Consumers Energy

A CMS Energy Company

Big Rock Point Nuclear Plant
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Charlevoix, MI 49720

Kurt M. Haas
General Manager

March 14, 2001

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

SUBJECT: BIG ROCK POINT PLANT - DOCKET 55-155 - LICENSE DPR-6 REQUEST FOR APPROVAL OF PROPOSED DISPOSAL PROCEDURES IN ACCORDANCE WITH 10 CFR 20.2002

The purpose of this letter is to submit a request for NRC approval of proposed procedures for disposal of demolition debris in accordance with provisions of 10 CFR 20.2002. It is not the intention of Consumers Energy to make this submittal for the intentional disposal of radioactive waste. However, it is recognized that a potential will exist for trace quantities of licensed radioactive material to be present in the demolition debris at levels below normal instrument detection capabilities. Therefore, this submittal is being made in accordance with provisions of 10 CFR 20.2002 because of the potential presence of licensed material in the demolition debris.

This application requires that the demolition debris (totaling approximately 85 million pounds) be deposited in a State of Michigan licensed Type II landfill. In accordance with existing State of Michigan Solid Waste Management Act Administrative Rules, demolition debris, such as that generated by the dismantlement of the Big Rock Point Plant, must be disposed of in a landfill. This requirement is applicable regardless of whether the demolition debris is generated prior to or subsequent to license termination.

The radiological survey process used to determine that the demolition debris is acceptable for landfill disposal will consist of a historical records review of radiological surveys, selected laboratory analysis of core-bore or other appropriate samples, decontamination (as required), and followed by either direct frisk or *In Situ* gamma spectroscopy prior to demolition of structures. The final step will be radiological monitoring of the bulk demolition debris prior to its removal from the BRP site. This radiological survey process will ensure that the consequence of any licensed radioactive material potentially present in the demolition debris at levels below detection capabilities of instruments used for the final release of demolition debris to an offsite landfill will not constitute a condition adverse to public health and safety or the environment. Adherence with the disposal concentration limit of licensed radioactive materials contained in this request will result in negligible dose in a controlled landfill and demonstrate that the potential radiological dose posed by the material does not exceed a maximum of 1 mrem/year to a member of the public. Consumers Energy requests approval of the 10 CFR 20.2002 request within 12 months of the date of this letter. This date has been chosen to ensure that the BRP site can be released for unrestricted use, the environment will not be significantly impacted, and that adequate funds will be available to complete the decommissioning.

A001

REQUEST FOR APPROVAL OF PROPOSED DISPOSAL PROCEDURES IN ACCORDANCE WITH 10 CFR 20.2002
MARCH 14, 2001

In accordance with 10 CFR 50.82, Consumers Energy has evaluated potential environmental impacts associated with this submittal, and has concluded that there are no significant environmental impacts.

Should you have any questions, please contact Mr. George Petitjean, Licensing Lead and point of contact for NRR at 231-547-8355.

Kurt M. Haas
Site General Manager

Attachment(s)
1. Affidavit
2. Request for Approval of Proposed Disposal Procedures In Accordance With 10 CFR 20.2002.

cc: Regional Administrator, Region III, USNRC
NRC Reactor Decommissioning Inspector, Region III - BRP
NRC Project Manager - OWFN, USNRC

ATTACHMENT 1
CONSUMERS ENERGY COMPANY

Request for Approval of Proposed Disposal Procedures
In Accordance with 10 CFR 20.2002

Affidavit

Submitted March 14, 2001

CONSUMERS ENERGY COMPANY
LICENSE DPR-6
DOCKET 50-155

Request for Approval of Proposed Disposal Procedures
In Accordance with 10 CFR 20.2002

CONSUMERS ENERGY COMPANY

To the best of my knowledge, information and belief, the contents of this submittal are truthful and complete.

By _____

Kurt M. Haas
Site General Manager

Sworn and subscribed to before me this 14th day of March, 2001.

Jennifer Lynn Helms

Jennifer Lynn Helms, Notary Public
Charlevoix County, Michigan

My commission expires August 29, 2003

SEAL

ATTACHMENT 2
CONSUMERS ENERGY COMPANY

Request for Approval of Proposed Disposal Procedures In Accordance with 10 CFR 20.2002

Request for Approval / Environmental Impact Determination

Submitted March 14, 2001

NUCLEAR REGULATORY COMMISSION
BIG ROCK POINT PLANT
REQUEST FOR APPROVAL OF PROPOSED DISPOSAL PROCEDURES UNDER 10 CFR 20.2002 PROVISIONS

For the reasons hereinafter set forth, it is requested that approval be granted to the Consumers Energy Big Rock Point Plant (BRP), as licensed by Facility Operating License DPR-6, Docket 50-155, issued on May 1, 1964, for procedures controlling the disposal of demolition debris in accordance with provisions of 10 CFR 20.2002. A description of the waste material for disposal that potentially contains licensed materials, including the physical and chemical properties important to risk evaluation, and the proposed manner and conditions of waste disposal is provided in the following sections. The content of this application follows the guidance of NUREG-1101, Volume 1, Onsite Disposal of Radioactive Waste – Guidance for Disposal by Subsurface Burial, March 1986 as applicable.

I. PROPOSED ACTIVITIES

This request for approval of proposed disposal procedures in accordance with the provisions of 10 CFR 20.2002 allows Consumers Energy to dispose of demolition debris originating from decommissioning activities at the Big Rock Point Plant at a State of Michigan licensed Type II landfill. The request is justified in the analysis discussed in the later sections of this document.

II. BACKGROUND

By letters dated June 18, 1997, and June 26, 1997, Consumers Energy notified the NRC, pursuant to 10 CFR 50.82(a)(1)(i), that Big Rock Point Plant would permanently cease operation on August 30, 1997. On August 29, 1997, the reactor was permanently shutdown, ending 35 years of electric power generation. On September 22, 1997, another letter was forwarded to the NRC certifying that the fuel had been removed from the reactor vessel and placed in the spent fuel pool for storage.

The BRP site is located on the northeast shore of Lake Michigan in Charlevoix County in the northern part of Michigan's Lower Peninsula. The site is approximately 60 miles northeast of Traverse City, Michigan, and about 4 miles north of the small town of Charlevoix along US Route 31.

The reactor at the BRP was of relatively small size (75 MWe) and contained a significantly small radioactive source term, only about 10 percent that of a standard boiling water reactor (BWR). Consumers Energy's goal is to dismantle BRP in a safe, environmentally conscious, and cost effective manner. This action will result in the timely removal of the existing nuclear plant in accordance with the DECON option found acceptable to the NRC in its Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, NUREG-0586. Decommissioning activities started in June 1997, and are expected to culminate in 2005 after which its Part 50 license will be terminated.

As a part of the decommissioning process, Consumers Energy plans to dismantle the individual structures when they are empty and when they have been decontaminated and

radiologically surveyed, as required. It is estimated that a total 84.5 million pounds of predominately concrete debris will originate from the decommissioning project. Approximately one half of this is non-impacted (i.e., has never had the potential for neutron activation or to be exposed to licensed radioactive materials). The other half has a potential to contain residual surface activity and/or neutron activation products in a limited quantity. This submission deals with the disposition of demolition debris from the Big Rock Point decommissioning.

III. JUSTIFICATION

10 CFR 20, Subpart K, §20.2001 requires that licensed radioactive material be disposed of only through (1) transfer to an authorized recipient, (2) decay in storage, (3) release in effluents within the limits in §20.1301, or (4) as authorized under §§20.2002, 20.2003, 20.2004, or §20.2005. This request for approval of proposed disposal procedures demonstrates compliance with 10 CFR 20.2001 requirements prior to disposal of radiologically clean demolition debris in a State of Michigan licensed landfill.

For demolition debris at Big Rock Point (BRP), three decommissioning options have been considered.

(1) License Termination with Structures Intact

This option would involve removal of licensed radioactive materials from the existing structures to residual radioactivity levels acceptable for termination of the license. Verification of achieving these residual radioactivity levels would require conducting a final status survey (FSS) for license termination on the remaining structures as well as the site environs. Specific disadvantages for application of this option at BRP include a delay in our management's environmental stewardship goal and commitment for restoration of the site to greenfield status. This option would also result in an increased expenditure of ratepayer decommissioning funds necessary to perform a much expanded FSS and demobilization followed by remobilization of the construction work force necessary for ultimate removal of site structures.

(2) Demolition Followed by License Termination

The initial process is similar to license termination with structures intact. Removal of licensed radioactive materials from existing structures to residual radioactivity levels acceptable for license termination with unrestricted access would still be performed. However, prior to performing the FSS, the remaining structures would be demolished and the concrete rubble left on site. The FSS would then be performed on the site environs. After license termination, the concrete rubble could be used as construction fill or disposed

of in a State of Michigan licensed landfill facility. While this methodology appears to be able to meet all NRC requirements and public health and safety goals, the disadvantages are that the debris would be expensive to stabilize over the long-term context. Furthermore, redevelopment of the site after license termination for other uses may require that debris be removed at some later date and relocated to another location on-site or off-site.

This option could be performed with somewhat less expenditure of ratepayer decommissioning funds than Option (1).

(3) Demolition and Disposal Followed by License Termination

This option involves removal of licensed radioactive materials from the existing structures and installations. After decontamination of a work area, debris with no detectable radioactivity would be disposed of in a State of Michigan licensed landfill facility. After removal of all demolition debris, the FSS would then be performed on the site environs, the license terminated by the NRC and the site released for unrestricted future use. This option is the most cost-effective use of ratepayer decommissioning funds and will result in the most expedient environmental restoration of the site.

The option that is most attractive to Consumers Energy and the public stakeholders is the disposition of demolition debris in a landfill prior to license termination; therefore, Big Rock Point has selected Option (3) as the preferred option. The criterion used in the License Termination Rule (10 CFR 20, Subpart E) for termination of the site license for unrestricted use is a total effective dose equivalent (TEDE) of 25 mrem/year. In comparison, the TEDE of this submission for Option (3) (demolition debris disposal in a State of Michigan licensed landfill) is 1 mrem/year. Therefore, selection of Option (3) is protective of the public health and safety, is consistent with As Low as Reasonably Achievable (ALARA), as well as being most cost-effective.

Consumers Energy is committed to conducting and completing decommissioning in a safe and cost efficient manner consistent with all regulatory requirements. Furthermore, Consumers Energy has determined that it is in the best interest to restore the site to greenfield conditions. Given the location of the site on the shore of Lake Michigan, the land is a valuable resource to the company and to the citizens of the area. The demolition debris that will originate from the demolition and removal of structures at the Big Rock Point Plant is included in this submission. This demolition debris includes flooring materials, concrete, rebar, roofing materials, structural steel, the soils associated with digging up foundations and concrete and/or asphalt pavement.

While Options (1) and (2) can be conducted under 10 CFR 20, Subpart E, Consumers Energy believes that Option (3) should be conducted under Subpart K. Although

Subpart E allows small quantities of detectable licensed material to be left onsite for license termination, until the license is terminated, no amount of licensed material may be released from the site unless it is authorized under Subpart K. Consumers Energy does not intend to make this submittal for intentional disposal of radioactive waste. However; it is recognized that, although the demolition debris will have been determined to be "radiologically clean" through structural surface surveys and bulk material assay of demolition debris, a potential will exist for trace quantities of licensed material to be present in the demolition debris at levels below instrument detection capabilities. Therefore, this submittal is being made in accordance with provisions of 10 CFR 20.2002 because of the potential presence of licensed material in the "radiologically clean" demolition debris.

IV. DESCRIPTION OF WASTE

A. Physical Properties

The demolition debris that will originate from the demolition and removal of structures and paved surfaces at the Big Rock Point Plant includes flooring materials, concrete, rebar, roofing materials, structural steel, soils associated with digging up foundations and concrete and/or asphalt pavement or other similar solid materials.

The physical form of this demolition debris will be that of bulk material with various screen sizes ranging from particles the size of sand up to occasional monoliths with a volume of several cubic feet. For the purpose of analyses performed for this application, the demolition debris is assumed to be a homogenous mixture with a density of 150 pounds per cubic foot (2.4 g/cm^3).

The demolition debris will exist as a dry solid waste containing no absorbents or chelating agents.

B. Estimated Waste Volume and Burials Each Year

It is estimated that the total mass of both contaminated and non-contaminated demolition debris originating from the decommissioning of BRP will total approximately 84.5 million pounds. With an assumed demolition debris density of 150 pounds per cubic foot, the estimated volume of demolition debris for disposal at a State of Michigan licensed landfill will be approximately 563,000 cubic feet.

For the purpose of analyses performed for this application, completion of landfill disposal of demolition debris is assumed to occur within a one-year period of time. BRP demolition debris will not be isolated or dedicated to a single burial cell at the landfill. Rather, it will be co-mingled with other landfill materials that are available for disposal when the demolition debris is delivered to the landfill facility.

Institutional controls required at a State of Michigan licensed landfill are discussed in a later section of this application. However, one of these requirements is that materials deposited in a burial cell are required to be covered with an interim 6-inch layer of soil each day. Final closure of the burial cell will not occur until the burial cell has reached its design capacity.

Therefore, if a burial for purposes of this application is defined as final closure of the burial cell in which BRP demolition debris has be deposited, the number of burials per year will be dependent on the total volume of other landfill materials delivered to the landfill for disposal. However, it should be noted that each day that demolition debris is deposited in a burial cell, it would be covered with an interim 6-inch layer of soil.

C. Radiological Characterization of Structural Concrete

It is recognized that a potential exists for trace quantities of licensed radioactive material to be present in the demolition debris. To identify radionuclides potentially present in demolition debris, a detailed laboratory characterization of three radioactive waste streams that currently exist during the decommissioning process was completed on February 9, 2001. These samples consisted of a smear from a contaminated floor surface, a smear from the inside of a contaminated pipe and a spent fuel pool water filter. This characterization identified the following radionuclides to be currently present in the decommissioning radioactive waste streams:

Ag-108m	Ag-110m	Am-241	C-14	Ce-144
Cm-243/244	Co-60	Cs-134	Cs-137	Fe-55
H-3	Mn-54	Ni-59	Ni-63	Pu-238
Pu-239/240	Pu-241	Sb-125	Sr-90	Tc-99
Zn-65				

Because of the potential for any or all of these radionuclides to be present in demolition debris, a radiological characterization of structural concrete contained in structures that will be demolished has been undertaken to identify radionuclides that may potentially be present in debris after demolition.

To date, over 200 core borings (2 inch diameter by 6 inch depth) have been taken from rooms or areas on the BRP site. Selection of the sampling location was biased toward areas expected to have the highest contamination potential. Each core is being analyzed onsite to determine what types of radioactive material are present and how far the contaminants have penetrated into the concrete. In addition, portions of 14 core samples have been analyzed by an offsite laboratory at typical environmental

monitoring lower limits of detection (LLD) using alpha and gamma spectrometry as well as liquid scintillation to analyze for the presence of the following radionuclides:

Ac-227	Ac-228	Ag-108m	Ag-110m	Am-241
C-14	Cd-109	Ce-144	Cm-242	Cm-243/244
Co-60	Cs-134	Cs-135	Cs-137	Eu-152
Eu-154	Fe-55	H-3	I-129	K-40
Mn-54	Ni-59	Ni-63	Nb-94	Pb-214
Pm-147	Pu-241	Pu-238	Pu-239/240	Ru-106
Sb-125	Sr-90	Tc-99	U-233/234	U-235/236
U-238	Zn-65			

One-half inch thick, near surface wafers from 12 of the core samples was submitted to represent potential radioactive materials remaining after remediation of the structural surfaces. Laboratory analysis of these samples identified only Am-241, Co-60, Cs-137, Fe-55 and H-3 at levels greater than the LLD values. K-40, Pb-214, U-233/234 and U-238 were also detected in these samples but at levels that were indistinguishable from naturally occurring background levels measured in concrete samples that did not have the potential for contamination by licensed radioactive materials. The results of these samples with concentration values representing the average concentration in the one-half inch thick wafer are detailed in Table 1.

Table 1

Remediated Concrete Core Sample Results

Sample Number	Radionuclide				
	Am-241 pCi/g	Co-60 pCi/g	Cs-137 pCi/g	Fe-55 pCi/g	H-3 pCi/g
19	<LLD	<LLD	<LLD	<LLD	<LLD
31	<LLD	<LLD	<LLD	<LLD	<LLD
83	<LLD	<LLD	0.130 ± 0.088	<LLD	<LLD
104	<LLD	<LLD	0.094 ± 0.054	0.181 ± 1.70	<LLD
112	<LLD	0.084 ± 0.065	<LLD	0.682 ± 1.64	6.24 ± 2.51
123	<LLD	<LLD	<LLD	0.841 ± 1.63	9.47 ± 2.88
128	<LLD	<LLD	0.166 ± 0.062	<LLD	<LLD
7	<LLD	<LLD	<LLD	<LLD	<LLD
90	<LLD	0.245 ± 0.141	0.241 ± 0.125	<LLD	<LLD
149	<LLD	0.458 ± 0.114	0.152 ± 0.057	<LLD	<LLD
117	<LLD	0.697 ± 0.280	0.292 ± 0.179	<LLD	5.18 ± 2.22
100	0.227 ± 0.187	<LLD	0.177 ± 0.101	<LLD	<LLD
119*	0.159 ± 0.321	2.47 ± 0.739	0.281 ± 0.282	9.63 ± 3.32	16.9 ± 11.9
153*	<LLD	0.261 ± 0.249	0.261 ± 0.165	8.21 ± 3.41	10.1 ± 8.89

*Remediated high surface contamination samples

The final two core samples listed above were taken from areas having a high potential for surface contamination and are average values of subsurface samples taken at various concrete depths. Laboratory analysis of these samples identified only Am-241, Co-60, Cs-137, Fe-55 and H-3. K-40, Pb-214, U-233/234 and U-238 were also detected in these samples but at levels that were indistinguishable from naturally occurring background levels measured in concrete samples that did not have the potential for contamination by licensed radioactive materials.

D. Calculated Licensed Radioactive Material Content of Demolition Debris

Results of the radiological characterization of structural concrete and current remedial action contamination surveys were used to classify the surfaces as either uncontaminated, shallow surface contaminated or deep surface contaminated.

Uncontaminated surfaces were defined as surfaces having no detectable contamination as evidenced by historical records review, current remedial action contamination surveys and laboratory analysis of representative core samples.

Shallow surface contamination is defined as surfaces having no detectable contamination ($\geq$5,000 dpm/100 cm^2 total activity) as evidenced by contamination surveys performed after remedial action (if required) but detectable shallow subsurface contamination identified by laboratory analysis of representative core samples. Shallow subsurface contamination is assumed (based on core sample profiling) to penetrate to a depth of 1 inch after surface remediation.

Deep surface contamination is defined as highly contaminated surfaces prior to remediation with no detectable contamination as evidenced by contamination surveys performed after remedial action, but with some detectable deep subsurface contamination identified by laboratory analysis of representative core samples. This subsurface contamination is assumed to penetrate to a depth of 6 inches after surface remediation.

Based on the results of the radiological characterization of structural concrete on a room-by-room basis, a total surface area of 10,200 square feet have been calculated to have deep surface contamination. 51,835 square feet have been calculated to have shallow surface contamination and the remainder is considered to be uncontaminated. This results in a calculated 5,100 cubic feet of deep surface contaminated concrete and 4,320 cubic feet of shallow surface contaminated concrete.

Averaging the greater than LLD results from Table 1 and applying the resulting concentrations to the 4,320 cubic feet of shallow surface contaminated concrete and 5,100 cubic feet of deep surface contaminated concrete results in concentrations and total activity as reported in Table 2.

Table 2

Volumetric Contamination of Remediated Surface Contaminated Concrete

Radionuclide	Concentration (pCi/g)	Total Activity (μCi)
Am-241	0.19	122
Co-60	0.70	449
Cs-137	0.20	128
Fe-55	3.91	2506
H-3	9.58	6140
Total	14.58	9345

Averaging the total activities from Table 2 over the total demolition debris mass of 84.5 million pounds results in activity concentrations as reported in Table 3.

Table 3

Total Demolition Debris Average Concentrations

Radionuclide	Concentration (pCi/g)
Am-241	0.003
Co-60	0.012
Cs-137	0.003
Fe-55	0.065
H-3	0.160
Total	0.243

E. Dose Impacts

To evaluate the dose impact of disposal of this material, Consumers Energy used the guidance contained in Nuclear Energy Institute (NEI) Topical Report 97-02, *Technical Basis for Alternate Disposal Methods*, May 1997. This NEI Topical Report used a modified version of the computer code IMPACTS-BRC (NUREG/CR-3585 and EPRI Report NP-5679). The assumptions used in the NEI Topical Report for disposal in an offsite sanitary landfill include:

Region of the US	Southeast (Humid)
Contaminated Waste Mass	1090 metric tons (2.40E+06 lb.)/yr
Contaminated Waste Volume	100,000 ft^3/yr
Non-contaminated Waste Mass	7500 metric tons (1.65E+07 lb.)/yr
Non-contaminated Waste Volume	480,000 ft^3/yr
Transport Distance	40 miles
Average Truck Speed	25 miles/hr
Max. Gamma Activity Concentration	25 pCi/g

The demolition debris to be disposed of at a State of Michigan licensed landfill is bounded by these assumptions (i.e., 9420 ft^3 of contaminated waste volume and a combined contaminated and non-contaminated waste volume of 564,000 ft^3), even assuming the worst case of all demolition debris shipped within the span of one year. Although transport distance to the landfill may be greater (60 miles to the most distant landfill being considered), the significantly lower activity concentration results in less exposure to a transport worker.

Based on the above assumptions, and the dose conversion factors found in the NEI Topical Report, demolition debris from BRP will result in the dose impacts shown in Table 4.

Table 4

Public Dose Impacts for BRP Based on NEI Topical Report

Impacted Individual	TEDE Dose Impact (mrem/year)	
Transport Worker*	0.073	
Landfill Worker	0.008	
Offsite Individual	2.77E-06	
Intruder (Public Access Time, yrs)	Agricultural Use	Construction Use
5	0.040	0.008
10	0.024	0.005
15	0.016	0.003
20	0.012	0.003
25	0.009	0.002
30	0.007	0.001

*Dose increased by a factor of 1.5 to account for 60 vs. 40-mile transport distance.

As shown above, the most limiting dose impact is that received by the transport worker. Landfills licensed by the State of Michigan are required to conduct post-closure care for not less than 30 years. Therefore, the public access time listed above could not be less than a 30-year period after placement of the demolition debris.

The dose impacts estimated in this application would not be measurable with state-of-the-art personnel dose monitoring instrumentation and are insignificant in comparison to the average annual dose received by an individual from natural sources (approximately 300 mrem per year). The dose impacts are far below all federal standards for dose to members of the public.

1. Independent Transport Dose Verification

   An independent evaluation of transport worker dose was performed using MicroShield, Version 5, from Grove Engineering and site-specific assumptions. The transport system chosen for this evaluation was a roll-off container system with dimensions of 21.5 feet long, 8 feet wide and 3.5 feet high.

   In addition to the above, the following assumptions were also applied to the analysis. In each case, the driver's seat is assumed to be 1 foot away from the cabin wall, which is conservatively assumed to be 0.12 inches thick, made of iron. The material hauler part of the truck is assumed to be made of iron with 0.25-inch thick sides, floor and tailgates. The distance between the hauler part and the driver's cabin is assumed to be 4 feet.

   It is assumed that three truck drivers will be used for the total duration of the project and that the number of loads transported will be divided equally between each driver. Given the anticipated volumes of the demolition debris (20,000 cubic yards), combined with the assumptions of standard load volumes, transport of all demolition debris within a one year period and the driving time of 2 hours per load to the landfill, each truck driver will be potentially exposed to radiation from residual radioactivity for 600 hours.

   Applying the above assumptions, results in a calculated dose rate to the driver of 3.20E-06 mrem/hour or an annual dose of 0.002 mrem to each of the truck drivers. Thus, the NEI Topical Report as presented in Table 4 provides a bounding evaluation of transport worker dose.

2. Independent Landfill Worker Dose Verification

   An independent evaluation of landfill worker dose was performed using RESRAD, Version 6.0. For landfill operation, the landfill is assumed to close

after placement of the demolition debris. Post-closure monitoring of the landfill is required by the State of Michigan for a 30-year period. Therefore, it is assumed that a member of the public, other than a landfill worker will not have access to a burial cell containing the demolition debris until 30 years after debris placement.

The following assumptions were made in the evaluation:

a. The most exposed individual at the landfill is the bulldozer operator, positioning and spreading the demolition debris and placing a soil cap on it at the end of the day.

b. The worker is assumed to work 10-hour days to disposition the material.

c. Based on the volume estimates of demolition debris and landfill disposition rate, the total exposure is limited to 100 hours. For this evaluation, the exposure time was increased by an additional 20 percent and is assumed to be 120 hours over a one-year duration. Because the worker may be present in the burial cell depositing other wastes, the calculated dose has been increased an additional 60 hours to account for this exposure.

d. All the demolition debris is conservatively assumed to be dispositioned by the same landfill worker.

e. A 0.15 m soil cover (which is a daily cover requirement) was assumed. No credit was taken for any other engineering controls required by the State of Michigan.

f. No credit was taken for shielding provided to the worker by the bulldozer.

The above assumptions result in a calculated annual TEDE dose of 6.34E-04 mrem for a landfill worker. Thus, the NEI Topical Report as presented in Table 4 provides a bounding evaluation of landfill worker dose.

3. Independent Landfill Resident / Farmer Dose Verification

An independent evaluation of dose to an individual member of the public was performed using RESRAD, Version 6.0. A post-closure monitoring of the landfill is required by the State of Michigan for a 30-year period. For purposes of this evaluation, it is assumed that a residence, including a basement to the residence and a vegetable garden, is established on the burial cell containing the demolition debris 30 years after debris disposal.

The following assumptions were made in the evaluation:

a. All RESRAD exposure pathways are active for the Resident / Farmer scenario except for the radon pathway (not regulated by the NRC).

b. The demolition debris is assumed to be soil like material even though its density is somewhat higher than most soils. Additionally, resuspension of potential demolition debris radioactivity is not expected to vary significantly from that for soil. Therefore, the RESRAD default soil parameters are considered appropriate for use in this analysis.

c. It is assumed that all licensed radioactive material in the demolition debris is dispersed throughout the volume of material originating at Big Rock Point and no dilution of the demolition debris occurs from other landfill materials deposited in the burial cell. This is conservative since Michigan law requires a 6-inch soil cover over the debris at the end of each day.

d. For the Resident / Farmer scenario, it is assumed that the resident spends 50 percent of the time indoors, 25 percent outdoors at the site, and 25 percent of the time away from the site. These are consistent with those suggested in the NRC Policy and Guidance Directive PG-8-08, Scenarios for Assessing Potential Doses Associated with Residual Radioactivity.

e. Fifty percent effectiveness is assumed for the leachate collection system required by the State of Michigan, and the required 18-inch infiltration layer, 24-inch erosion layer and 6-inch earthen material layer capable of sustaining native plant growth are considered to be intact at the end of the 30-year period.

f. No credit is taken for landfill material originating elsewhere which may be deposited on top of the demolition debris.

g. The 563,000 cubic feet (15,860 cubic meters) of demolition debris are assumed to be deposited in a uniform 2-meter thick, 7,930 square meter layer.

h. All other RESRAD parameters were set at their default values for this evaluation.

Applying the above assumptions, results in the calculated maximum annual doses shown in Table 5 for a resident / farmer. The dose calculated using the NEI Topical Report dose conversion factors is shown as a basis of comparison.

As can be seen, the NEI Topical Report provides a bounding evaluation of resident / farmer dose.

Table 5

Resident / Farmer Calculated Public Dose Impacts

Public Access Time, yrs*	TEDE Dose Impact (mrem/year)	
	NEI Topical Report	Site-Specific RESRAD
5	0.040	0.00017
10	0.024	0.00016
15	0.016	0.00015
20	0.012	0.00014
25	0.009	0.00014
30	0.007	0.00013

*For the site-specific RESRAD analyses, this is the time following the 30-year post-closure monitoring period.

F. Requested Limiting Demolition Debris Concentration

Consumers Energy requests a bounding, dose based concentration limit for licensed radioactive materials contained as trace contamination in demolition debris for disposal in a State of Michigan licensed Type II landfill. The requested bounding principal gamma emitter concentration limit of 5 pCi/gm corresponds to 20 percent of the bounding concentration value identified in the NEI Topical Report for offsite sanitary landfill disposal. The limiting concentration is correlated to allowing a maximum TEDE dose of 1 mrem/year to the maximally exposed individual (Transport Worker). To ensure that the 1-mrem/year TEDE dose limit is not exceeded, structural surfaces will be surveyed prior to demolition and all demolition debris will be monitored by a bulk assay system prior to disposal. Structural surface survey and bulk assay detection limits will be established at no greater than a licensed principal gamma emitter activity concentration of 5 pCi/gm averaged over the total quantity of demolition debris.

Establishment of this concentration limit will ensure that any uncertainties in the content of licensed radioactive material in demolition debris sent to a State of Michigan licensed landfill will not present a dose impact problem.

G. Prohibition on Burial of Hazardous Waste

Hazardous waste as defined in the regulations of the Environmental Protection Agency (EPA), 40 CFR Parts 260 through 265, is not permitted to be included in the BRP demolition debris. Hazardous waste is required to be disposed of in a manner set out in EPA regulations and in accordance with applicable local and State laws and codes, and will not be disposed of in conjunction with the debris considered here.

V. PACKAGING OF WASTE

Big Rock Point demolition debris to be disposed of at a State of Michigan licensed Type II landfill will not be packaged. Since the radiological survey process used to determine that the demolition debris is acceptable for landfill disposal will ensure that trace quantities of licensed material potentially present in the demolition debris are at levels below normal instrument detection capabilities, BRP demolition debris will be processed the same as debris generated from the demolition of any non-nuclear industrial facility.

Demolition debris will be transported from the BRP site to the landfill facility by truck transportation using either of three types of truck transport systems that are generally the common practice for carrying demolition debris. These transport systems include a roll-off container system, a dual-trailer mule system or a wide-bodied demolition hauler.

Roll-off container systems have the dimensions of 21.5 feet long by 8 feet wide by 3.5 feet high. Dual-trailer mule systems use two trailers, each having the dimensions of 50 feet long by 8 feet wide by 5 feet high. Wide-bodied demolition haulers have the dimensions of 30 feet long by 8 feet wide by 6 feet high.

Type II landfills licensed by the State of Michigan are required to implement controls to isolate the contents of burial cells from the environment. These controls will provide isolation of the BRP demolition debris from the environment over a reasonable period of time similar to the use waste packaging. The controls are discussed in Section VIII, Nature of the Burial Site.

VI. BURIAL LOCATION

The State of Michigan licensed Type II landfill selected for burial of BRP demolition debris will be located within approximately 60 miles of the BRP site.

The State of Michigan Solid Waste Management Act Administrative Rules Promulgated Pursuant To Part 115 Of the Natural Resources and Environmental Protection Act, 1994 Pa 451, As Amended contains restrictions on the location of Type II landfill facilities. Among these are restrictions on groundwater isolation, horizontal isolation distances,

floodplains, wetlands, fault areas and seismic impact zones, and unstable areas. These restrictions are discussed in Section VIII, Nature of the Burial Site.

VII. INSTITUTIONAL CONTROLS

Part 115 of the State of Michigan Administrative Rules contains institutional controls that restrict access to Type II licensed landfills. The landfill operator is required to control public access to the landfill and prevent unauthorized vehicular traffic and illegal dumping of wastes by using artificial or natural barriers, or both, as appropriate.

After the final closure of a burial cell, the landfill operator is required to conduct post-closure care for not less than 30 years. This post-closure care includes:

- Maintaining the integrity and effectiveness of any final cover,
- Maintaining, operating, and monitoring the leachate collection system,
- Monitoring the groundwater,
- Monitoring all secondary collection systems and leak detection systems, and
- Maintaining and operating the gas monitoring and collection system.

VIII. NATURE OF THE BURIAL SITE

The Type II landfill where the BRP demolition debris will be sent for disposal will meet State of Michigan Part 115 Administrative Rules that will limit migration of licensed radioactive material potentially mixed with the demolition debris in trace amounts. These requirements include but are not limited to:

- Location restrictions,
- A composite liner,
- Leachate collection and removal systems,
- Leak detection systems,
- Daily 6 inch interim soil covers,
- Explosive gas control and monitoring,
- Groundwater monitoring,
- Surface and Groundwater Performance,
- Run-On and Run-Off Control Systems, and
- Final cover composite liner designed to minimize infiltration and erosion.

A. Location Restrictions

The location of each burial cell will be isolated from groundwater sources. Permanent minimum clearances of ten feet to the natural groundwater level and

7 feet to a permanently depressed groundwater level is required to be maintained from the top of the primary liner.

The active work area at the landfill is required to not be located closer than 100 feet to adjacent property lines or road rights-of-way or closer than 300 feet to domiciles that exist at the time a landfill license is requested. It is also not allowed to be located within 400 feet of inland lakes and streams or within 2,000 feet of the Great Lakes. The active work area is also required to be a minimum of 2,000 feet from wells that serve Type I and Type IIa water supplies and a minimum distance of 800 feet from wells that serve Type IIb and Type III public water supplies.

If a landfill is located within a floodplain, the landfill operator is required to demonstrate that:

- The cell will not restrict the flow of the 100-year flood,
- The cell will not reduce the temporary water storage capacity of the floodplain,
- The cell will not result in washout of solid waste so as to pose a hazard to human health and the environment,
- The cell does not encroach upon the floodway and will not increase upstream or downstream flood stages,
- The cell has a natural or compacted soil base which is not less than 10 feet thick,
- The distance from the normal water line of the water body to the solid waste boundary of the landfill will not be less than 500 feet, and
- The design of the landfill will include a dike to preclude floodwater inundation with a top elevation that is not less than 5 feet above the 100-year flood elevation.

Landfills are not allowed to be located in wetlands unless extensive measures are taken for protection of the wetlands.

Landfill burial cells are not permitted to be located within 200 feet of a fault that has had displacement in holocene time, unless the landfill operator demonstrates that an alternative setback distance of less than 200 feet will prevent damage to the structural integrity of the cell and will be protective of human health and the environment. They are also not permitted to be located in seismic impact zones, unless the landfill operator demonstrates that all containment structures, including

liners, leachate collection systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

B. Composite Liners

Burial cells are required to be constructed with a composite liner and a leachate collection system that is designed and constructed to maintain less than a 1-foot depth of leachate over the liner, excluding the sump.

Burial cells are required to be located, designed, and constructed so that the risks posed by leakage through the composite liner are minimized. To do so, a cell is required to be either a monitorable cell that is located over a natural soil barrier so as to restrict the migration of leakage from the unit or designed with a double liner system that is capable of detecting and collecting leakage through the primary composite liner.

C. Leachate Collection and Removal Systems

Each burial cell is required to have a leachate collection system that is designed and constructed to maintain less than a 1-foot depth of leachate over the primary liner. To do so, the system is required to be designed to do all of the following:

- Limit the head at any point in the system, excluding the sump, to not more than 1 foot,
- Extend across the entire bottom of the system,
- Be chemically resistant to the waste that is managed in the landfill and the leachate that is expected to be generated and be of sufficient strength and thickness to prevent collapse under the pressures that are exerted by overlying wastes, waste cover materials, and equipment that is used at the landfill,
- Minimize clogging during the active life and postclosure care period,
- Drain leachate to sumps using pumps that are of a sufficient size to collect and remove liquids from the sump and prevent liquids from backing up into the drainage layer. The design of each sump and removal system provides a method for measuring and recording the volume of liquids removed and the depth of leachate in the sump.

A secondary collection system is required to be provided and be capable of detecting, collecting, and removing leaks of hazardous constituents at the earliest

practicable time through all areas of the top liner that are likely to be exposed to waste or leachate during the active life and postclosure care period.

The landfill operator is required to remove leachate from a burial cell as frequently as necessary to ensure that the leachate depth on the liner, excluding the sump, is not more than 1 foot, except after a significant storm event. The leachate depth on the liner is not allowed to be more than 1 foot for more than seven days after a significant storm event. A significant storm event is a storm that generates 0.1 inches or more of rainfall in 24 hours.

D. Leak Detection Systems

Each burial cell is required to have a leak detection system. For unmonitorable units, the secondary collection system is also a leak detection system. A response flow rate is established in the operating license for each landfill to evaluate the performance of a leak detection system.

If the average daily flow rate removed from the sump of a leak detection system is more than the action flow rate for that burial cell, the landfill operator is required to evaluate the chemical characteristics of liquid in the leak detection system by sampling and analyzing the system and evaluating for the presence of a leak by a statistical test, a trend analysis, or other means. Before solid waste is placed in any new burial cell that has a leak detection system, the landfill operator may, at his discretion, establish a baseline concentration of constituents in the secondary collection system based on an analysis of representative samples from the system.

The landfill operator must conduct required response actions if monitoring of the leak detection system determines that both of the following apply to liquid that is removed from the system:

- The average daily flow rate is more than the response flow rate that is established for the unit and
- The liquid contains hazardous substances indicative of leachate from the unit.

A landfill operator who is required to conduct response actions is required to take all of the following actions:

- Within seven days of a determination that the response flow rate has been exceeded, notify the State of Michigan, in writing, that the response flow rate has been exceeded,

- Submit a preliminary written assessment to the State of Michigan within 14 days of a determination that the response flow rate has been exceeded. A preliminary written assessment is required to include all of the following information for the landfill cell in which the response flow rate was exceeded:
  - The amount of liquids removed from the leak detection system,
  - The likely sources of liquids, including the depth of leachate in the leachate collection system,
  - The possible location, size, and cause of any leaks, and
  - The short-term actions taken and planned.
- Determine, to the extent practicable, the location, size, and cause of any leak.
- Determine whether waste receipt should cease or be curtailed, whether any waste should be removed from the landfill cell for inspection, repairs, or controls, and whether or not the cell should be closed.
- Determine any other short-term and longer-term actions to be taken to mitigate or stop any leaks.
- After a determination that the response flow rate has been exceeded, and for as long as the flow rate in the system exceeds the response flow rate, the landfill operator is required to submit to the State of Michigan, within 30 days of the end of the calendar quarter, a report that summarizes the results of any remedial actions taken and planned.
- To make the leak or remediation determinations required, the landfill operator is required to do all of the following:
  - Assess the source of liquids and amounts of liquids by source,
  - Conduct a fingerprint, hazardous constituent, or other analysis of the liquids in the system to identify the source of liquids and possible location of any leaks and the hazard and mobility of the liquid, and
  - Assess the seriousness of any leaks in terms of potential for escaping into the environment or document why the assessments are not needed.

E. Daily Six-Inch Interim Soil Covers

The landfill operator is required to cover disposed of solid waste with 6 inches of earthen material at the end of each operating day or at more frequent intervals, if necessary, to control disease vectors, fires, odors, blowing litter, and scavenging. If clay or other low-permeability material is used as daily cover, then the operator is required to scrape back the previous day's cover to allow the free movement of liquids and gases through the landfill.

If an active burial cell will lie idle for a period of three months or more before additional lifts are constructed, the landfill operator is required to place 1 foot of compacted cover, which may include the 6-inch daily cover, on the surface to minimize nuisance conditions.

F. Explosive Gas Control and Monitoring

The landfill operator is required to ensure that the concentration of methane gas generated by the facility is not more than 25 percent of the lower explosive limit for methane in facility structures, excluding gas control or recovery system components, and the leachate collection system and that the concentration of methane gas is not more than the lower explosive limit at or beyond the facility property boundary. To demonstrate compliance with this requirement the landfill operator is required to implement a routine methane monitoring program.

G. Groundwater Monitoring

Detection monitoring is required at all required groundwater monitoring wells. At a minimum, a detection-monitoring program for a landfill is required to include monitoring for all of the following constituents:

- The listed primary indicators and pH, at least quarterly during the active life and semiannually during the postclosure period and
- The following constituents listed at least semiannually during the active life of the facility and the postclosure period:
    - Heavy metals that are listed,
    - Listed primary volatile organic constituents, and
    - Listed secondary organic constituents.

The landfill operator of a cell that contains a secondary collection system may conduct sampling and analysis for listed primary indicators in place of the heavy metals if all of the following conditions are met:

- Leachate monitoring shows that the concentration of all of the indicators in leachate is not less than ten times the concentration in groundwater and

- Secondary collection system monitoring shows all of the following:

  - That the allowable flow rate has not been exceeded,

  - That the concentration of two or more indicators in the system is not more than the following threshold values for two consecutive sampling events:

    - For chlorides, 250 mg/l,
    - For iron, 0.3 mg/l,
    - For sulfates, 250 mg/l,
    - For total inorganic nitrogen, 10 mg/l, and
    - For total dissolved solids, 500 mg/l.

  - That listed volatile organics have not been detected in the secondary collection system,

  - That the listed concentration of metals has not exceeded 1/10 the specified value,

- The unit is a monitorable unit, and

- The concentration of the indicators in groundwater is normally distributed.

Assessment monitoring is required at a landfill if a statistically significant increase over background has been detected for one or more of the listed constituents.

Within 90 days of the triggering of an assessment monitoring program, and annually thereafter, the landfill operator is required to sample and analyze the groundwater for all constituents listed in 40 CFR part 258, Appendix II. A minimum of one sample from each downgradient well is required to be collected and analyzed during each sampling event. For any constituent that is detected in the downgradient wells as a result of the complete Appendix II constituent analysis, a minimum of four independent samples from each background and downgradient well are required to be collected and analyzed to establish background for the constituents.

H. Surface and Groundwater Performance

Operation of a State of Michigan licensed landfill is not allowed to cause a discharge of pollutants into waters of the United States, including wetlands, that is in violation of any of the requirements of the federal clean water act, including the national

pollutant discharge elimination system (NPDES) requirements under Section 402 of the Federal Clean Water Act. Also, the landfill is not allowed to cause the discharge of a nonpoint source of pollution to waters of the United States, including wetlands, that is in violation of any of the requirements of an areawide or statewide water quality management plan that has been approved under Section 208 or 319 of the Federal Clean Water Act.

To demonstrate compliance with these requirements, the landfill operator is required to conduct a surface water-monitoring program approved by the State of Michigan for any surface water that may receive run-off from the active work area. Monitoring results are required to be submitted to the State of Michigan not more than 30 days after the end of the calendar quarter.

I. Run-On and Run-Off Control Systems

Two systems are required to control the flow of rainwater over burial cells. A run-on control system is required to prevent flow onto the active portion of the landfill during the peak discharge from a 25-year, 24-hour storm. Also, a run-off control system from the active portion of the landfill is required to collect and control at least the water volume that results from a 24-hour, 25-year storm.

J. Final Cover Composite Liner

A final cover system is required to be installed on each burial cell which is designed to minimize infiltration and erosion and which is comprised of an erosion layer underlain by an infiltration layer. The final cover system is required to be comprised of the following components:

- An infiltration layer that is comprised of either a minimum of 18 inches of earthen material that has a permeability which is less than or equal to 1.0×10^{-5} cm/sec or a bentonite geocomposite liner which is underlain by not less than 18 inches of earthen material to protect the liner from waste and minimize the effect of settlement.

- An erosion layer that consists of both a soil layer which is not less than 2 feet thick, which is immediately above the composite cover liner, and which is designed to do all of the following:

  - Provide for the lateral drainage of precipitation off the cover of the landfill,

  - Minimize frost penetration into the infiltration layer, and

- Protect the flexible membrane liner from root penetration, ultraviolet light, and other deleterious effects.

A minimum of 6 inches of earthen material capable of sustaining native plant growth is required to be placed over the final cover system. To prevent the ponding of water on completed fill surfaces, the grading contours are required to be sufficient to prevent the development of local depressions due to post construction settlement. Slopes of the final cover are required to be not less than four percent at any location.

IX. BURIAL PROCEDURES

Please refer to Section VIII, Nature of the Burial Site regarding the burial of BRP demolition debris at a State of Michigan licensed landfill facility.

X. RADIATION SAFETY PROCEDURES

BRP is currently conducting decommissioning activities under a Radiation Protection Program and implementing procedures that comply with NRC regulatory requirements contained in 10 CFR 20, Standards for Protection Against Radiation. The Radiation Protection Program and implementing procedures are a requirement of the BRP Defueled Technical Specifications 6.6.1 and 6.6.2. The NRC Region III Office routinely reviews the Radiation Protection Program and implementing procedures and their implementation.

Disposal of BRP demolition debris will be performed in accordance with the Radiation Protection Program and implementing procedures as applicable.

XI. RECORDKEEPING

Recordkeeping requirements for landfill disposal of demolition debris are specified in BRP procedures.

As a minimum, these records will include:

- Surface contamination monitoring reports and
- Bulk container assay records for each container which will include but not be limited to:
  - Date and time the assay was performed,
  - Source of the demolition debris,
  - Mass, volume and composition of the demolition debris,
  - Landfill destination for the demolition debris, and

- Assay results.

XII. ANALYSIS OF NO SIGNIFICANT ENVIRONMENTAL IMPACTS EVALUATION

Consumers Energy finds, in compliance with 10 CFR 50.82(a)(6)(ii), that activities associated with this application involve no significant environmental impacts. The following evaluation in conjunction with the foregoing discussion supports that finding.

A. Will the proposed activity result in significant environmental impacts not previously reviewed?

No significant environmental impacts are expected from the disposal of demolition debris with trace concentrations of licensed radioactive materials in a State of Michigan licensed landfill. Total volume of waste projected for Big Rock Point Plant decommissioning is 635,100 cubic feet including 72,100 cubic feet of radioactive waste and 563,000 cubic feet of demolition debris. In comparison, NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities" (GEIS) lists a volume for the reference boiling water reactor (BWR) of 662,500 cubic feet, including disposable containers.

Although the GEIS evaluation of waste disposal volumes did not address the removal and disposal of non-radioactive structures and materials beyond that necessary to terminate the NRC license, the volume of waste evaluated in the GEIS (662,500 cubic feet) exceeds the total waste volume (including demolition debris and radioactive waste) projected for Big Rock Point Plant decommissioning of 635,100 cubic feet.

Non-radiological environmental impacts evaluated in the GEIS included:

- Demography and human activities in the area,
- Hydrology,
- Aquatic resources/ecosystems in the area surrounding the plant site,
- Terrestrial resources,
- Endangered and threatened species,
- Land use,
- Air pollution control requirements,
- Water pollution control requirements,
- Hazardous materials and waste control,
- Occupational safety, and
- Public safety.

Radiological environmental impacts evaluated in the GEIS included:

- Occupational radiation exposure,
- Radiation exposure to the public,
- Radioactive waste management systems,
- Liquid radioactive effluents, and
- Airborne radioactive effluents.

The GEIS concludes that the major environmental impact of decommissioning is the commitment of small amounts of land for waste burial in exchange for reuse of the facility and site for other purposes. Since in many instances, such as at a reactor facility, the land is a valuable resource, return of this land to the commercial or public sector is highly desirable. Therefore, the GEIS evaluation bounds disposal of all BRP demolition debris including disposal of the demolition debris containing trace concentrations of licensed radioactive materials requested by this application.