific parameters when they are known. In most cases, default values are used in the simulations, and the applicability of the results cannot be determined.

2. The responses to Comments 13, 21, 23, 26, 56, 57, 58, 59, 60, and 65 refer to a Work Plan under development. The responses to Comments 62, 63, 68, and 71 refer to an Environmental Health and Safety Plan under development. These plans have not been forwarded to the Michigan Department of Public Health for review.

3. A specific clean up level should be determined and used. Appendix E details a survey taken of radiation levels between the Bay City and Midland piles and the Salzburg location and an analysis of core samples en route. The document is currently not internally consistent regarding the cleanup criteria that will be used. The response to Comment 6 states that it is intended to remove thorium contamination to residual levels below 10 pCi/g total thorium. Comment 6 also states that the cleanup criteria can be translated to 5 pCi/g ^{232}Th above background. Comment 6 later states that residual radioactivity will be a maximum of 5 pCi/gm ^{232}Th. The response to Comment 15 states that the residual ^{232}Th concentration will be less than the standard of 5 pCi/g above background. The response to Comment 22 states that slag and soil will be removed until a residual concentration of $\leq$ 10 pCi/g ^{232}Th plus ^{228}Th is achieved. Section 12 of Appendix U states that "all the material in each pile will be excavated until remaining ^{232}Th concentrations of 10 pCi/gm are achieved."

4. The dose due to gamma radiation and thoron (radon-220) infiltration should be calculated for a worker inside the lift stations (10 foot diameter pipe extending to the bottom of the cell), monitor stations (4 foot diameter pipe extending to the bottom of the cell), and other cap penetrations large enough for a person to enter.

SPECIFIC REMARKS

1. Response to Comments 4 and 5.

This response states that cell 36/37 will only be filled with licensed material from the 2 thorium sites. No other material will be used in these cells. The response to Comment 3 states that an arrangement may be possible to put the thoriated material from the Kawkawlin landfill into these cells. The Kawkawlin landfill thoriated material is not currently licensed by the NRC. The response to Comments 6 and 16 state that additional soil will be removed from the Midland and Bay City piles to fill Cell 36/37. It is not apparent if this additional material has been analyzed to predict its effect on migration in the filled cells. The response to Comment 82 refers to the information contained in Appendix U, which states that "with void space being filled with clean borrow material" in Section 12.0.

Response to Comment 6.

This response states that a maintenance of 10 inches of clean fill over the residual material left at the Midland and Bay City thorium piles would reduce long-term total dose to about 10 mrem/yr or the presumption of continued control over site access would eliminate the presence of an intruder. The 10 CFR 20.302 application does not commit the applicant to long-term ownership of these properties and maintenance of a cover, nor does the application state that continued site control is under consideration.

This response states that the external dose at 100 years time using the RESRAD computer code is 64 mrem/year. It should be noted that this is a predicted gamma dose rate at 1 meter above the ground.

This response states that (referring to the thickness of the contaminated zone input to the RESRAD calculations) "the 1 meter thick layer of residual contamination is a conservative modeling assumption. Thorium does not leach readily, and prior experience shows soil contamination to commonly be limited to the top 15 cm (6 inches)." No explanation is given of this "prior experience". If this "prior experience" is the difference in depth of the soil borings to go from a ^{232}Th concentration of 5 pCi/g to a concentration of 1 pCi/g, consideration should be given to excavate the additional 6 inches of material if cell volume is available.

3. Response to Comment 9.

This response does not address the monetary or the radiological costs associated with disposal at Dawn Mining in the State of Washington or some other location where byproduct material (as defined in Section 11(e)(2) of the Atomic Energy Act is disposed as part of a decommissioning process. No reason is given for this omission.

It appears that the monetary estimate of costs associated with disposal at the Salzburg Landfill includes costs associated with the disposal operation (approximately 1 year), but does not include long-term (indefinite period) costs associated with radiological monitoring, leachate monitoring, site maintenance, the loss of money that could otherwise be obtained for the land since the institutional control period will extend indefinitely instead of allowing sale after the RCRA period, taxes owed during this time, etc.

The off-site disposal cost estimates for disposal at Envirocare in Utah or Beatty, Nevada assume that material is shipped in trucks of 25 cubic foot capacity. The analysis does not consider shipping by covered rail car, which could result in reduced costs. No reason is given why this option was not considered.

The projected employee and population doses also assume transport via truck to the out-of-state disposal sites. The use of a covered rail car would reduce employee and population doses.

The occupational air particulate dose is presented in Table I-2.0. The "Maximally Exposed Individual" dose is calculated by dividing the predicted "Total Dose" for an activity by the number of workers. This column should be relabelled "Average Individual Dose". e.g. The total dose to the bone marrow of the 10 employees excavating material and moving it to the staging area is 174 mrem. The listed "Maximally Exposed Individual" dose is 17.4 mrem.

Table I-2.0 predicts the whole body, lung, and bone marrow dose to employees due to air particulate inhalation during excavation at the Bay City and Midland thorium piles and emplacement at the Salzburg site. The dose to the bone surface due to inhalation should also be presented. According to Table 7-5 of Impacts BRC, Version 2.0 - Program User's Manual, NUREG/CR-5517, the dose to the bone surface will be more than 10 times the dose to the bone marrow.

4. Response to Comment 14.

An errata sheet is included in the response to rectify the incorrect half-lives of ^{212}Po and ^{228}Ra in the original submission. It should be noted that the same erroneous half-lives of ^{212}Po and ^{228}Ra are included in the response document in Table 5 of Appendix E, entitled Thorium Decay Series. A review of Tables 6, 7, and 8 of Appendix E shows erroneous information contained in each. Table 6, Uranium Decay Series,

lists the half-life of ^{234}U as 2.47×10^3 years whereas a value of 2×10^5 is more typically seen. Table 7, Primordial Radionuclides, has seven incorrect entries for half-lives entered including two that are 30 orders of magnitude incorrect. Table 8, Major Cosmic-Ray-Activated Radionuclides, has a column entitled "Energy of Primary Emission (MeV)." The column actually lists the maximum possible energy of the beta emissions which is not the most likely energy to be encountered and may be overshadowed by the gamma emissions for the particle decay. For instance, the listed "Energy of Primary Emission" for ^{22}Na is .54 MeV which is the maximum energy of beta particles which are emitted 90% of the time when ^{22}Na decays, but the 1.27 MeV gamma energy emitted 99.9% of the time when ^{22}Na decays is not mentioned.

5. Response to Comment 15.

The response states that at the Midland site, "the conservative approach of using 2 consecutive measurements of less than 5 pCi/g ^{232}Th was acceptable to validate the intact nature of the pile" and reviewers are referred to Appendix C for the survey records. Figure C-1 is a map of bore hole locations at the Midland pile and includes a table of contaminated and clean samples. Since no indication is given on the table of the units, we assume here, for convenience, that the numbers represent feet. Contrary to the statement that samples were taken until the thorium concentration was less than 5 pCi/g on two consecutive samples, Figure C-1 shows that Bore #7 had contamination to 6 feet and no deeper samples were taken and that Bore #19 had contamination to 6 feet and only one deeper sample was taken.

Figure C-1 shows that Bore #8 was contaminated to 10 feet (5 samples taken), the next two samples were less than 5 pCi/g, but the next two samples were greater that 5 pCi/g. Bore #48 was less than 5 pCi/g to 8 feet (4 samples taken) but greater than 5 pCi/g on the next two samples taken. The assumption that two consecutive samples of less than 5 pCi/g could be used to determine the depth of the contamination does not seem to be substantiated by the data.

The response could have provided isotopic concentrations, where known, instead of the filled circle and empty circles used on Figure C-1. It would have been helpful to have included a table of contaminated and clean samples for the Bay City pile instead of just showing the locations the borings were taken.

6. Response to Comment 20.

This response commits Dow to sample the sediments in the waters adjacent to the Bay City site to assess whether runoff has transported any contamination into these water bodies. This Department would be interested in the sampling results.

7. Response to Comment 30.

This response refers to Appendix I, entitled Cells 36 & 37 Leachate Collection System and Analysis of Radiological Concentrations Permitting Unrestricted Release of Leachate. No analysis of radiological concentrations is included in Appendix I.

8. Response to Comment 41.

This response discusses dose to intruders based on the RESRAD computer model. Time constraints did not allow an analysis of the computer codes or of the conclusions stated in the response. The statements that certain results can be ignored as "an artifice of the code methodology and does not represent a realistic estimate of potential impacts" have not been, but should be, fully examined.

9. Response to Comment 50.

Comment 50 states that comparison of concentrations of ^{232}Th in groundwater with 10 CFR 20, Appendix B is "inappropriate since Appendix B applies to licensed operations and not for conditions of unrestricted release." The response that "the comment is correct if the site was intended to be released for unrestricted access" implies that the Cell 36/37 will have an NRC license renewed indefinitely.

10. Response to Comment 53.

The calculation of the inhalation exposure to someone along the transportation route in Appendix P contains an arithmetic error, reducing the calculated exposure by an order of magnitude. (3760 pCi divided by 1.94×10^6 m^3 equals 2×10^{-3} pCi/m^3. However, 2×10^{-4} pCi/m^3 is the figure given in the text and used as the basis for the subsequent calculations in Appendix P and the response to this comment.)

The response to Comment 65 states that the undercarriage and wheels will be washed after a truck dumps its load at the Salzburg site. Since the truck bed will not be washed, additional gamma exposure, deposition, and subsequent dose to the public due to inhalation will occur on the return trip from Salzburg to the Midland and Bay City piles.

The listed dose conversion factors for inhalation for ^{228}Ra and ^{228}Th in Appendix P are incorrect. According to Column H_E of Table 7-5 in Impacts-BRC, Version 2.0 - Program User's Manual, NUREG/CR-5517, the correct values for ^{228}Ra and ^{228}Th are 0.00477 and 0.324, respectively.

The dose to the bone surface due to inhalation should also be calculated. Using the methodology in Appendix P, the dose to the bone surface will be approximately 21 times higher than the whole body dose predicted.

11. Response to Comment 54.

The response does not provide the requested data on the effects of radiation on the liners, the cover systems, the leachate piping and holding tanks, or the pumps with which the radioactive material may be in contact.

12. Response to Comment 58.

The response did not state that the thoron source term after cell closure will be determined by monitoring the amount of thoron released at the vent pipes. If the source term is known, an air dispersion model can be used to predict off-site doses. Additional monitoring, as proposed, can determine the thoron flux through the cell cap.

It is not clear from the discussion if the vent pipes for the lift stations and monitor stations will be tested for thoron.

The discussion on thoron flux through the cover is based on calculations in Appendix Q of the response document. Appendix Q erroneously uses the decay constant for ^{222}Rn instead of the decay constant for ^{220}Rn (thoron) in its calculations. Therefore, the response based on these calculations is specious.

13. Response to Comment 65.

Provisions should be made to decontaminate the trucks. Instructions to the drivers should be developed to ensure their radiological protection and to minimize contamination.

14. Response to Comment 68.

Personnel air samplers should be addressed.

15. Response to Comment 71.

Since no provision is made to decontaminate or monitor the cab of the trucks used for transport, the cab should be considered to be contaminated. The use of protective clothing by the truck drivers is not addressed.

16. Response to Comment 82.

The response states that the results of the COMPLY simulations run in support of the discussion are in Appendix O. Appendix O contains drawings showing topographic features and surface contours at the Salzburg landfill. The correct reference should be Appendix U.

Contrary to the statement that the results of the COMPLY simulations run in support of the discussion are in Appendix O (sic), the simulations

run for the excavation and removal operations at the Bay City and Midland piles and for emplacement at the Salzburg site are not included.

Since Section 12 of Appendix U states that "all the material in each pile will be excavated until remaining ^{232}Th concentrations of 10 pCi/gm are achieved," this comment should mention that the cleanup criteria cited in the Appendix have been modified.

A conversion factor from picocuries to curies has been omitted from Equation 1 in Section 11.1 of Appendix U.

A table on page 6 of Appendix U is used in the calculation of the amount of radioactive dust produced with the covers on the Midland and Bay City piles and during excavation and emplacement activities. For wind speeds over 21 knots, the frequency of occurrence 0.00669 is multiplied by the dusting factor 2.08×10^{-4}. The listed result is 1.39×10^{-4}. The summation at the bottom of the table is correct, despite the above noted error.

The calculated offsite whole body exposure to radioactive dust during excavation assumes that "water sprays will be used as needed to keep the material surface moist" (page 10 in Appendix U).