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K. L. COOL, Director

March 8, 1999

Mr. John W. N. Hickey, Chief
Low-Level Waste and Decommissioning Projects Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission
Mail Stop T-7 F27
Washington, DC 20555-0001

Dear Mr. Hickey:

The attached document entitled "MDNR Response to NRC's Letter Dated January 11, 1999" addresses each enumerated item in Sherry Wu's comment letter of January 11, 1999, and should complete MDNR's license application for the Tobico Marsh State Game Area Site (Docket Number 40-9015). The document specifically parallels and/or references: 1) the Michigan Department of Natural Resource's (MDNR) fourth license application of September 5, 1997, 2) the Nuclear Regulatory Commission's (NRC) response dated April 28, 1998, 3) the MDNR's preliminary responses dated July 27, 1998, and the discussions held in Washington on September 22, 1998.

Mr. Tim Johnson of your staff indicated that there was no need to resubmit the license application as a part of the response to these comments. If you have any questions with regard to the license, please feel free to call Denise Gruben at 517-335-4036.

Sincerely,

Kelli Sobel
Administrative Services Deputy
517-373-2425

Attachment

cc: Ms. Sherry Wu, NRC
Mr. K. L. Cool, Director, MDNR
Mr. Christopher D. Dobyns, MDAG
Ms. Cordree McConnell, MDNR
Ms. Denise Gruben, MDNR

A114

MDNR RESPONSE TO NRC'S LETTER
DATED JANUARY 11, 1999

The following numbers correlate to NRC's April 28, 1998, letter, MDNR's July 27, 1998, responses, and NRC's January 11, 1999 letter. The MDNR agrees that any items that are part of the licensing basis for the application will be tied to the license.

GENERAL COMMENT

Comment 1

NRC: *We had requested you to submit a schedule for the submission of your Decommissioning Plan for the Tobico Marsh site. You proposed an alternative 24-month schedule. We find this acceptable. Your response to this comment needs to be in the license application.*

MDNR: The MDNR agrees that the proposed alternative 24-month schedule in the MDNR's July 27, 1998 letter is part of the license application.

SPECIFIC COMMENT

Comment 2

NRC: *We had requested additional information on the operation of the Leachate Collection and Treatment System (LCTS). You responded that all references to the LCTS are to be excluded from the September 5, 1997, license application because you do not have any current plans to operate the system. We will include a license condition stating that you shall request approval from us prior to operation. We find this acceptable. Your response to this comment needs to be in the license application.*

MDNR: The MDNR agrees that all references to the LCTS are excluded from the license application and that a license condition stating that the MDNR shall request approval from the NRC prior to operation of the LCTS is part of the license application.

Comment 3

NRC: *We had requested explanation of the purpose and function of a force main. You responded that the system is part of the LCTS, and is to be excluded from the September 6, 1997, license application. We find this acceptable.*

MDNR: The MDNR agrees that LCTS and the force main are excluded from the license application.

Comment 4

NRC: *We had requested description of the LCTS design and function. You responded that the LCTS is to be excluded from the September 5, 1997, license application. We find this acceptable.*

MDNR: The MDNR agrees that LCTS is excluded from the license application.

Comment 5

NRC: *We had requested identification of all credible accidents at the Tobico Marsh site. We had also requested information, for each accident, regarding the cause of the event, detection of the event, a summary, and corrective course of action. You responded that credible accidents are limited to a few events. In addition, you requested guidance from us regarding credible accidents that were analyzed and the documentation of such analyses.*

At the September 22, 1998, meeting, we provided accident analyses submitted by the Chemetron Corporation and the Cimarron Corporation. You committed to submit worst case credible accident analyses for the Tobico Marsh site. We consider this information that you will submit to be part of the licensing basis for this application.

MDNR: The MDNR has performed a worst case credible accident analysis for the Tobico Marsh State Game Area Site, which is included as Attachment A to this response. The MDNR agrees that this analysis is part of the licensing basis for the application.

Comment 6

NRC: *We had requested identification of all credible accidents during operation of the LCTS. You responded that the LCTS is to be excluded from the September 5, 1997, license application. We find this acceptable.*

MDNR: The MDNR agrees that LCTS is excluded from the license application.

Comment 7

NRC: *We had requested identification of As Low As Reasonably Achievable (ALARA) targets and action levels for your Radiation Safety Program. You responded that they are in the ALARA Program dated August 15, 1997. We find this acceptable. We consider the document "ALARA Program" to be part of the licensing basis for the application.*

MDNR: The MDNR agrees that the "ALARA Program" dated August 15, 1997, is part of the licensing basis for the application.

Comment 8

NRC: *We had asked if you will use an ALARA program as a guide to achieve compliance with your ALARA commitments. You responded in the affirmative. We find this acceptable. We consider this commitment to be part of the licensing basis for the application.*

MDNR: The MDNR agrees to use an ALARA program as a guide to achieve compliance with our ALARA commitments and that this commitment is part of the licensing basis for the application.

Comment 9

NRC: *We had asked if there will be a sign-in procedure for those entering the site. You responded in the affirmative, and referenced the Personnel Site Access dated August 15, 1997. We find this acceptable. We consider this commitment to be part of the licensing basis for the application.*

MDNR: The MDNR agrees to use a sign in procedure for individuals entering the site and that this commitment is part of the licensing basis for the application.

Comment 10

NRC: *We had asked what are the alpha/beta counting systems. We have interpreted the words "alpha/beta counting system" to be a system that counts both alpha and beta particles. At the September 22, 1998, meeting, you indicated that the "alpha/beta counting system" meant systems that count alpha, systems that count betas, and systems that count both. We find this acceptable. We consider this commitment to be part of the licensing basis for the application.*

MDNR: A description of the alpha/beta counting systems is contained in our response to Comment 10 in the MDNR's July 27, 1998 letter. The MDNR agrees that the above

definition of "alpha/beta counting system" is part of the licensing basis for the application.

Comment 11

NRC: *We had asked you to commit to decontamination limits in "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," Policy and Guidance Directive 83-23, August 1987. You responded in the affirmative. We consider this commitment to be part of the licensing basis for the application.*

At the September 22, 1998, meeting, we inquired about the qualification of individuals that will calibrate radiation instruments. You indicated that you contract with outside vendors to calibrate the instruments. During our phone conversation on January 8, 1999, you said that you will identify the vendor that will calibrate your radiation instruments through a competitive bidding process. You committed to using vendors that are NRC or Agreement State licensees. We consider this commitment to be part of the licensing basis for this application.

MDNR: The MDNR commits to follow the decontamination limits in Policy and Guidance Directive 83-23 and to use vendors to calibrate radiation instruments that are NRC or Agreement State licensees. The MDNR agrees that these commitments are part of the licensing basis for the application.

Comment 12

NRC: *We had requested identification of the instrumentation used to monitor intakes of radioactive materials. You responded by listing a sampler and referencing Operation of the Lapel Air Sampler dated August 15, 1997. If you plan to use other instrumentation, you need to provide a complete list of these instruments. Please note that you may add "or equivalent" for each instrument. We find this acceptable with these additions. We consider this to be part of the licensing basis for this application.*

MDNR: Comment 12 of the MDNR's July 27, 1998 letter identifies the instrumentation, referenced above, that will be used to monitor intakes of radioactive materials and agrees that "or equivalent" may be added to each instrument. The MDNR does not currently plan to use other instruments for this purpose, instead of the stated equipment, but understands that it may do so provided they are equivalent. The MDNR agrees that this information is part of the licensing basis for the application.

Comment 13

NRC: *We had requested identification of the instrumentation used to monitor the external dose from radioactive materials. You responded by listing a sampler. If you plan to use other instrumentation, you need to provide a complete list of these instruments. Please note that you may add "or equivalent" for each instrument. We find this acceptable with these additions. We consider this to be part of the licensing basis for this application.*

MDNR: Comment 13 of the MDNR's July 27, 1998 letter identifies the instrumentation that will be used to monitor the external dose from radioactive materials and agrees that "or equivalent" may be added to each instrument. The MDNR does not currently plan to use other instruments for this purpose, instead of the stated equipment, but understands that it may do so provided they are equivalent. The MDNR agrees that this information is part of the licensing basis for the application.

Comment 14

NRC: *We had requested identification of the instrumentation used to determine airborne radioactivity and of the criteria for performing bioassays. You responded by listing a sampler and referencing Operation of the Lapel Air Sampler dated August 15, 1997. If you plan to use other instrumentation, you need to provide a complete list of these instruments. Please note that you may add "or equivalent" for each instrument. You also responded that you do not intend to implement a routine bioassay program and will use lapel air sampling as the primary monitor for internal exposure when an operation may require monitoring or when there is potential internal exposure such as during invasive activities. We find this acceptable with these additions. We consider this to be part of the licensing basis for this application.*

MDNR: Comment 14 of the MDNR's July 27, 1998 letter identifies the instrumentation, referenced above, "or equivalent," that will be used to determine airborne radioactivity. The MDNR will also use air samplers to determine work area and downwind airborne radioactivity concentrations during invasive activities. These air samples will be collected on filter paper using a HI-Q Model VS23-0523CV constant flow air sampler, or equivalent. The filter paper air samples will be analyzed for gross alpha radioactivity using the alpha/beta counting system, or equivalent, described in Comment 10 above. The MDNR does not currently plan to use any other instruments for this purpose, instead of the stated equipment, but understands that it may do so provided they are equivalent. The MDNR agrees that this information is part of the licensing basis for the application.

Comment 15

NRC: *We had asked if you will commit to follow Information Notice 96-18, "Compliance with 10 CFR Part 20 for Airborne Thorium," if bioassay assessment is implemented. You responded in the affirmative. We find this acceptable. We consider this to be part of the licensing basis for this application.*

MDNR: The MDNR agrees to follow Information Notice 96-18 and that this commitment is part of the licensing basis for the application.

Comment 16

NRC: *We had requested the action levels of contamination surveys and your actions if the levels were exceeded. You responded by referencing Radiological Surveys dated August 15, 1997.*

At the September 22, 1998, meeting, you said that contamination surveys are intended for equipment and materials, not area surveys of the land. We asked whether the surveys are performed by measuring fixed contamination or exposure rates, and you replied that it does both. We find this acceptable. We consider this to be part of the licensing basis for this application.

MDNR: The MDNR intends to perform both fixed (direct radiation) and loose contamination surveys for equipment and materials. Loose contamination surveys will be performed by taking smears and analyzing them on alpha/beta counting systems described in Comment 10 above. Fixed contamination (direct radiation) surveys will be performed using the alpha/beta friskers described in Comment 10 above. The MDNR intends to perform contamination surveys of land areas by performing exposure rate measurements using the instruments described in Comment 13 above. The MDNR agrees that these commitments are part of the licensing basis for the application.

Comment 17

NRC: *We had requested information on liquid effluent controls. You responded that there are currently no liquid effluents from the site.*

At the September 22, 1998, meeting, we indicated that liquid effluent includes runoff and groundwater. You need to clarify that there will be no liquid effluents from the site to sewer or drains. In addition, you said that the site does have sampling wells that are used to draw liquid samples to analyze for radioactive materials. If the radionuclide concentration in the liquid is less than the 10 CFR Part 20 release limit, then the liquid would be discharged without restriction. If the radionuclide concentration in the liquid is greater than the release limit, then the liquid will be

disposed as radioactive waste. We consider this to be part of the licensing basis for this application.

MDNR: The MDNR agrees that there will be no liquid effluent from the site to sewers or drains. The MDNR also agrees that liquid removed from on-site wells may be discharged without restrictions when radionuclide concentrations are less than the 10 CFR 20 release limits but will be disposed of as radioactive waste when radionuclide concentrations exceed those limits. The MDNR agrees that these commitments are part of the licensing basis for the application.

Comment 18

NRC: *We had requested the action levels of liquid effluents and your actions if the levels were exceeded. You listed Table 2 of Appendix B to 10 CFR Part 20 as the action level, and described your radioactive waste disposal process. At the September 22, 1998, meeting, you explained that an action level below Table 2 of Appendix B to 10 CFR Part 20 is not applicable for this site. Once a sample is collected, it will either be released for unrestricted use or disposed of as radioactive waste according to NRC regulations. You said that term "action level" implies that you will take a course of action to lower the radioactive content in the liquid onsite if the measured activity is greater than a certain value. You stated that the liquid is only drawn to measure the radioactive materials on the site, and there is not a course of action that you would take to lower the radioactive content in future samples.*

However, we determined that an action level is needed to ensure there are procedures in place and a course of action has been planned in event of off-normal situations. You need to submit a liquid effluent action level that is a fraction of the limits in Table 2 of Appendix B to 10 CFR Part 20. Your course of action in such cases needs to be described. The sections on ALARA goals and investigation levels in Regulatory Guide 8.37, "ALARA Levels for Effluents From Materials Facilities," may be used as guidance. We consider this to be part of the licensing basis for this application.

MDNR: The MDNR's action levels for liquid effluents are 20% of the limits specified in Table 2 of Appendix B to 10 CFR Part 20, based on ALARA goal recommendations stated in Regulatory Guide 8.37 *ALARA Levels for Effluents From Materials Facilities*. In the unlikely event that these action levels are exceeded, the following course of action will be followed: 1) The Radiation Safety Officer will be notified as soon as practical; 2) an investigation will be initiated and the results documented; 3) at its next scheduled meeting, the Radiation Safety Committee will review the results of the investigation and determine appropriate corrective actions, if any; and 4) the corrective actions will be implemented. The MDNR agrees that these commitments are part of the licensing basis for the application.

Comment 19

NRC: *We had requested information on airborne effluent controls. You responded that there are currently no airborne effluents from the site.*

At the September 22, 1998, meeting, you said that you plan to have air monitoring only when there is intrusive activity at the site, and that there are area air monitors on the site. You intend to have air sampling taken at the point of intrusive activity and downwind of the point. You also need to commit to using personnel air samplers during intrusive activities at the site. We consider this to be part of the licensing basis for this application.

MDNR: During intrusive activities at the site, the MDNR agrees that it will use personnel air samplers and perform air sampling at the point of intrusive activity and downwind of the point. The MDNR agrees that these commitments are part of the licensing basis for the application.

Comment 20

NRC: *We had requested identification of the instrumentation used to sample and monitor exhaust from airborne effluent systems. You responded that the LCTS is designed to exhaust airborne effluents and that the LCTS is to be excluded from the September 5, 1997, license application. We find this acceptable.*

MDNR: The MDNR agrees that LCTS is excluded from the license application. See response to Comment 2.

Comment 21

NRC: *We had requested the action levels of airborne effluents and your actions if the levels were exceeded. You responded that you will not operate any systems that could exhaust airborne effluents that are potentially contaminated with radioactive material.*

At the September 22, 1998, meeting, you said that you do not need an airborne effluent action level for the above reason. However, we determined that an action level is needed during invasive procedures to ensure there are procedures in place and a course of-action has been planned. You need to submit an airborne effluent action level. Your course of action needs to be described if the effluent action level is exceeded. The sections on ALARA goals and investigation levels in Regulatory Guide 8.37, "ALARA Levels for Effluents From Materials Facilities," may be used as guidance. This Regulatory Guide suggested: "licensee should establish investigation levels at effluent values that are close to normal or anticipated release levels. If exceeded, an investigation should be initiated and corrective actions

should be taken, as appropriate." We consider this to be part of the licensing basis for this application.

MDNR: The MDNR's action levels for airborne effluents are 20% of the limits specified in Table 2 of Appendix B to 10 CFR Part 20, based on ALARA goal recommendations stated in Regulatory Guide 8.37 *ALARA Levels for Effluents From Materials Facilities*. In the unlikely event that these action levels are exceeded, the following course of action will be followed: 1) The Radiation Safety Officer will be notified as soon as practical; 2) an investigation will be initiated and the results documented; 3) at its next scheduled meeting, the Radiation Safety Committee will review the results of the investigation and determine appropriate corrective actions, if any; and 4) the corrective actions will be implemented. The MDNR agrees that these commitments are part of the licensing basis for the application.

Comment 22

NRC: *We had requested information on the provisions for environmental monitoring. You responded that you have no current plans to implement an environmental monitoring program.*

At the September 22, 1998, meeting, we said that during invasive procedures at the site, environmental monitoring is required. You agreed to submit provisions for environmental monitoring during invasive procedures. This commitment needs to be in the license application. At a minimum, the license application needs to describe the surveys, the air effluent monitoring, and the liquid effluent monitoring that will be implemented during invasive procedures. The action levels or justification for not having an action level also need to be included for each. We consider this to be part of the licensing basis for this application.

MDNR: The MDNR commits to perform environmental monitoring during invasive procedures. This environmental monitoring will include air effluent and liquid effluent monitoring and exposure rate surveys. During invasive activities, air effluent monitoring will be accomplished by performing air sampling in the work area and downwind, as described in Comment 14 above. The action levels for airborne effluents are described in Comment 21 above. During invasive activities, liquid effluents will be collected, and samples will be taken and analyzed prior to discharge. Discharge limits and action levels for liquid effluents are described in Comment 18 above. During invasive activities, exposure rate surveys will be performed using the handheld radiation detection instrumentation described in Comment 13 above. The MDNR agrees that these commitments are part of the licensing basis for the application.

Comment 23

NRC: *We had asked you to commit to low-level radioactive waste (LLW) disposal regulations. You responded in the affirmative. We find this acceptable. We consider this to be part of the licensing basis for this application.*

MDNR: The MDNR agrees to comply with low-level radioactive waste disposal regulations and agrees that this commitment is part of the licensing basis for the application.

Comment 24

NRC: *We had requested additional information on your proposed onsite LLW storage. You responded that, if space is limited, you plan to store small quantities of LLW within the LCTS building or within locked containers located onsite. We find this acceptable. We consider this to be part of the licensing basis for this application.*

MDNR: The MDNR agrees that it will store small quantities of LLW within the LCTS building or within locked containers located onsite. The MDNR agrees that this commitment is part of the licensing basis for the application.

Comment 25

NRC: *We had requested additional information as to where you plan to temporarily store liquid waste onsite. You responded that contaminated liquid will be stored in locked sea-land containers or other enclosures onsite along with other LLW. We find this acceptable. We consider this to be part of the licensing basis for this application.*

MDNR: The MDNR agrees that it will store contaminated liquid in locked sea-land containers or other enclosures on-site along with the low-level radioactive waste. The MDNR agrees that this commitment is part of the licensing basis for the application.

Comment 26

NRC: *We had requested information on the materials that the package containers are constructed. You responded that the containers will at least meet the U.S. Department of Transportation requirements for shipment of such waste. We find this acceptable. We consider this to be part of the licensing basis for this application.*

MDNR: The MDNR agrees that package containers for radioactive waste will at least meet the U.S. Department of Transportation requirements for shipment of such waste. The MDNR agrees that this commitment is part of the licensing basis for the application.

Comment 27

NRC: *We had requested information on potential erosion of temporary storage facilities. You responded that the potential for flooding is extremely low, and temporary storage facilities are adequate to resist wind or water erosion. We consider this to be part of the licensing basis for this application.*

At the September 22, 1998, meeting, the participants discussed the potential for flooding at the site under the discussion of Comment No. 5 on Accident Analysis. We find this acceptable.

MDNR: As described in MDNR's July 27, 1998 letter, the potential for flooding of, or erosion from any on-site areas is extremely low, and temporary storage facilities are adequate to resist expected wind and water erosion. The MDNR agrees that this is part of the licensing basis for the application. Potential flooding at the site is discussed in the worst case credible accident analysis for the Tobico Marsh State Game Area Site, which is included as Attachment A to this response.

Comment 28

NRC: *We had requested a revised organization chart to reflect the position of the Radiation Safety Engineer and the Health and Safety Officer. You provided a revised chart. We find this acceptable. We consider this to be part of the licensing basis for this application.*

MDNR: A revised organizational chart was submitted with MDNR's July 27, 1998 letter and the MDNR agrees that it is part of the licensing basis for the application.

Comment 29

NRC: *We had requested a resume with adequate qualifications for the Radiation Safety Officer (RSO) position at the Tobico Marsh site. You responded by submitting the updated resume of Ms. Denise Gruben. We reviewed the resume and have determined her qualifications to be adequate. At the September 22, 1998, meeting, we asked Ms. Gruben if she will take annual radiological refresher training. Ms. Gruben replied that, as RSO, she will have annual refresher training (approximately 8 hours), which can be either in a classroom taught by a lecturer or on the site taught by a consultant. You have committed to provide annual refresher training to the RSO. The initial radiation safety training (about 40 hours) and the annual refresher training need to be listed as a requirement for qualification as RSO in the license application.*

At the meeting, the participants also discussed the role of the duly authorized representative of the RSO. Our position is that a duly authorized representative can

perform some but not all of the RSO function. MDNR has committed to requiring that the duly authorized representative of the RSO will have the basic RSO qualifications, and that only the RSO can delegate a duly authorized representative. We consider these commitments to be part of the licensing basis for this application.

In addition, you informed us that Mr. James Blute is no longer a consultant for you. Mr. Blute's resume needs to be removed from the license application.

MDNR: The MDNR agrees that Mr. Blute's resume be removed from the license application. The MDNR agrees that initial radiation safety training (about 40 hours) and annual refresher training (approximately 8 hours) are part of the requirements for qualification of the RSO. The MDNR agrees that, as RSO, Ms. Denise Gruben will have annual refresher training and that these commitments are part of the licensing basis for the application.

Comment 30

NRC: *We had asked if you will commit to provide information to radiation workers about declaration of pregnancy and to make editorial changes. You responded in the affirmative. We find this acceptable. We consider this to be part of the licensing basis for this application.*

In addition, you informed us that Mr. James Blute is no longer a consultant for you. Mr. Blute's resume needs to be removed from the license application.

MDNR: The MDNR agrees that Mr. Blute's resume be removed from the license application. The MDNR agrees to provide information to radiation workers about declaration of pregnancy and to make editorial changes in the training program and that this commitment is part of the licensing basis for the application.

Comment 31

NRC: *We had requested identification of the exposure limits for personnel internal radiation monitoring. You responded that they are in the ALARA Program dated August 15, 1997. We find this acceptable. We consider the document "ALARA Program" to be part of the licensing basis for the application.*

MDNR: The MDNR agrees that exposure limits for personnel internal radiation monitoring are in the ALARA Program dated August 15, 1997 and that this document is part of the licensing basis for the application.

ALARA PROGRAM

Comment 1

NRC: *We had requested consistency in the ALARA Program between the goals for the Total Effective Dose Equivalent (TEDE) and the goals for internal and external dose. You responded that the typographical error will be revised. You also said that the external goal is 250 mrem/yr, the internal goal is 500 mrem/yr, and the ALARA goal is 700 mrem/yr,*

At the September 22, 1998, meeting, we said that it is confusing when the ALARA goals for the internal dose and external dose do not add up to the TEDE goal. You have committed to change the goals so that the numbers add up. As we mentioned above, we consider the document "ALARA Program" to be part of the licensing basis for the application.

MDNR: The MDNR agrees to revise the ALARA Program to correct the typographical error and to make the TEDE goal 750 mrem to be consistent with the goals for internal and external dose. The MDNR agrees that these commitments and the ALARA Program are part of the licensing basis for the application.

Comment 2

NRC: *We had requested the ALARA goal for airborne effluent releases. You responded that you will not operate any systems that could exhaust airborne effluents that are potentially contaminated with radioactive material.*

At the September 22, 1998, meeting, you said that the ALARA goal for airborne effluent release was originally intended for the operation of the LTCS, and that it is not able to establish airborne effluent release ALARA goals at this time for invasive activities during site characterization because there is nothing on which to base the goal now. You did commit to establishing an ALARA goal as appropriate, i.e., when there is a possibility of release. However, we determined that an ALARA goal needs to be in the license application. Regulatory Guide 8.37, "ALARA Levels for Effluents From Materials Facilities," may be used as guidance in establishing the ALARA goal, and the goal may be re-evaluated and modified when data become available for a more realistic ALARA goal.

MDNR: The MDNR's ALARA goal for airborne effluents are 20% of the limits specified in Table 2 of Appendix B to 10 CFR Part 20, based on ALARA goal recommendations stated in Regulatory Guide 8.37 *ALARA Levels for Effluents From Materials Facilities*. The ALARA Program will be revised to reflect this. The MDNR agrees that these commitments are part of the licensing basis for the application.

TRAINING PROGRAM

Comment 3

NRC: *We had requested that radiation protection training should be expanded to 6 to 8 hours to adequately cover all the topics identified in Appendix A of the Training Program. You responded in the affirmative. We find this acceptable. We consider the document "Training Program" to be part of the licensing basis for the application.*

MDNR: The MDNR agrees to expand the radiation protection training to 6 to 8 hours and that this commitment is part of the licensing basis for the application.

Comment 4

NRC: *We had requested you to provide instruction to radiation workers regarding prenatal exposure and declaration of pregnancy per Regulatory Guide 8.13, "Operating Philosophy For Maintaining Occupational Radiation Exposures as Low as is Reasonably Achievable." You responded in the affirmative. We find this acceptable.*

MDNR: The MDNR agrees to provide instruction to radiation workers regarding prenatal exposure and declaration of pregnancy per Regulatory Guide 8.13, "Instruction Concerning Prenatal Exposure."

Comment 5

NRC: *We had requested you to provide information to radiation workers that they are able to request radiation exposure reports pursuant to 10 CFR 19.13. You responded in the affirmative. We find this acceptable.*

MDNR: The MDNR agrees to provide information to radiation workers that they are able to request radiation exposure reports pursuant to 10 CFR 19.13.

Comment 6

NRC: *We had requested editorial changes for the abbreviation "mr" You responded in the affirmative. We find this acceptable.*

MDNR: The MDNR agrees to make the indicated editorial changes to the Training Program.

OTHER COMMENTS

NRC: *At the September 22, 1998, meeting, you asked if it would delay our review of the license application if you submit sealed sources as additional materials to be possessed in the license application. We replied that it would not. You then submitted to us, via email, the list of sealed sources, their form, and their quantity limit. You need to also submit this information in a letter that can be incorporated, as part of the licensing basis for this application.*

MDNR: The list of sealed sources, their form, and their quantity limit is included as Attachment B to this response. The MDNR agrees that this information is part of the licensing basis for the application.

NRC: *We have reviewed the pertinent information in your application without regard to whether it is in "Part I" or "Part II," but whether information is needed as part of the licensing basis.*

The appropriate detail for a radiation protection program was the document, "Radiation Safety Program," dated August 15, 1997. Therefore, we intend to use the "Radiation Safety Program" as the licensing basis for your application and would explicitly reference this document as a condition of the license. Detailed procedures that support the "Radiation Safety Program" would not be explicitly referenced in the license. Other documents that we consider as part of the licensing basis of your application include the "ALARA Program," and the "Training Program," both dated August 15, 1997. You may choose to allow the Radiation Safety Committed (RSC) to modify and/or approve changes to the procedures in these documents without submitting a license amendment. If you choose this as the process by which the RSC changes and reviews the detailed procedures, then this process should be described in the license application.

MDNR: The MDNR agrees that "Part II" of the license application dated September 5, 1997, and the "Radiation Safety Program," "ALARA Program," and "Training Program," all dated August 15, 1997 are part of the licensing basis for the application. The MDNR chooses to allow the Radiation Safety Committee to approve changes to the procedures in these documents and understands that such changes may be made without submitting a license amendment.

The following procedure will be followed to make and approve changes to the procedures contained in these documents: 1) The Radiation Safety Officer (RSO) or designee will prepare proposed changes to these documents; 2) at the next scheduled meeting, the RSO or designee will present the proposed changes to the Radiation Safety Committee; 3) the Radiation Safety Committee (RSC) will review the changes and either approve or disapprove them; 4) the minimum membership of the RSC as defined in "Section 7.2 of Part I" of the license application, dated September

5, 1997, must approve the changes; and 5) a record of the proposed changes and the committee's decision will be kept in the RSC records.

ATTACHMENT A

WORST CASE CREDIBLE ACCIDENT ANALYSIS FOR THE TOBICO MARSH STATE GAME AREA SITE

Worst Case Credible Accident Analysis
Tobico Marsh SGA Site
Kawkawlin, Michigan

1.0 INTRODUCTION

In a letter dated January 11, 1999 (NRC 1999), the NRC transmitted comments regarding the license application that the Michigan Department of Natural Resources had submitted on September 5, 1997. The letter also addressed the NRC's April 28, 1998, questions on the application and the MDNR's July 1998 response to those questions.

In response to Specific Comment 5 of the January 11, 1999 letter, the MDNR committed to submit a worst case credible accident analysis for the Tobico Marsh Site. This calculation contains the results of that analysis.

2.0 BACKGROUND INFORMATION

The Tobico Marsh Site consists of an approximately three-acre waste disposal area that is closed and has been capped and surrounded by slurry walls. The disposal area is located in the Tobico Marsh State Game Area, Kawkawlin Township, Bay County, Michigan. The Site is bounded by the north, east, and west by marsh. The closed SCA Landfill Site is located on the Site's southern boundary. It is approximately 3,000 feet to the nearest residence.

A slag waste product of thorium-magnesium foundry operations was disposed of at the Site and is now encapsulated by the cap and slurry walls. The slag contains elevated concentrations of naturally occurring thorium. The NRC contracted Oak Ridge Associated Universities (ORAU) to perform a radiological survey of the Site in 1984 (ORAU 1985). Over 100 systematic soil samples were collected during the survey prior to installation of the cap; one sample had a Th-232 concentration of 70 pCi/g and the remainder had concentrations less than 10 pCi/g. Biased core samples were also collected during the survey from four locations having elevated contact radiation levels. The core samples identified maximum Th-232 concentration of 561, 355, 47.5 and 199 pCi/g. In each of the core samples the activity was contained in an approximately 10 centimeter deep layer.

3.0 WORSE CASE CREDIBLE ACCIDENT

Routine radiological activities will consist of sampling and surveying, contaminated soil and debris removal, and shipment and disposal of contaminated soil and low-level radioactive waste. Affected areas of the Site will be controlled as restricted areas during radiological activities. The potential dose to workers and members of the public during routine radiological activities has been analyzed. The license application and associated Radiation Safety Program

(RSP) were designed to ensure compliance with the regulatory limits promulgated by the NRC for workers and members of the public.

During characterization and remediation activities at the site, unanticipated events may occur that could result in radiation exposure to workers and members of the public. The MDNR has evaluated the potential for exposure from abnormal conditions that could arise both on and off the site. Considering the remote nature of the site, the fact that the thorium contamination is encapsulated, and the types of radiological activities that will be conducted under the license, a transportation accident is the most credible scenario that could result in dose to a member of the public.

The worst case scenario would involve a transportation accident that causes spillage of the entire contents of a radioactive waste shipment. It is assumed that it would take one day (24 hours) to clean up such a spill. It is further assumed that members of the public could be exposed to direct radiation, and inhalation and ingestion of radioactive material during the entire clean up period.

The potential off-site impact of wind and water erosion or flooding on stored radioactive waste was also evaluated as a potential worst case scenario. The potential flooding of, or erosion from, any on-site areas used for temporary storage is extremely low. This low potential is demonstrated by the fact that the site is located on the boundary between the 100 and 500 year floodplain. In addition, the site's cap increases the elevation of the center of the site by 8 to 10 feet above the elevation of the surrounding marsh, on which the floodplain is based. Even in the unlikely event that a major flood or major windstorm occurs, it would tend to disperse the radioactive materials in a large volume of water or over a large area. Consequently, dose from such an event would be much less than that due to a transportation accident involving the same material.

4.0 DOSE ASSESSMENT

Source Term

The highest concentration of Th-232 measured during the ORAU Survey (ORAU 1985) was 561 pCi/g. Concentrations of uranium substantially above background were not identified during the Survey and concentrations of Th-230 were not evaluated during the survey. The MDNR performed a Scoping Survey (HLA 1998) which indicated that the Th-230 to Th-232 ratio at the site is approximately 2.3. It is assumed that all daughters of Th-232 are in secular equilibrium. It is assumed that Th-230 daughters have ingrown for a period of 50 years. The ingrowth calculation was performed using RadDecay (GEI 1994) program from Grove Engineering, Inc.

Inhalation Exposure

An effective ALI for the Th-232 chain is calculated as shown in Table 1, assuming all daughters are in secular equilibrium. An effective ALI for the Th-230 chain is calculated as shown in Table 2, assuming daughters have ingrown for a period of 50 years. An effective ALI for the Th-232 and Th-230 chains is calculated as shown in Table 3. All effective ALIs are related to Th-232 activity and were calculated, by the "sum of the fractions rule," using the following equation:

$$ALI_{eff} = \left[\sum_i \frac{F_i}{ALI_i} \right]^{-1}$$

Where: $ALI_{eff} \equiv$ the effective ALI
$F_i \equiv$ the fraction of Th-232 or Th-230 activity for radionuclide i
$ALI_i \equiv$ the ALI for radionuclide i

It is assumed that a sufficient volume of soil is spilled during the hypothetical transportation accident such that the total airborne dust loading is due to the spilled material. It is assumed that the average concentration of Th-232 in the soil is 25% of the maximum concentration measured during the ORAU Survey (ORAU 1985) or 140 pCi/g.

Table 1
Th-232 and Daughter

Radionuclide	Fraction of Th-232 Activity	Lu Clea Cla	Occupational Inhalation ALI (uCi)
Th-232	1	W	1E-03
Ra-228	1	W	1E 00
Ac-228	1	D	9E 00
Th-228	1	W	1E-02
Ra-224	1	W	2E 00
Rn-220	1	N/A	2E+04
Pb-212	1	D	3E+02
Bi-212	1	D	2E+02
Effective Inhalation Th-232 ALI			**9.1E-04**

Table 2 Th-230 and Daughters			
Radionuclide	Fraction of Th-230 Activity	Lung Clearance Class	Occupational Inhalation ALI (uCi)
Th-230	1	W	6E-03
Ra-226	2.14E-02	W	6E-01
Rn-222	2.14E-02	N/A	1E+04
Pb-214	2.14E-02	D	8E+02
Bi-214	2.14E-02	D	8E+02
Pb-210	1.06E-02	D	2E-01
Bi-210	1.06E-02	W	3E+01
Po-210	1.06E-02	D	6E-01
Effective Inhalation Th-230 ALI			**6.0E-03**

Table 3 Effective Th-232 Inhalation ALI		
Radionuclide	Fraction of Th-232 Activity	Occupational Inhalation ALI (uCi)
Th-232 Chain	1	9.1E-04
Th-230 Chain	2.3	6.0E-03
Effective Inhalation Total Th-232 ALI		**6.7E-04**

Calculation:

- CD - Airborne dust loading is assumed to be 4E-04 g/m^3, which is the default value for gardening activities given in NRC 1998a and NRC 1998b.
- t – It is assumed that it takes 24 hours to clean-up the spill.
- BR – It is assumed that the breathing rate for a member of the public is 1.4 m^3/hr, which is the default value for outdoor activities given in NRC 1998a and NRC 1998b.
- C - It is assumed that the average Th-232 concentration in the spilled soil is 140 pCi/g.
- I_b – The potential Th-232 inhalation intake in pCi by a member of the public in 24 hours.
- D_b – The dose received by a member of the public from inhalation of Th-232, Th-230 and their daughters.

- ALI_{be} – Effective inhalation ALI for Th-232, Th-230 and their daughters, as calculated in Tables 1, 2, and 3 (6.7E-04 uCi).

- 5000 – dose (mrem) to a worker that intakes 1 ALI of radioactivity

- 10^{-6} – conversion factor uCi per pCi

$$I_b = CD \cdot BR \cdot C \cdot t$$

$$I_b = \frac{4E-04\,g}{m^3} \cdot \frac{1.4\,m^3}{hr} \cdot \frac{140\,pCi}{g} \cdot 24\,hr = 1.9\,pCi$$

$$D_b = \frac{5000\,mrem}{ALI_{be}} \cdot \frac{10^{-6}\,\mu Ci}{pCi} \cdot I_b$$

$$D_b = \frac{5000\,mrem}{6.7E-04\,\mu Ci} \cdot \frac{10^{-6}\,\mu Ci}{pCi} \cdot 1.9\,pCi = 14.2\,mrem$$

Ingestion Exposure

An effective ALI for the Th-232 chain is calculated as shown in Table 4, assuming all daughters are in secular equilibrium. An effective ALI for the Th-230 chain is calculated as shown in Table 5, assuming daughters have ingrown for a period of 50 years. An effective ALI for the Th-232 and Th-230 chains is calculated as shown in Table 6. All effective ALIs are related to Th-232 activity were calculated, by the "sum of the fractions rule," using the same equation applied to inhalation ALIs above. It is assumed that the average concentration of Th-232 in the soil is 25% of the maximum concentration measured during the ORAU Survey (ORAU 1985) or 140 pCi/g. The dose from ingestion of soil and dust inadvertently transferred to the mouth is assumed to result in dose to a member of the public.

Table 4 Th-232 and Daughters		
Radionuclide	Fraction of Th-232 Activity	Occupational Ingestion ALI (uCi)
Th-232	1	7E-01
Ra-228	1	2E 00
Ac-228	1	2E+03
Th-228	1	6E 00
Ra-224	1	8E 00
Rn-220	1	0E 00
Pb-212	1	8E+02
Bi-212	1	5E+03
Eff. IngestionTh-232 ALI		**4.5E-01**

Table 5 Th-230 and Daughters		
Radionuclide	Fraction of Th-230 Activity	Occupational Ingestion ALI (uCi)
Th-230	1	4E 00
Ra-226	2.14E-02	2E 00
Rn-222	2.14E-02	0E 00
Pb-214	2.14E-02	9E+03
Bi-214	2.14E-02	2E+04
Pb-210	1.06E-02	6E-01
Bi-210	1.06E-02	8E+02
Po-210	1.06E-02	3E 00
Eff. Ingestion Th-230 ALI		**3.5E 00**

Table 6 Effective Th-232 Ingestion ALI		
Radionuclide	Fraction of Th-232 Activity	Occupational Ingestion ALI (uCi)
Th-232 Chain	1	4.5E-01
Th-230 Chain	2.3	3.5E 00
Eff. Ingestion Total Th-232 ALI		**3.5E-01**

Calculation:

- It is assumed that a sufficient volume of soil is spilled during the transportation accident such that the all soil and dust inadvertently transferred to the mouth is from the spilled material.

- GR – Effective transfer rate for ingestion of soil and dust transferred to the mouth 0.05 g/d, which is the default value given in NRC 1998a and NRC 1998b.

- t – It is assumed that it takes one day to clean up the spill.

- C - It is assumed that the average Th-232 concentration in the spilled soil is 140 pCi/g.

- I_g – The potential Th-232 ingestion intake in pCi by a member of the public in 24 hours

- D_g – The dose received by a member of the public from ingestion of Th-232, Th-230 and their daughters

- ALI_{ge} – Effective ingestion ALI for Th-232, Th-230 and their daughters, as calculated in Tables 4, 5, and 6 (3.5E-01 uCi).

- 5000 – dose (mrem) to a worker that ingests 1 ALI of radioactivity

- 10^{-6} – conversion factor uCi per pCi

$$I_g = GR \cdot C \cdot t$$

$$I_g = \frac{0.05\ g}{d} \cdot \frac{140\ pCi}{g} \cdot 1\ d = 7.0\ pCi$$

$$D_g = \frac{5000\ mrem}{ALI_{ge}} \cdot \frac{10^{-6}\ \mu Ci}{pCi} \cdot I_g$$

$$D_g = \frac{5000\ mrem}{3.5E-01\ \mu Ci} \cdot \frac{10^{-6}\ \mu Ci}{pCi} \cdot 7.0\ pCi = 0.10\ mrem$$

Direct Radiation Exposure

An effective dose conversion factor (DCF) for the Th-232 chain is calculated as shown in Table 7, assuming all daughters are in secular equilibrium. An effective dose conversion factor for the Th-230 chain is calculated as shown in Table 8, assuming daughters have ingrown for a period of 50 years. An effective dose conversion factor for the Th-232 and Th-230 chains is calculated as shown in Table 9. All effective dose conversion factors were calculated by adding the individual isotope dose conversion factors and are related to Th-232 activity. It is assumed that the average concentration of Th-232 in the soil is 25% of the maximum concentration

measured during the ORAU Survey (ORAU 1985) or 140 pCi/g. It is assumed that a sufficient volume of soil is spilled during the transportation accident such that it represents an isotropic infinite plane source that is 15 cm deep. Effective dose conversion factors are calculated using the following formula:

$$DCF_{eff} = \sum_i (F_i \cdot DCF_i)$$

Where: $DCF_{eff} \equiv$ the effective dose conversion factor
$F_i \equiv$ the fraction of Th-232 or Th-230 activity for radionuclide i
$DCF_i \equiv$ the dose conversion factor for radionuclide i

Table 7
Th-232 and Daughters

Radionuclide	Fraction of Th-232 Activity	DCF Sv per Bq-s-m^{-3}
Th-232	1	2.78E-21
Ra-228	1	0.00E 00
Ac-228	1	2.76E-17
Th-228	1	4.17E-20
Ra-224	1	2.62E-19
Rn-220	1	1.10E-20
Po-216	1	4.87E-22
Pb-212	1	3.62E-18
Bi-212	1	5.36E-18
Po-212	0.64	0.00E 00
Tl-208	0.36	9.68E-17
Effective Th-232 DCF		**7.17E-17**

Table 8 Th-230 and Daughters		
Radionuclide	Fraction of Th-230 Activity	DCF Sv per Bq-s-m^{-3}
Th-230	1	6.39E-21
Ra-226	2.14E-02	1.65E-19
Rn-222	2.14E-02	1.14E-20
Po-218	2.14E-02	2.63E-22
Pb-214	2.14E-02	6.70E-18
Bi-214	2.14E-02	4.36E-17
Po-214	2.14E-02	2.40E-21
Pb-210	1.06E-02	1.31E-20
Bi-210	1.06E-02	1.86E-20
Po-210	1.06E-02	2.45E-22
Effective Th-230 DCF		**1.09E-18**

Table 9 Effective Th-232 ALI		
Radionuclide	Fraction of Th-232 Activity	DCF Sv per Bq-s-m^{-3}
Th-232 Chain	1	7.17E-17
Th-230 Chain	2.3	1.09E-18
Effective Total Th-232 DCF		**7.42E-17**

Calculation:

- t - It is assumed that it takes one day to clean-up the spill.
- C - It is assumed that the average Th-232 concentration in the spilled soil is 140 pCi/g.
- D_d - The dose received by a member of the public from direct radiation from Th-232, Th-230, and their daughters.
- DCF_{de} - Effective dose conversion factor for Th-232, Th-230, and their daughters, as calculated in Tables 7, 8, and 9 (7.42E-17 Sv per Bq-s-m^{-3}).
- ρ - Density of the spilled contaminated soil 1.6 g/cm^3, as given in EPA 1993.
- 10^5 - Conversion factor mrem per Sv.

- 8.64E+04 - Conversion factor seconds per days.
- 10^6 - Conversion factor cubic centimeters per cubic meter.
- 3.7E-02 - Conversion factor Bq per pCi.

$$D_d = DCF_{de} \cdot C \cdot t \cdot \rho \cdot (10^5) \cdot (8.64E04) \cdot (10^6) \cdot (3.7E-02)$$

$$D_d = \left[\begin{array}{l} \left(\frac{7.42E-17\,Sv \cdot m^3}{Bq \cdot s}\right) \cdot \left(\frac{140\,pCi}{g}\right) \cdot \left(\frac{1.6\,g}{cm^3}\right) \cdot \left(\frac{10^5\,mrem}{Sv}\right) \\ \cdot \left(\frac{8.64E+04\,s}{d}\right) \cdot \left(\frac{10^6\,cm^3}{m^3}\right) \cdot \left(\frac{3.7E-02\,Bq}{pCi}\right) \cdot (1\,d) \end{array} \right] = 5.3\,mrem$$

5.0 CONCLUSION

Based on the information contained in the ORAU report (ORAU 1985), thorium contamination at the Site is confined to a strip of land that runs through the center of the site. The contamination is contained in a layer that is approximately 10 centimeters thick.

The site is now covered by a clay cap and surrounded by slurry walls. The layer of radioactivity now lies several feet beneath the surface. If it becomes necessary to excavate some of this material it will become mixed with the covering cap and surrounding soils, which will lower the average concentration of the radioactivity.

Excavated contaminated soils represent the greatest potential source for exposure to members of the public during an accident. Given the remote location of the site, a transportation accident involving shipment of excavated radioactive material represents the worst scenario for exposing members of the public to a large source of radioactivity from the site.

Extremely conservative calculations were performed to estimate the dose to a member of the public from a transportation accident. The calculations are very simple and do not take credit for many physical effects (e.g., actual exposure duration, dilution of contamination with excavated soil, wind dilution of airborne material, finite source size, etc.) that would tend to lower radioactivity concentrations and reduce dose. The calculations also assume that the entire contents of a shipment of radioactivity contaminated dirt were spilled during the accident.

Given the unlikely occurrence of such an accident and the extremely conservative dose calculations, a member of the public could potentially receive a Total Effective Dose Equivalent of 19.6 mrem during the clean up of such an accident (Inhalation 14.2 mrem, ingestion 0.1 mrem, direct radiation 5.3 mrem). This conservative estimate is substantially

below the 100 mrem annual dose limit for a member of the public that is allowed by the NRC in 10 CFR 20.1301.

6.0 REFERENCES

EPA 1993 "External Exposure to Radionuclides in Air, Water, and Soil," Federal Guidance Report 12, US EPA, September 1993

GEI 1994 RadDecay, General purpose use of the Grove Engineering nuclide library and decay information, version 5.01 Grove Engineering, Inc.

HLA 1998 "Scoping Survey Report Tobico Marsh State Game Area Site," prepared by Harding Lawson Associates for Michigan Department of Natural Resources, October 1998

NRC 1999 Letter from Sherry C. Wu of the NRC to Denise Gruben of the Michigan Department of Natural Resources, "Summary of September 22, 1998, Meeting Regarding Michgan Department of Natural Resources License Application and Future Activities at the Tobico Marsh Site," Docket Number 40-9015, dated January 11, 1999

NRC 1998a Version 1 of the NRC DandD Computer Program

NRC 1998b "Review of Parameter Data for the NUREG/CR-5512 Residential Farmer Scenario and Probability Distributions for the DandD Parameter Analysis," Letter Report for NRC Project JCN W6227, January 30, 1998

ORAU 1985 "Radiological Survey of the Michigan Department of Natural Resources Landfill Site Bay City, Michigan," Oak Ridge Associated Universities, July 1985

ATTACHMENT B

POSSESSION OF CALIBRATION AND REFERENCE SOURCES

ADDITION OF SEALED SOURCES TO THE MDNR LICENSE APPLICATION

The Michigan Department of Natural Resources (MDNR) would like to amend its September 5, 1997 U.S. Nuclear Regulatory Commission (NRC) License Application to include provisions for possession of calibration and reference sources that are not currently listed. A list of sealed sources, their form, and their quantity limit is shown below. Specifically the MDNR would like to make the following change and add the following materials to Section 5.0 of the Application, "MATERIAL TO BE POSSESSED":

Change the Following:

Material	Form	Quantity	Location
Change from			
(3) Thorium-232[2]	Any	0.1 μCi	Tobico Marsh Site

(1) Contaminated soil, sludge, sediment, trash, building rubble, structures, and any other material contaminated in excess of background levels.

(2) Includes check sources and calibration standards for use in radiation protection applications and instrument calibrations.

To			
(3) Thorium-230[2]	Any	10 μCi	Tobico Marsh Site

Add the following:

Material	Form	Quantity	Location
(4) Americium-241	Sealed sources[3]	0.5 μCi	Tobico Marsh Site
(5) Cadmium-109	Sealed sources[3]	5.0 μCi	Tobico Marsh Site
(6) Cerium-139	Sealed sources[3]	0.2 μCi	Tobico Marsh Site
(7) Cesium-137	Sealed sources[3]	5.0 μCi	Tobico Marsh Site
(8) Cobalt-57	Sealed sources[3]	0.2 μCi	Tobico Marsh Site
(9) Cobalt-60	Sealed sources[3]	0.5 μCi	Tobico Marsh Site
(10) Mercury-203	Sealed sources[3]	0.4 μCi	Tobico Marsh Site
(11) Technetium-99	Sealed sources[3]	1.0 μCi	Tobico Marsh Site
(12) Tin-113	Sealed sources[3]	0.4 μCi	Tobico Marsh Site
(13) Yttrium-88	Sealed sources[3]	0.5 μCi	Tobico Marsh Site

(3) As defined in 10 CFR 30.4.