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June 28, 2013  
TMI-13-041

10 CFR 50.51  
10 CFR 50.82

Attn: Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

Subject:  
Three Mile Island Nuclear Station, Unit 2  
Docket No. 50-320, Possession Only License No. DPR-73  
Post-Shutdown Decommissioning Activities Report Submittal

By letter dated August 14, 2012 (Accession No. ML12235A227), GPU Nuclear, Inc. (GPUN) notified the Nuclear Regulatory Commission (NRC) of the intent to submit a post-shutdown decommissioning activities report (PSDAR) for Three Mile Island Nuclear Station, Unit 2 (TMI-2). The letter also provided the date that GPUN intended to use as the date of permanent cessation of operations for TMI-2.

By letter dated February 13, 2013 (Accession No. ML12349A291), the NRC acknowledged GPUN's intended actions to be appropriate while noting that the timing of the TMI-2 PSDAR submittal did not meet the requirement to submit a PSDAR prior to or within two years of cessation of operations. This letter also established the date of permanent cessation of TMI-2 operations to coincide with License Amendment 45, dated September 14, 1993. The letter concluded that GPUN's intent to restore compliance with a 2013 submittal of a TMI-2 PSDAR to be of very low safety and security significance.

The attached PSDAR is provided to establish TMI-2 compliance with 10 CFR 50.82(a)(4), and recognizes September 14, 1993 as the established date for permanent cessation of TMI-2 operations. The current decommissioning plan will maintain TMI-2 in the post-defueling monitored storage state up to an additional 20 years to coincide with the end of the TMI-1 Operating License in order to synchronize decommissioning of TMI-1 and TMI-2.

FSMEZD

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If there are any questions or if additional information is required, please contact Mr. Gregory H. Halnon at (330) 436-1369.

Sincerely,

A handwritten signature in black ink, appearing to read 'Paul A. Harden', written over a white background.

Paul A. Harden  
President

Attachment:  
Three Mile Island Nuclear Power Station, Unit 2 Post-Shutdown  
Decommissioning Activities Report, June 2013

cc: NRC Region I Administrator  
NRC Senior Resident Inspector  
NRC Project Manager  
Director BRP/DEP  
Site BRP/DEP Representative

# Three Mile Island Nuclear Power Station, Unit 2 Post-Shutdown Decommissioning Activities Report

June 2013

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## I. INTRODUCTION

GPU Nuclear, Inc. (GPUN), acting for itself and for the Metropolitan Edison Company, Jersey Central Power and Light Company, and the Pennsylvania Electric Company, has developed this post-shutdown decommissioning activities report (PSDAR) for the Three Mile Island Nuclear Station, Unit 2 (TMI-2) in accordance with the requirements of 10 CFR 50.82, "Termination of license," paragraph (a)(4)(i).

TMI-2 has a possession only license (POL), and is currently maintained in accordance with the Nuclear Regulatory Commission (NRC) approved SAFSTOR condition (method in which a nuclear facility is placed and maintained in a condition that allows it to be safely stored and subsequently decontaminated) known as post-defueling monitored storage (PDMS). GPUN has maintained TMI-2 in the PDMS state since the NRC provisions for cleanup were met and accepted in 1993.

By letter dated August 14, 2012, GPUN informed the NRC of the TMI-2 status relative to the 1996 Decommissioning Rule changes specifically related to 10 CFR 50.51, "Continuation of license," and 10 CFR 50.82, "Termination of license." The letter stated the intent to submit a PSDAR that describes the planned decommissioning activities, schedule, cost estimates, and the environmental impacts of TMI-2 plant specific decommissioning. By NRC letter dated February 13, 2013, the NRC stated that September 14, 1993 is considered the date of TMI-2's cessation of operations.

The following PSDAR report is provided in accordance with the requirements in 10 CFR 50.82. The PSDAR includes:

- A description of the planned decommissioning activities,
- A schedule for their accomplishment,
- A site-specific decommissioning cost estimate including the projected cost of managing irradiated fuel, and
- A discussion that provides the reasons for concluding that the environmental impacts associated with site-specific decommissioning activities will be bounded by previously issued environmental impact statements.

Due to the unique nature of TMI-2, GPUN has included a Section II, "Background," in the PSDAR report to provide information on the design, history, and current status of the Three Mile Island Nuclear Station Unit 2. Sections III through V address the 10 CFR 50.82 requirements to describe and provide a

schedule and cost estimate for the planned decommissioning activities. Section VI provides the reasons for concluding that the activities planned for the decommissioning of TMI-2 are bounded by previously issued environmental impact statements. Section VII provides a list of references used in the PSDAR.

## II. BACKGROUND

TMI-2 is located on the northern-most section of Three Mile Island near the east shore of the Susquehanna River in Dauphin County, Pennsylvania. The station is comprised of two pressurized water reactors. The TMI Nuclear Station includes the operating Unit 1, owned by Exelon Generation Company, LLC (Exelon), and the shutdown Unit 2 owned by GPUN.

TMI-2 is a non-operational pressurized water reactor that was rated at a core thermal power level of 2772 megawatt-thermal with a corresponding turbine-generator gross output of 959 megawatt-electric. TMI-2 employed a two loop pressurized water reactor nuclear steam supply system designed by Babcock and Wilcox Corporation. The reactor coolant system is housed within a steel-lined, post-tensioned concrete structure (reactor building), in the shape of a right, vertical cylinder with a hemispherical dome and a flat, reinforced concrete basemat. A welded steel liner plate, anchored to the inside face of the reactor building, serves as a leak-tight membrane.

GPUN was issued an operating license for TMI-2 on February 8, 1978, with commercial operation declared on December 30, 1978. On March 28, 1979, the unit experienced an accident initiated by interruption of secondary feedwater flow.

The lack of secondary feedwater resulted in the reduction of primary-to-secondary heat exchange that caused an increase in the reactor coolant temperature, creating a surge into the pressurizer, and an increase in system pressure. The pressure operated relief valve (PORV) opened to relieve the pressure, but failed to close when the pressure decreased. The reactor coolant pumps were turned off and a core heat-up began as the reactor coolant system water inventory continued to decrease resulting in a reactor vessel water level below the top of the core. This led to a core heat up that caused fuel damage. The majority of the fuel material travelled down through the region of the southeastern assemblies and into the core bypass region. A portion of the fuel material passed around the bypass region and migrated down into the lower internals and lower head region, but overall reactor vessel integrity was maintained throughout the accident.

As a result of this accident, small quantities of core debris and fission products were transported through the reactor coolant system and the reactor building. In addition, a small quantity of core debris was transported to the auxiliary and fuel handling buildings. Further spread of the debris also occurred as part of the post-accident water processing cleanup activities.

The quantity of fuel remaining at TMI-2 is a small fraction of the initial fuel load; approximately 99 percent (%) was successfully removed in the defueling. Additionally, large quantities of radioactive fission products that were released into various systems and structures were removed as part of the waste processing activities during the TMI-2 Clean-up Program. The cleanup to meet the NRC post accident safe storage criteria was completed and accepted by the NRC with TMI-2 entering into post-defueling monitored storage in 1993.

NUREG-0683, "The Programmatic Environmental Impact Statement Related to Decontamination and Disposal of Radioactive Wastes Resulting from the March 28, 1979 Accident Three Mile Island Nuclear Station, Unit 2," Supplement 3 (PEIS) discusses the activities performed to achieve the PDMS state at TMI-2. The PEIS evaluates the activities associated with the post-accident cleanup for environmental impact, and addresses the significant amount of decontamination and waste removal that would normally be part of a decommissioning plan, which were completed to achieve PDMS.

Approximately 99% of the fuel was removed and shipped to the Idaho National Engineering and Environmental Laboratory (INEEL) under the responsibility of the Department of Energy (DOE). The reactor coolant system was decontaminated to the extent practical to reduce radiation levels to as low as is reasonably achievable (ALARA). As part of the decontamination effort, water was removed to the extent practical from the reactor coolant system and the fuel transfer canal, and the fuel transfer tubes were isolated. Radioactive wastes from the major clean-up activities have been shipped off-site or has been packaged and staged for shipment off-site.

Following the decontamination activities, only the reactor building and a few areas in the auxiliary and fuel handling buildings continued to have general area radiation levels higher than those of an undamaged reactor facility nearing the end of its operating life.

GPUN maintained TMI-2 in the PDMS state while successfully operating TMI-1 until AmerGen (a joint venture between Philadelphia Energy Company and British Energy) purchased the operating TMI-1 from GPUN in 1998. The sale of TMI-1 included the Unit 1 buildings, structures, and the majority of the site property; however GPUN maintained ownership of TMI-2. A monitoring agreement between AmerGen and GPUN provides for AmerGen performing certain functions at TMI-2

while TMI-2 is in PDMS on the behalf of GPUN. These functions include maintenance and testing, radiological and environmental controls, security and safety functions and licensing activities required by the PDMS Technical Specifications and PDMS Final Safety Analysis Report.

FirstEnergy acquired GPUN and ownership of TMI-2 in 2001 as part of a larger acquisition of GPU, and continued the monitoring agreement with AmerGen. In December 2003, Exelon acquired sole ownership of TMI-1. A 2004 site-specific cost estimate for decommissioning TMI-2 assumed a delayed DECON scenario, which deferred the decontamination and dismantling activities at TMI-2 until they are synchronized with TMI-1 such that the licenses for both units are terminated concurrently. This scenario assumed a 10-year dormancy period for TMI-2, following the TMI-1 original license expiration in 2014, with decommissioning preparation to begin in about 2024. The initial schedule assumed decommissioning operations would begin in about 2026, and would be completed over a 10-year period with site restoration projected in 2036. Since that time an extension to the TMI-1 operating license has been granted warranting a revision to the decommissioning schedule for TMI-2.

The NRC approved a 20-year extension to the TMI-1 Operating License by letter to Exelon dated October 22, 2009. As a result, the TMI-1 Operating License has been extended until April 19, 2034. The TMI-2 PSDAR establishes the schedule for the decommissioning of TMI-2 to commence following the expiration of the TMI-1 Operating License on April 19, 2034.

### III. DESCRIPTION OF DECOMMISSIONING ACTIVITIES

The objective of decommissioning TMI-2 is to safely perform all the activities associated with decontamination and dismantlement of the remaining plant systems, components, structures, and facilities in a cost effective manner. The decommissioning plan assumes that TMI-2 is effectively maintained in the current SAFSTOR mode of PDMS until the expiration of the TMI-1 operating license in 2034, which could extend through the period of spent fuel removal and storage from TMI-1. The decontamination and dismantling activities at TMI-2 will then be synchronized with the adjacent unit such that the licenses for both units are terminated concurrently.

The decommissioning plan for TMI-2 involves activities to address the higher source term materials to eliminate elements that would contribute to higher worker exposure during activities that are typical of decommissioning an operating plant at the end of plant life.



The decommissioning will focus on the use of both ultra high pressure water sprays and mechanical decontamination methods for the removal of the remaining high source term materials. Since the majority of the spent fuel has already been removed from site and transferred to a DOE facility, there is no need to construct an independent spent fuel storage installation (ISFSI) specific to TMI-2. GPUN will explore two options for storage and transfer of the remaining residual fuel and greater than class C (GTCC) waste. First, GPUN will work with the DOE to obtain authorization to transport the remaining fuel and GTCC waste to INEEL, where the majority of TMI-2 spent fuel is currently stored, or to an alternate storage or repository location designated by DOE, if available, by that time. If DOE storage options are not deemed viable, GPUN will explore an agreement with Exelon to have the remaining TMI-2 fuel and GTCC stored in the TMI-1 ISFSI until a DOE geological repository becomes operational.

Based on the above overall plan, the decommissioning of TMI-2 has been divided into the following periods:

- PDMS (SAFSTOR Dormancy)
- Preparations for Decommissioning
- Decommissioning Operations
- Non-radiological Restoration of the Site

The following provides a discussion of the decommissioning plan, the significant activities, and the general sequencing of activities in each of the above periods. The planning required for each decommissioning activity, including the selection process to perform the work, will be completed prior to the start of work for that activity.

#### Period 1: PDMS (SAFSTOR Dormancy)

The PDMS condition was established following the accident at TMI-2 to establish an inherently stable and safe condition of the facility such that there was no risk to the public health and safety. The PDMS state has been approved by the NRC and is governed by a PDMS Safety Analysis Report, PDMS Technical Specifications, and PDMS Quality Program.

The PDMS Technical Specification requirements to monitor and survey radiological conditions have been established and maintained since 1993. Site security is maintained as a contracted service by Exelon that owns and operates TMI-1.

As discussed in the TMI-2 PDMS Safety Analysis Report:

- There is no credible possibility of nuclear criticality.
- Fuel and core debris removed from the reactor vessel and associated systems has been shipped offsite.
- Any potential for significant release of radioactivity has been eliminated.
- Water has been removed to the extent practical from the reactor coolant system and fuel transfer canal, and fuel transfer tubes have been isolated. The treatment and processing of accident generated water has been completed.
- Radioactive waste from the major cleanup activities has been shipped off-site or has been packaged for shipment off-site.
- Radiation within the facility has been reduced, as necessary, consistent with ALARA principles to levels that will allow necessary plant monitoring activities, the performance of required maintenance, and any necessary inspections.

The PDMS dormancy period is expected to extend until the end of TMI-1 operating license in 2034, and could extend until completion of the TMI-1 spent fuel removal and storage campaign. In the event that circumstances dictate an earlier shut down of TMI-1, the expected TMI-2 PDMS dormancy period will be reduced, and the PSDAR will be revised to reflect a decommissioning schedule that maintains concurrent decommissioning with TMI-1.

#### Period 2: Preparations for Decommissioning

A decommissioning organizational structure and selected staff will be developed to identify roles, responsibilities, and accountabilities for the decommissioning preparations and decommissioning operations.

Preparations include the planning for the removal of the remaining residual fuel, decontamination of the structures, and dismantling the remaining equipment and facilities.

In preparation for actual decommissioning, activities that will be performed include:

- Conduct a characterization of the site and the surrounding environs. This includes radiation surveys of the reactor building including basement, elevator block wall area, areas surrounding major components, internal piping, and primary shield cores.
- Conduct radiation surveys of the auxiliary and fuel handling buildings with emphasis on areas with known and potential alpha contamination, and known fission products.
- Conduct radiation surveys and sample analysis on exterior buildings, land areas surrounding the facility, subsurface soil and groundwater.
- Develop specifications for transport and requirements for highly radioactive waste and hazardous waste.
- Develop procedures for occupational exposure control, control and handling of liquid and gaseous effluents, processing of radioactive waste, site security, emergency programs, and industrial safety.

### Period 3: Decommissioning Operations

The actual decommissioning and dismantlement of TMI-2 will occur during the period of decommissioning operations. Significant decommissioning activities to be performed during this period include, but are not limited to, those listed below. Some of the activities are unique to the decommissioning of TMI-2, but a number of these activities may be coordinated with Exelon as they may be needed to support the concurrent decommissioning of TMI-1.

- Construction of temporary facilities or modifications to existing facilities to support dismantlement activities.
- Design and fabrication of temporary and permanent shielding to support removal and transportation activities, construction of contamination control envelopes, and the procurement of specialty tooling.
- Procurement of shipping containers, cask liners, and industrial packages for packaging.

- Reconfiguration and modification of site structures and facilities as needed to support decommissioning operations. This may include the upgrading of roads and rail facilities to facilitate hauling and transport.
- Decontamination of components and structures as required to reduce source term and control (minimize) worker exposure.
- Inventory, decontamination, and removal of legacy equipment inventory left over from defueling campaign.
- Disassembly and segmentation of the remaining reactor vessel internals. Some internals are expected to exceed GTCC requirements. As such, the segments will be appropriately packaged for disposal.
- Removal of control rod drive housings and the head service structure from reactor vessel head.
- Segmentation of the reactor vessel head.
- Segmentation of the reactor vessel.
- Removal of the steam generators and pressurizer for material recovery and controlled disposal.
- Removal of the free standing concrete and other internal structures in the reactor building including: polar crane, biological shield, D-rings, floors, etc.

A license termination plan (LTP), in accordance with 10 CFR 50.82(a)(9), will be prepared at least two years prior to the anticipated date of license termination. The LTP will include a site characterization, description of remaining dismantling activities, plans for site remediation, updated cost estimate to complete the decommissioning, any associated environmental concerns, designation of the end use of the site, and the procedures for the final radiation survey. The LTP will be developed following the guidance contained in Regulatory Guide 1.179, "Standard Format and Content of License Termination Plans for Nuclear Power Reactors." As described in Regulatory Guide 1.179, the LTP will use the guidance contained in NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)" to develop the final radiological survey plan and survey methods. The use of MARSSIM to develop the final radiological survey plan and survey methods will demonstrate compliance with the requirements 10 CFR 20, Subpart E, "Radiological Criteria for License Termination." Once the LTP is approved, the final remediation of the site

facilities and services can commence. These activities include, but are not limited to:

- Removal of remaining plant systems and components as they become nonessential to the decommissioning program, or worker health and safety (for example, waste collection and processing systems, electrical power and ventilation systems).
- Removal of contaminated yard piping and any contaminated soil.
- Remediation and removal of the contaminated equipment and material from the auxiliary and fuel buildings, and any other contaminated facility.

Use of the NUREG-1575 guidance ensures that the surveys are conducted in a manner that provides a high degree of confidence that applicable NRC criteria are satisfied. Once the final survey is complete, the results are provided to the NRC. The NRC will terminate the license if it determines that site remediation has been performed in accordance with the LTP, and that the terminal radiation survey and associated documentation demonstrate that the facility is suitable for release.

#### Period 4 – Site Restoration

Following completion of decommissioning operations, site restoration activities will begin. Site restoration will involve the dismantling and disposal of any remaining non-radiological structures. Restored areas of the site will be backfilled, graded and landscaped to support vegetation for erosion control.

#### IV. SCHEDULE OF DECOMMISSIONING ACTIVITIES

The decommissioning plan for TMI-2 can be characterized as a delayed DECON approach. The schedule for decommissioning of TMI-2 is based on the assumption that TMI-2 will be decommissioned with TMI-1 to achieve economies of scale, by sharing costs between units, and coordinating the sequence of work activities.

The high level schedule for decommissioning of TMI-2 assumes that the PDMS SAFSTOR dormancy period will extend past the TMI-1 shutdown date to allow for TMI-1 ISFSI construction and spent fuel removal and storage. Prior to completion of the TMI-1 ISFSI program, the preparation for TMI-2 decommissioning will begin. As decommissioning approaches, schedule variations to account for availability of waste disposal facilities and coordination

with Exelon and vendors will be incorporated. It is not expected that these variations will impact the overall completion schedule.

The schedule for decommissioning of TMI-2 has been developed in order to achieve the termination of license by September 14, 2053. This termination date ensures compliance with the NRC requirement to complete decommissioning 60 years from certificate of cessation to operate as defined in 10 CFR 50.82(a)(3). In the event of any unforeseen circumstances that should warrant a request that TMI-2 license termination be allowed beyond September 14, 2053, GPUN will notify the NRC to request consideration of an exemption to the 60-year requirement as defined in 10 CFR 50.82(a)(3). As noted in letter from the NRC to GPUN dated February 13, 2013, the equivalent to the certificate of cessation of operations was determined to be the NRC's issuance of TMI-2 License Amendment 45, converting the TMI-2 operating license to a possession only license. This amendment was granted on September 14, 1993 and establishes that date as the date that TMI-2 is considered to have submitted certification of permanent cessation of operations. Upon receipt of NRC termination of license, site restoration activities will commence. It is estimated that the site restoration will take approximately one year to complete thereby rendering the Three Mile Island site restored to greenfield status in 2054.

Major milestones established for decommissioning of TMI-2 are listed in the table below.

MAJOR DECOMMISSIONING ACTIVITY	DATES
TMI-2 PDMS SAFSTOR Dormancy	1993 – 2043
TMI-1 Shutdown	April 19, 2034
TMI-2 Decommissioning Preparation	2043 – 2044
TMI-2 Decommissioning Operations	2044 – 2053
TMI-2 Site Restoration	2053 – 2054

#### V. ESTIMATED COSTS OF DECOMMISSIONING ACTIVITIES

In February 1996, TLG Services, Inc. completed the first TMI-2 site-specific decommissioning cost estimate that was developed for GPUN. That analysis was first updated in 2004 and has been further refined to reflect current assumptions pertaining to disposition of the nuclear unit and relevant industry experience in undertaking decommissioning projects.

The decommissioning activities for TMI-2 are a continuation of the decontamination efforts started in the 1980s. The cost estimate recognizes the present state of TMI-2 decontamination, contingency for unknown or uncertain conditions, the availability of

low and high level radioactive waste disposal sites, and site remediation requirements. The methodology used to develop the cost estimate follows the basic approach developed by the Atomic Industrial Forum (now the Nuclear Energy Institute) in AIF/NESP-036, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates." The method uses a unit cost factor approach, including application of work difficulty adjustment factors to develop decommissioning activity costs, and incorporates local information related to labor rates, as well as latest available industry experience. The unit factor method provides a demonstrable basis for establishing reliable cost estimates. The detail provided in the unit factors, including activity duration, labor costs (by craft), and equipment and consumable costs, ensures that essential elements have not been omitted.

The estimate presented herein is based upon the most recent update to the site specific cost estimate completed by TLG Services in January 2009, and provided to the NRC as part of the 10 CFR 50.75(f)(1), "Reporting and record keeping for decommissioning planning," submittal on March 29, 2010 (Accession No. ML 100960464).

Consistent with a signed memorandum of understanding between FirstEnergy Corp. (parent of GPUN) and Exelon regarding the timing of decommissioning activities at TMI-2, it is assumed that decommissioning at TMI-2 will not begin until the expiration of the TMI-1 operating license in 2034 and will be coordinated with post-shutdown activities for TMI-1. For the purpose of this cost estimate the integration of site security and the final site radiological survey between the two units is assumed.

There are a number of considerations that affect the method for decommissioning the TMI-2 site and the degree of restoration required. The cost estimate includes the considerations identified below.

The majority of the fuel was removed during the TMI-2 Cleanup Program's reactor vessel defueling effort that concluded in January 1990. Title to this fuel was transferred to the Department of Energy (DOE). The remainder of the fuel (about 1%) is dispersed within the primary system and to a lesser extent in other systems and structures. This residual material will be removed as radioactive waste. Therefore, the cost of managing irradiated fuel is not reflected within the estimates to decommission the TMI-2 site.

It is expected that there will be some wastes, (GTCC waste) generated in the decommissioning of TMI-2 that are not suitable for shallow land burial and therefore cannot be shipped for disposal until a high level waste repository is made available by DOE. Although the material is not classified as high-level

waste, the DOE has indicated they will accept this waste for disposal at the future high-level waste repository. However, the DOE has not developed an acceptance criteria or disposition schedule for this material, and numerous questions remain as to the ultimate disposal cost and waste form requirements. For purposes of the cost estimate, it is assumed that GTCC waste will be packaged and disposed of as high-level waste, at a cost of \$25,000 per cubic foot (in 2008 dollars). It is also assumed that the DOE will accept the GTCC material in a timely manner so as not to affect the TMI-2 decommissioning schedule. No additional costs are included for the temporary storage of GTCC material.

The decommissioning cost estimate for TMI-2 has been summarized in Table 1.

This PSDAR will not be updated for minor changes in anticipated decommissioning costs. However, the status of TMI-2 decommissioning funding will continue to be reported to the NRC in accordance with 10 CFR 50.75(f)(1) and 10 CFR 50.82(a)(8)(v). This report will include, at a minimum, the assumptions used in the rates of escalation of decommissioning costs and rates of earnings used in funding projections. Additionally, GPUN, in accordance with 10 CFR 50.82(a)(7), will inform the NRC in writing (with a copy sent to Pennsylvania), before performing any decommissioning activity inconsistent with or making any significant schedule change from those actions and schedules described in the PSDAR, including changes that significantly increase the decommissioning cost. GPUN will also include an updated site specific estimate of remaining decommissioning costs in the license termination plan in accordance with 10 CFR 50.82(a)(9)(ii)(F). The annual 10 CFR 50.75(f)(1) reports continue to demonstrate that the current fund balances are more than adequate to cover the expected future cost of decommissioning. In the event that future estimated costs or funding levels change significantly, GPUN will make the necessary adjustments to ensure that sufficient funds remain available for decommissioning.



**TABLE 1**  
**TMI-2 DECOMMISSIONING COST SUMMARY**  
(Thousands based on 2008 dollars)

<b>Decontamination</b>	<b>\$ 31,577</b>
<b>Removal</b>	<b>\$ 149,523</b>
<b>Packaging</b>	<b>\$ 17,232</b>
<b>Transportation, Off-site Waste Processing, and Disposal</b>	<b>\$ 204,189</b>
<b>Program Management</b>	<b>\$ 371,633</b>
<b>Miscellaneous Equipment</b>	<b>\$ 23,169</b>
<b>Insurance and Regulatory Fees</b>	<b>\$ 17,868</b>
<b>Other Decommissioning Costs</b>	<b>\$ 29,694</b>
<hr/>	
<b>Total Decommissioning Costs</b>	<b>\$ 844,885</b>
<i>(Based on 2008 Dollars)</i>	

## VI. ENVIRONMENTAL IMPACTS OF DECOMMISSIONING ACTIVITIES

10 CFR 50.82(a)(4)(i) requires that the PSDAR include "a discussion that provides the reasons for concluding that the environmental impacts associated with the site-specific decommissioning activities will be bounded by appropriate previously issued environmental impact statements ..." The potential environmental impacts associated with the proposed decommissioning activities for TMI-2 were compared with similar impacts given in the PEIS related to post-accident cleanup activities resulting from the March 28, 1979 accident; and with NUREG-0586, "Generic Environmental Impact Statement on Decommissioning of Nuclear Power Facilities," dated August 1988 and Supplement 1, Volumes 1 and 2, dated November 2002 (collectively known as GEIS) on decommissioning and radiological criteria for license termination. The following discussion provides the comparison.

### PEIS

The PEIS identified that the post-accident cleanup activities can be categorized into four fundamental activities:

1. Building and equipment decontamination,
2. Fuel removal and the reactor coolant system decontamination,
3. Treatment of radioactive liquids, and
4. Packaging, handling, shipment, and disposal of radioactive wastes

These activities were used in the evaluation of the alternatives to GPUN's proposed action of delayed decommissioning. As described in the PEIS, the NRC evaluated seven alternatives relative to delayed decommissioning. The NRC concluded (except for the no action alternative, which was not considered acceptable) that no alternative was found to be superior to GPUN's proposal from an environmental impact perspective.

Of the seven alternatives evaluated in the PEIS (except for the no action alternative) as well as the proposed GPUN's delayed decommissioning plan, the NRC concluded that each alternative could be conducted in conformance with applicable regulatory requirements and implemented without significant impact to the human environment. Hence, it is reasonable to conclude that the activities described for the TMI-2 decommissioning will be accomplished with no adverse environmental impacts based upon the following:

- The activities to be performed for decommissioning are equivalent to the activities performed during the post-accident cleanup evaluated in the PEIS,
- The radiation control techniques and decontamination methods since the post TMI-2 accident cleanup have improved,
- No site-specific activities pertaining to TMI-2 decommissioning would alter the conclusions of the PEIS,
- Radiation dose to the public will be minimal, and
- Radiation dose to decommissioning workers will be maintained ALARA according to 10 CFR Part 20.

As noted in the PEIS, the outcome of completing the clean-up activities at TMI-2 would result in many areas decontaminated to the point where general area dose rates approximate those in an undamaged reactor facility nearing the end of its operating life.

### GEIS

The remaining decommissioning activities for the delayed decommissioning of TMI-2 can be compared to the activities evaluated in the GEIS.

As a general matter, TMI-2 is smaller than the reference PWR used in NUREG-0586 to evaluate the environmental impacts of decommissioning, and is likewise smaller than a number of PWRs that were evaluated in NUREG-0586, Supplement 1.

Decommissioning activities are identified in Appendix E of NUREG-0586, Supplement 1. No activities planned for TMI-2 deviate from the activities listed in terms of environmental impact. A deviation exists in terms of the variables associated with transuranic fuel and higher source terms. However, these variables are addressed through controlled decontamination and dismantlement, and following NRC regulations associated with dose. So long as decontamination and dismantlement are performed within the guidelines of the regulations regarding release of effluents, occupational dose, and offsite dose; and GTCC waste is contained in approved shipping containers; the decommissioning activities at TMI-2 are directly comparable to the activities evaluated in the GEIS.

NUREG-0586, Supplement 1, Section 4.3, "Environmental Impacts from Nuclear Power Facility Decommissioning," provides a listing of 18 issues pertinent to the decommissioning of a reactor. A discussion of these issues follows.

#### 1. Onsite/Offsite Land Use

The GEIS concluded that the impacts on land use are not detectable or small for facilities having only onsite land-use changes as a result of large component removal, structure dismantlement, and low level waste packaging and storage. There are no anticipated changes in land use beyond the site boundary during decommissioning. Therefore, it can be concluded that the impacts on land use are bounded by the GEIS.

#### 2. Water Use

Since the shutdown of TMI-2 and the entry into the PDMS state, the demand for potable water has decreased significantly below the demand during operation. The operational demand for cooling water, makeup water, and service water has ceased. The demand for water needed to conduct plant decommissioning activities (flushing piping, hydro-lasing, dust abatement, etc.) will be less than the demand for water supply during operation. Hence, the impacts on water use are bounded by the GEIS.

#### 3. Water Quality - Non-Radiological

Programs and processes designed to minimize, detect, and contain spills will be maintained throughout the decommissioning process. Federal, state and local regulations, and permits pertaining to water quality will remain in effect, and no significant changes to water supply reliability are expected. Therefore, the impact of TMI-2 decommissioning on water quality is bounded by the GEIS.

#### 4. Air Quality

There are many types of decommissioning activities that have the potential to affect air quality. These activities are listed in the GEIS and evaluated from the perspective of the ability to mitigate consequences of activities through the use of high efficiency particulate filters. In addition, the release of any effluents must be controlled to keep contaminated material within the NRC's regulatory limits. For the purposes of assessing radiological impacts, impacts are of small significance if doses and releases do not exceed limits established by the NRC's regulations. GPUN does not anticipate any activities beyond those listed in the GEIS that could potentially affect air quality. Therefore, the impact of the TMI-2 decommissioning on air quality is bounded by the GEIS.

#### 5. Aquatic Ecology

GPUN does not anticipate disturbance of lands beyond the current operational areas of the plant. No alteration to the shores of the Susquehanna River will occur. All activities within the current operational areas of the plant will be conducted in accordance with required permits. Therefore, the impacts of decommissioning TMI-2 on aquatic ecology are bounded by the GEIS.

#### 6. Terrestrial Ecology

Terrestrial ecology considers the plants and animals in the vicinity of Three Mile Island as well as the interaction of those organisms with each other and the environment. Evaluations of impacts to terrestrial ecology are usually directed at important habitats and species, including plant and animals that are important to industry, recreational activities, the area ecosystems, and those protected by endangered species regulations and legislation. GPUN does not anticipate activities to be conducted that would disturb habitat beyond the operational areas of the plant. In addition, the Pennsylvania Department of Natural Resources controls impacts to the environment through regulation of construction activities. Therefore, the impacts of decommissioning TMI-2 on terrestrial ecology are bounded by the conclusions in the GEIS, which concludes the impact to be small.

#### 7. Threatened and Endangered Species

Of the state or federally listed endangered or threatened animal and plant species, only the bald eagle, the osprey, the peregrine falcon, and American holly were identified to have a presence on or near the island.

The bald eagle has recently been removed from the endangered species list but remains protected by two other federal laws. The Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act became effective in 2007. Bald

eagles have become relatively common along the Susquehanna River and have been known to nest in Dauphin, Lancaster, and York counties. Occasionally they have been observed on Three Mile Island, but there are no known nests on the island. There is a bald eagle nest located approximately 20 miles south, near Holtwood Dam.

The Susquehannah River and the associated environment and wetland areas in the vicinity of Three Mile Island are used by many migratory and resident bird species. Osprey and peregrine falcon nests are known to occur on Three Mile Island. Ospreys have nested on the meteorological tower every year since 2004. A 55-foot nesting platform was erected near the tower, but the ospreys have not used it. Peregrine falcons have nested on the TMI-1 Reactor Building since 2002. A nest box designed for peregrine falcons was placed on the TMI-2 reactor building in 2002, but the birds have not used it. Exelon regularly monitors the osprey and the peregrine falcon nests on Three Mile Island. The American holly, state-listed as threatened, has been recorded on the TMI-1 property.

Should the situation change and the identified species routinely be found in or around any of the TMI-2 buildings or property, it is GPUN's intent to notify the NRC and the Pennsylvania Department of Environmental Protection to evaluate the impact of decommissioning activities.

## 8. Radiological Occupational Dose

It is anticipated that low-level radioactive waste removed from TMI-2 will be disposed of at approved waste disposal sites, and that the disposal at local commercial landfills will be minimized in favor of low-level radioactive waste disposal to reduce the risk of inadvertent release of radiological material.

Radiation dose to the public is expected to remain below levels comparable to when TMI-2 was operating, through the continued application of radiation protection and contamination controls combined with the reduced source term available in the facility.

It is anticipated that an occupational dose estimate for the decommissioning of TMI-2 will be performed prior to the start of decommissioning activities based on confirmed characterization results of area contamination and activity levels.

Occupational dose will be limited to 5 rem/year total effective dose equivalent (TEDE) as required by 10 CFR 20.1201(a)(1)(i), and is expected to be administratively controlled to a lower TEDE limit to ensure that personnel doses do not exceed regulatory limits. It is also anticipated that administrative practices will result in equitable distribution of dose among available qualified workers to ensure collective dose to the work force is kept ALARA.

The decommissioning activities dose will be maintained within the regulatory limits, and as such, is consistent and within the conclusions of the GEIS

#### 9. Radiological Accidents

The likelihood of a large offsite radiological release that impacts public health and safety with TMI-2 in the PDMS state is considerably lower than the likelihood of a release from the plant during power operation. This is because the majority of the potential releases associated with power operation are not relevant after the fuel has been removed from the reactor.

GEIS, Supplement 1 also considers the possibility of a zircalloy fire. This accident is not relevant to TMI-2 in the current PDMS condition with approximately 99% of the fuel material having been removed from the site and sent to INEEL.

The potential for decommissioning activities to result in radiological releases not involving spent fuel (that is, releases related to decontamination and dismantlement activities) will be minimized by use of procedures designed to minimize the likelihood and consequences of such releases.

Therefore, GPUN concludes that the impacts of decommissioning on radiological accidents are small and bounded by the GEIS.

#### 10. Occupational Issues

GPUN will continue to maintain appropriate administrative controls and requirements to ensure occupational hazards are minimized and that applicable federal, state and local occupational safety standards and requirements continue to be met. GPUN has reviewed the occupational hazards and injuries in the GEIS and concluded that they are not unique or different than activities performed during construction and cleanup of TMI-2. Therefore, the impact of decommissioning TMI-2 on occupational issues is bounded by the GEIS.

#### 11. Cost

Decommissioning costs for TMI-2 are discussed in Section IV of the PSDAR report. The GEIS recognizes that an evaluation of decommissioning cost is not a National Environmental Policy Act requirement. Therefore, a bounding analysis is not applicable.

## 12. Socioeconomics

Decommissioning of TMI-2 is expected to result in positive socioeconomic impacts. As TMI-2 transitions from the PDMS state to a unit undergoing decommissioning, the potential for local employment to support decommissioning operations becomes available.

GPUN has reviewed the GEIS and has determined that the decommissioning of TMI-2 is bounded by the GEIS analysis of socioeconomic effects on the shutdown and decommissioning of an operating unit.

## 13. Environmental Justice

Executive Order 12898, dated February 16, 1994, directs Federal executive agencies to consider environmental justice under the National Environmental Policy Act. It is designed to ensure that low-income and minority populations do not experience disproportionately high and adverse human health or environmental effects because of federal actions.

Because the activities of the decommissioning plan create the potential for additional work opportunities, the decommissioning of TMI-2 could have a positive impact on environmental justice by providing job opportunities for lower income or minority populations around the area.

The decommissioning activities are bounded by the evaluation of the post accident clean up activities relative to socioeconomic and environmental justice. GPUN concludes that the employment opportunities created by decommissioning will have a positive impact on environmental justice and that no further evaluation of detrimental impacts is required.

## 14. Cultural, Historic, and Archeological Resources

The PEIS makes no mention of cultural, historic or archeological resources on Three Mile Island. In addition, GPUN expects that most decommissioning activities will be conducted within the protected areas of the site. As stated in the GEIS, where disturbance of lands beyond the operational areas is not anticipated, the impacts on cultural, historic and archeological resources are not considered to be detectable or destabilizing. GPUN has concluded that the impact of decommissioning TMI-2 on cultural, historic, and archeological resources to be bounded by the GEIS.

## 15. Aesthetic Issues

The impact of decommissioning activities on aesthetic resources will be temporary and remain consistent with the aesthetics of an industrial plant. After the decommissioning process is complete, site restoration activities will result in structures being removed from the site and the site being backfilled, graded and landscaped as needed. The removal of structures is generally considered beneficial to the aesthetic impact of the site. Therefore, GPUN has concluded that the impact of decommissioning TMI-2 on aesthetic issues is bounded by the GEIS.

## 16. Noise

General noise levels during the decommissioning process are not expected to be any more severe than during refueling outages and are not expected to present an audible intrusion on the surrounding community. Some decommissioning activities may result in higher than normal noise levels (that is, some types of demolition activities). However, these noise levels would be temporary and are not expected to present an audible intrusion on the surrounding community. Therefore, GPUN has concluded that the impact of decommissioning TMI-2 on noise is bounded by the GEIS.

## 17. Transportation

The GEIS states that NRC regulations are adequate to protect the public against unreasonable risk from the transportation of radioactive material and that the effects of transportation of radioactive waste on public health and safety are considered to be neither detectable nor destabilizing. The NRC analysis further determined that their consideration of the existing data for decommissioning methods and transportation modes should bound the transportation impacts for all decommissioning options for pressurized water reactors and boiling water reactors.

For the decommissioning of TMI-2, the transportation modes assumed are shielded container removal by rail or truck. The reactor vessel internal components are expected to be transported in spent fuel casks by rail. Other highly radioactive wastes will be transported in shielded containers via truck. The major transport mode for waste generated from filtering and demineralization of the reactor coolant system and the fuel transfer pool water is assumed to require shipment in shielded truck casks. The low level radioactive wastes requiring controlled disposal are expected to be sent to a waste processor or a low-level radioactive waste disposal facility via railroad.



The transportation impacts of decommissioning are dependent on the number of shipments to and from the plant, the types of shipments, the distance the material is shipped, and the radiological waste/fixed waste quantities and disposal plans. The estimated number and volume of shipments from the plant will be much smaller than shipments to the plant during decommissioning. The shipments from the plant would be primarily radioactive wastes and non-radioactive wastes associated with dismantlement and disposal of structures, systems and components.

GPUN must comply with applicable regulations when shipping radioactive waste, and the NRC has concluded in the GEIS that these regulations are adequate to protect the public against unreasonable risk from transportation of radioactive materials. In addition, shipments of waste from the site are not expected to result in measurable deterioration of affected roads or a destabilizing increase in traffic density.

Therefore, GPUN has concluded that the impact of decommissioning TMI-2 on transportation is bounded by the GEIS.

#### 18. Irreversible and Irretrievable Commitment of Resources

Irreversible commitments are commitments of resources that cannot be recovered, and irretrievable commitments of resources are those that are lost for only a period of time.

Uranium is a natural resource that is irretrievably consumed during power operation. After the plant is shutdown uranium is no longer consumed. The use of the environment (air, water, land) is not considered to represent a significant irreversible or irretrievable resource commitment but rather a relatively short-term investment. Since the decommissioning plan is to release the site for unrestricted use after license termination, land is not considered an irreversible resource. The only irretrievable resources that would occur during decommissioning would be materials used to decontaminate the facility (for example, rags, solvents, gases, and tools) and the fuel used for decommissioning activities and transportation of materials to and from the site. However, the use of these resources is minor.

Therefore, GPUN has concluded that the impact of decommissioning TMI-2 on irreversible and irretrievable commitment of resources is bounded by the GEIS.

### Additional Considerations

While not quantitative, the following considerations are also relevant to concluding that decommissioning activities will not result in significant environmental impacts not previously reviewed.

Significant cleanup of the TMI-2 facility has already been completed with approximately 99% of the fuel removed and shipped to INEEL.

Decontamination has been completed to the extent that further major decontamination programs are not justified on the basis of worker dose.

Prior to decommissioning, TMI-2 will be maintained in accordance with the NRC approved PDMS mode governed by the associated PDMS Technical Specifications, PDMS Quality Assurance Program, and PDMS Final Safety Analysis Report. As such, TMI-2 will be maintained in a condition of stability and safety such that there is minimal risk to public health and safety.

Radiation protection techniques used at the time of decommissioning are expected to improve over current practices and should ensure reduction in occupational exposure.

Site access control processes during decommissioning are expected to reduce the risk of public contamination due to trespassing.

### Conclusion

Based on the above discussion, the potential environmental impacts associated with decommissioning TMI-2 have already been postulated in and will be bounded by the previously issued environmental impact statements, specifically the PEIS, and the GEIS and its supplement. This is principally due to the following reasons:

- The postulated impacts associated with the decommissioning method chosen have already been considered in the PEIS and the GEIS, including its supplement.
- There are no unique aspects of TMI-2 or of the decommissioning techniques to be utilized that would invalidate the conclusions reached in the PEIS, and the GEIS and its supplement.

## VII. REFERENCES

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3. Masnik, M. T. (NRC) to Long, R. L. (GPU Nuclear) letter, "Issuance of Amendment No. 45 for Facility Operating License No. DPR-73 to Possession Only License for Three Mile Island Nuclear Station Unit 2 (TAC No. ML69115)," dated September 14, 1993
4. NUREG-0683, Supplement 3, "Programmatic Environmental Impact Statement Related to Decontamination and Disposal of Radioactive Wastes Resulting from March 28, 1979 Accident Three Mile Island Nuclear Station, Unit 2," Supplement 3, dated August 1989
5. TLG Services, Inc., "Decommissioning Cost Analysis for Three Mile Island Unit 2," dated September 2004
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7. Robinson, J. E. (NRC) to Gallagher, M. P. (Exelon Generation Company, LLC) letter, "Issuance of Renewed Facility Operating License No. DPR-50 for the Three Mile Island Nuclear Station, Unit 1," dated October 22, 2009
8. NUREG-0586, "Generic Environmental Impact Statements on Decommissioning and Radiological Criteria for License Termination," dated August 1988, and Supplement 1, Volumes 1 and 2, November 2002