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Trojan Nuclear Plant License Termination Plan Development Project

Technical Report

Trojan Nuclear Plant License Termination Plan Development Project

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REPORT SUMMARY

This report provides a concise account of the development of the first License Termination Plan in the nuclear industry to receive Nuclear Regulatory Commission (NRC) approval. The report includes details of significant challenges encountered during preparation and NRC review of the License Termination Plan, and discussion of how the utility addressed these challenges.

Background

The Trojan Nuclear Plant (TNP) was a 3,411 MWt/1,1130 MWe, four-loop pressurized water reactor (PWR) which was shut down for the last time on November 9, 1992. On January 27, 1993, after approximately 17 years of operation, Portland General Electric (PGE) notified the NRC of its decision to permanently cease power operations. The NRC amended the TNP Facility Operating License (NPF-1) to a Possession Only License on May 5, 1993. On October 7, 1993, PGE transmitted an updated Safety Analysis Report for the Defueled Condition (DSAR).

PGE submitted a proposed TNP Decommissioning Plan in accordance with NRC rule 10 CFR 50.82, "Application for Termination of License." They also submitted a Supplement to the Environmental Report on January 26, 1995, and the NRC approved both reports on April 15, 1996. The 1996 revision of rule 10 CFR 50.82 added a new requirement for power reactor licensees to develop and submit for NRC approval a license termination plan, either prior to or with the licensee's application for license termination, at least two years before termination of the license date. Therefore, PGE developed the TNP License Termination Plan to satisfy the requirements of 10 CFR 50.82.

Objective

To describe the experience and lessons learned in the development of the license termination plan for Trojan Nuclear Plant

Approach

PGE prepared the Trojan Nuclear Plant License Termination Plan in accordance with the requirements of 10 CFR 50.82 "Termination of License." It was also prepared with the guidance provided in Regulatory Guide 1.179, *Standard Format and Content of License Termination Plans for Nuclear Power Reactors*, and NUREG-1700, *Standard Review Plan for Evaluating Nuclear Power Reactor License Termination Plans*. The utility developed the TNP License Termination Plan to be consistent in format and content with the guidance provided in NRC's NUREG-1727, *NMSS Decommissioning Standard Review Plan*. In accordance with 10 CFR 50.82 (a)(9), PGE developed the TNP License Termination Plan to describe the process by which they will complete decommissioning and release the TNP site for unrestricted use.

Results

On February 12, 2001, the NRC approved the TNP License Termination Plan. The NRC issued its approval via an amendment to TNP License No. NPF-1, such that the TNP license incorporates the License Termination Plan into a new license condition. The new license condition includes provisions that, if met, would allow changes to the approved TNP License Termination Plan without prior NRC approval.

This report describes the lessons learned during the development of the plan, including the need to maintain close communication with NRC. Since the guidelines were relatively new, the NRC had not finalized all of the associated guidance documents, resulting in sometimes limited guidance and direction.

EPRI Perspective

One of the goals of the EPRI Decommissioning Technology Program is to capture the growing utility experience in nuclear plant decommissioning activities, for the benefit of other utilities that will face similar challenges in the future. Several nuclear utilities are currently preparing license termination plans and/or have submitted license termination plans to the NRC for approval. Still others are approaching the point at which preparation and submittal of a license termination plan is required in the near future. The experience gained and lessons learned from the account provided in this report will assist others in the nuclear utility industry in developing a license termination plan that meets NRC regulatory requirements and guidance expectations. EPRI will publish three other documents relating to license termination in 2002. These involve a review of recent utility experiences with license termination plans (TR-1003426), a guide to radiological elements of license termination (TR-1003196) and a review of the use of probabilistic methods for decommissioning dose analysis (TR-1006959). The proceedings of a workshop on license termination and site release, held in October 2001, are also available in *Decommissioning: License Termination and Final Site Release* (TR-112871).

Key Words

Decommissioning
Decommissioning plan
Final survey
License termination
License termination plan
Site characterization

ABSTRACT

This report provides a concise, yet comprehensive account of the development of the Trojan Nuclear Plant (TNP) License Termination Plan, which was the first license termination plan in the nuclear industry to receive Nuclear Regulatory Commission (NRC) approval. It is hoped that the experience gained and lessons learned from the account provided in this report may assist others in the nuclear utility industry in developing a license termination plan that meets NRC regulatory requirements and guidance expectations.

By letter VPN-007-99, dated March 10, 1999, PGE forwarded to the NRC the proposed TNP License Termination Plan. This letter also transmitted to the NRC License Change Application (LCA) No. 247, which requested amendment of the TNP License to authorize implementation of the TNP License Termination Plan. The TNP License Termination Plan was approved by the NRC on February 12, 2001, almost two years following the initial submittal. During this approximately two year period, numerous telephone conferences, meetings, and written communications (e.g., requests for additional information, etc.) between PGE and the NRC Staff occurred to resolve the many issues that arose during the NRC's review. This report details the more significant issues and how they were resolved.

The issues encountered during the development of the TNP License Termination Plan primarily were the result of the fact that the regulation requiring license termination plans was relatively new, as was the associated guidance (as stated previously, much of the guidance was not finalized at the point that the TNP License Termination Plan was being prepared), and the NRC was still in the formative stages of decision making with respect to some of the major issues and concepts of license termination and, in particular, final survey plans. The transfer of oversight and review authority of power reactor final survey and license termination plans from the Office of Nuclear Reactor Regulation (NRR) to the Office of Nuclear Material Safety and Safeguards (NMSS), and the new concepts and methodologies introduced by the new Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) approach, only compounded the magnitude of these issues. However, by the time the NRC approved the TNP License Termination Plan in early-2001, many of these issues had been resolved.

Issues surrounding understanding and interpreting the concepts and methodologies introduced by the new MARSSIM approach have continued to be addressed since receipt of the NRC's approval of the TNP License Termination Plan, and as PGE has continued to implement the approved TNP License Termination Plan. Continual improvements in communication between PGE and the NRC Staff during the TNP License Termination Plan development and approval process fostered hopes for a smooth and continued resolution of license termination issues. However, these improvements in communication have deteriorated since receipt of NRC approval of the TNP License Termination Plan, such that any questions and/or concerns regarding implementing the approved TNP License Termination Plan once again require a

lengthy process of formal written communications. This setback is largely attributed to the loss of experience and lessons learned on the NRC's part as a result of personnel changes in the NRC (NMSS) Staff responsible for oversight of TNP license termination and final survey implementation.

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INTRODUCTION

1.1 Purpose

This report provides a concise, yet comprehensive account of the development of the Trojan Nuclear Plant (TNP) License Termination Plan, which was the first license termination plan in the nuclear industry to receive Nuclear Regulatory Commission (NRC) approval. It is hoped that the experience gained and lessons learned from the account provided in this report may assist others in the nuclear utility industry in developing a license termination plan that meets NRC regulatory requirements and guidance expectations.

1.2 Background

1.2.1 TNP Operating History

TNP is located along the bank of the Columbia River in Columbia County, Oregon, approximately 42 miles north of Portland, Oregon. TNP is jointly owned by Portland General Electric Company (PGE), 67.5 percent; the City of Eugene, 30 percent through the Eugene Water and Electric Board (EWEB); and Pacific Power and Light/PacifiCorp (PP&L), 2.5 percent. PGE is the majority owner and has responsibility for operating and maintaining the TNP. The Bonneville Power Administration, a power marketing agency under the United States Department of Energy, is obligated through Net Billing Agreements to pay costs associated with EWEB's share of TNP, including decommissioning and spent fuel management costs.

TNP, Docket 50-344, achieved initial criticality in December 1975 and began commercial operation in May 1976. The reactor output was rated at 3,411 MWt with an approximate net electrical output rating of 1,130 MWe. The nuclear steam supply system was a four-loop pressurized water reactor designed by Westinghouse Electric Corporation.

TNP was shut down for the last time on November 9, 1992. On January 27, 1993, after approximately 17 years of operation, PGE notified the NRC of its decision to permanently cease power operations. The owners' decision was predicated on both financial and reliability considerations. The NRC amended the TNP Facility Operating License (NPF-1) to a Possession Only License on May 5, 1993.

1.2.2 Plant Closure Activities

On July 31, 1993, PGE submitted to the NRC a request to revise the TNP Technical Specifications to reflect the permanently defueled status of the plant. That request was supplemented by PGE on March 8, 1994. On March 31, 1995, the NRC issued Amendment No. 194 to Facility Operating (Possession Only) License NPF-1. This amendment revised the TNP Technical Specifications to reflect the permanently defueled condition of the plant. The revised TNP Technical Specifications, or Permanently Defueled Technical Specifications (PDTS), incorporate regulatory requirements and operating restrictions to ensure the safe storage of spent fuel in the Spent Fuel Pool. On October 7, 1993, PGE transmitted an updated Safety Analysis Report for the Defueled Condition (DSAR).

In accordance with the then-current version of 10 CFR 50.82 that governs decommissioning and termination of licenses, on January 26, 1995, PGE submitted to the NRC an application for termination of the TNP License. This application was accompanied by a proposed TNP Decommissioning Plan and Supplement to the Environmental Report, which were approved by the NRC on April 15, 1996. Prepared using the guidance provided in Draft Regulatory Guide DG-1005, "Standard Format and Content for Decommissioning Plans for Nuclear Reactors," the TNP Decommissioning Plan discusses TNP decommissioning methodology and organization; estimated costs and available funds; major tasks and schedules; and protection of occupational and public health and safety, including site characterization, radiation protection, waste management, and analyses of hypothetical decommissioning events. It also addresses a number of additional areas and programs such as quality assurance, fire protection, and physical security provisions. Reflecting the choice of "DECON" as the decommissioning alternative at TNP, the objective of the Decommissioning Plan is to demonstrate TNP can be decommissioned in a safe manner and to describe plans for demonstrating the facility and site meet the criteria for release for unrestricted use.

1.2.3 Overview of TNP Decommissioning

As described in the TNP Decommissioning Plan approved by the NRC on April 15, 1996, TNP decommissioning is divided into two broad periods: a Transition Period and a Decontamination and Dismantlement Period. The Transition Period began with permanent plant shutdown in January 1993 and will continue until spent fuel is transferred to an on-site Independent Spent Fuel Storage Installation (ISFSI) . The Decontamination and Dismantlement Period will begin once the spent fuel is transferred to the ISFSI. Site restoration will begin following termination of the 10 CFR 50 license and involves the final disposition of structures, systems, and components.

1.2.3.1 Transition Period

As of the date of this report, the Transition Period of TNP decommissioning is nearing completion. PGE continues to maintain systems and components required to support decommissioning and spent fuel storage in accordance with the Facility Operating (Possession Only) License NPF-1 and administrative procedures. The facility currently is maintaining its spent fuel in the Spent Fuel Pool and undergoing active decontamination and dismantlement and

activities in accordance with the approved TNP DSAR and the Decommissioning Plan and License Termination Plan. Final survey of areas for which remediation has been completed has also begun.

A concurrent effort is underway to complete the construction of an ISFSI at the Trojan site to facilitate decommissioning of the TNP. Fuel transfer to the ISFSI is planned to begin in 2002. The completion of fuel transfer to the ISFSI will allow the removal or decontamination in place of systems and components that support the Spent Fuel Pool or wet fuel storage, including the Spent Fuel Pool itself.

Removal of the four steam generators and pressurizer has been completed. These components were disposed of at the US Ecology low level radioactive waste disposal facility near Richland, Washington. During 1999, the reactor vessel with internals intact (reactor vessel package) was also transported for disposal at US Ecology. Removal of the reactor vessel package from the 10 CFR 50 licensed area of the TNP site eliminated approximately 2 million curies of activity from the TNP. Not including the spent nuclear fuel that will be transferred to the ISFSI, removal of the reactor vessel and internals resulted in elimination of greater than 99 percent of the remaining radioactivity (curies) at the TNP facility.

1.2.3.2 Decontamination and Dismantlement Period

Once the spent fuel is transferred to the ISFSI, the Transition Period ends and the Decontamination and Dismantlement Period begins. Major activities planned during the Decontamination and Dismantlement Period include removing the remaining contaminated systems and components, and continuing the decontamination of structures and final radiation surveys. The final surveys are performed to demonstrate that radiological conditions at TNP satisfy the final site release criteria of 10 CFR 20.1402 to support unrestricted release of the TNP site and license termination.

2
REGULATORY REQUIREMENTS GOVERNING LICENSE TERMINATION

2.1 Revised Regulation Governing License Termination (10 CFR 50.82)

As stated above, on January 26, 1995, PGE submitted to the NRC a proposed TNP Decommissioning Plan and Supplement to the Environmental Report, which were approved by the NRC on April 15, 1996. The TNP Decommissioning Plan was submitted and approved in accordance with the NRC's rule governing decommissioning and termination of license, 10 CFR 50.82. Less than four months after the NRC approved the TNP Decommissioning Plan, a final rulemaking was issued (61 FR 39278 dated July 29, 1996) that revised 10 CFR 50.82 such that power reactor licensees no longer were required to submit decommissioning plans. The revised rule, effective August 28, 1996, replaced the requirement for power reactor licensees to submit a detailed decommissioning plan with a new requirement to submit a post-shutdown decommissioning activities report (PSDAR), of much less detail than the previously required decommissioning plan, either prior to or within 2 years following permanent cessation of operations. For nuclear plants such as the TNP that already maintain an approved decommissioning plan, the revised 10 CFR 50.82 specified that the approved decommissioning plan is considered to be the PSDAR.

The revised rule also added a new requirement for power reactor licensees to develop and submit a license termination plan, either prior to or with the licensee's application for license termination, for NRC approval at least two years before termination of the license date. This requirement is similar to what had been required in the previous version of 10 CFR 50.82 for submission of a proposed decommissioning plan. In fact, much of the content required to be in the TNP License Termination Plan under the 1996 revision of 10 CFR 50.82 was already incorporated into, and thus redundant with, that of the TNP Decommissioning Plan submitted and approved under the previous revision of 10 CFR 50.82. Nevertheless, the 1996 rulemaking did not exempt plants with approved decommissioning plans from the requirement to submit a license termination plan.

2.2 License Termination Plan Requirements

The regulatory requirements governing submittal, NRC approval, and implementation of a license termination plan are contained in 10 CFR 50.82(a)(9), (10), and (11). As indicated in Section 3.1 of this report, 10 CFR 50.82(a)(9) contains the specific requirement to submit a license termination plan, and specifies the timing and contents of this submittal.

As indicated in Section 3.2.1 of this report, 10 CFR 50.82(a)(10) provides general criteria that a proposed license termination plan must satisfy in order to gain NRC approval, and also specifies that NRC approval must be in the form of a license amendment with conditions and limitations, as necessary.

As indicated in Section 3.1 of this report, 10 CFR 50.82(a)(11) contains requirements for implementation of an approved license termination plan, including the final survey plan incorporated into it, such that the NRC would allow termination of the license.

2.3 Format and Content of License Termination Plans

General requirements for the content of license termination plans are codified in 10 CFR 50.82(a)(9)(ii)(A) through (G), as follows:

> *(iii) The license termination plan must include –*
> *(A) A site characterization;*
> *(B) Identification of remaining dismantlement activities;*
> *(C) Plans for site remediation;*
> *(D) Detailed plans for the final radiation survey;*
> *(E) A description of the end use of the site, if restricted;*
> *(F) An updated site-specific estimate of remaining decommissioning costs; and*
> (G) *A supplement to the environmental report, pursuant to §51.53, describing any new information or significant environmental change associated with the licensee's proposed termination activities.*

Supplementing these requirements is guidance for license termination plan format and content provided in Regulatory Guide (RG) 1.179, "Standard Format and Content of License Termination Plans for Nuclear Power Reactors;" NUREG-1700, "Standard Review Plan for Evaluating Nuclear Power Reactor License Termination Plans;" and NUREG-1727, "NMSS Decommissioning Standard Review Plan."

As indicated above, a proposed license termination plan is required by 10 CFR 50.82 (a)(9)(ii)(D) to include a final survey plan. In addition to the guidance documents cited above that provide general direction for the contents of the final survey plan, other guidance documents have been published that provide much more specific direction for the final survey design and implementation methodology. These guidance documents are discussed further in Section 3.3.5 of this report.

3
LICENSE TERMINATION PLAN DEVELOPMENT

3.1 Scheduling the License Termination Plan Submittal

In late-1998, TNP decommissioning had progressed to the point at which remediation of many areas of the TNP facility was nearing completion. Construction of an on-site ISFSI was also progressing, with transfer of spent nuclear fuel from the Spent Fuel Pool to the ISFSI storage casks, removal and/or remediation of remaining contaminated systems and components, and completion of final radiation surveys scheduled to support the termination of the TNP License by the end of 2002.[1] Thus, in late-1998, termination of the TNP License was anticipated in approximately 4 years. To support this schedule, the requirements of 10 CFR 50.82 were reviewed to ensure that the schedule, format, and content requirements associated with 10 CFR 50.82(a)(9) submittals would be met.

10 CFR 50.82(a)(9) states, in part:

> *(9) All power reactor licensees must submit an application for termination of license. The application for termination of license must be accompanied or preceded by a license termination plan to be submitted for NRC approval.*
>
> *(i) The license termination plan must be a supplement to the FSAR or equivalent and must be submitted at least 2 years before termination of the license date.*

10 CFR 50.82(a)(11) states:

> *(11) The Commission shall terminate the license if it determines that –*
>
> *(i) The remaining dismantlement has been performed in accordance with the approved license termination plan, and*
>
> *(ii) The terminal radiation survey and associated documentation demonstrates that the facility and site are suitable for release in accordance with the criteria for decommissioning in 10 CFR part 20, subpart* E.

From a review of these requirements, it was clear that the NRC could not take any meaningful action on an application for termination of the TNP License until well after the TNP License Termination Plan was approved. Specifically, 10 CFR 50.82(a)(11) specifies that the NRC's approval of an application for license termination is predicated on their review of documentation that would not exist until some period of time following NRC approval of a license termination plan. Thus, PGE determined that the proposed TNP License Termination Plan submittal would precede the application for termination of the TNP License. Furthermore, PGE's application for termination of the TNP License, to be submitted towards the completion of final survey

[1] The resolution of design issues associated with the Trojan ISFSI storage canister has since extended the TNP license termination schedule.

activities, would forward summary documentation as necessary to assist the NRC in verifying that the provisions of 10 CFR 50.82(a)(11)(i) and (ii) were satisfied.

With regard to submittal of the proposed TNP License Termination Plan, and with consideration for the goal in late-1998 of terminating the TNP License by the end of 2002, the "at least 2 years before termination of the license date" requirement of 10 CFR 50.82(a)(9)(i) meant that the proposed TNP License Termination Plan would need to be submitted no later than late-2000. Even allowing up to nine months to prepare the proposed TNP License Termination Plan, starting the effort to prepare this submittal at the beginning of 2000 would have allowed sufficient time to meet the schedule requirements of 10 CFR 50.82(a)(9)(i). However, another consideration for deciding when to submit the proposed license termination plan was related to the need to commence final surveys, and the risk associated with starting such activities without having received NRC approval of the final survey design and implementation methodology.

Specifically, as of late-1998, dismantlement and remediation of many areas of the TNP site had progressed to the point that they were nearly ready to undergo final surveys, but a detailed final survey plan had not yet been approved by the NRC. To proceed with final survey activities prior to NRC approval of a final survey plan detailing the accepted survey design and implementation methodology would represent undesirable economic risk. The final survey plan description that had been incorporated into the approved TNP Decommissioning Plan had deferred the submittal of survey design and methodology details to later in the decommissioning process when these details would be more tangible. Upon PGE inquiry, the NRC Staff made clear to TNP management that a proposed final survey plan would only be reviewed and approved if it were submitted as part of a proposed license termination plan pursuant to 10 CFR 50.82(a)(9)(ii). Thus, it was determined in late-1998 that submittal of the TNP License Termination Plan should be completed as soon as possible to allow for the commencement of final survey activities under an NRC-approved final survey plan. Based on the above considerations, planning and preparation of the proposed TNP License Termination Plan were begun in December 1998.

3.2 Planning the Proposed TNP License Termination Plan Submittal

10 CFR 50.82(a)(9)(ii)(A) through (G) stipulate general topics that must be included in a proposed license termination plan. However, other regulatory requirements exist that must be considered in preparing a license termination plan submittal. The most significant of these is 10 CFR 50.82(a)(10), which requires NRC approval of a license termination plan by license amendment. Thus, a license change application (LCA), including a "No Significant Hazards Consideration" determination pursuant to 10 CFR 50.92, is also required to be submitted with a proposed license termination plan.

10 CFR 50.82(a)(9)(i) requires that the proposed license termination plan be submitted as a supplement to the FSAR or equivalent. This requirement introduces additional distribution and copy requirements contained in 10 CFR 50.4(b)(6).

3.2.1 License Change Application for the Proposed TNP License Termination Plan

In developing the LCA, designated LCA 247, that would be submitted with the proposed TNP License Termination Plan, the requirements of 10 CFR 50.82(a)(10) were considered, as follows:

> *…the Commission shall approve the plan, by license amendment, subject to such conditions and limitations as it deems appropriate and necessary and authorize implementation of the license termination plan.*

Thus, a new license condition was proposed in LCA 247 for TNP License No. NPF-1. The new license condition incorporated the above stipulations of 10 CFR 50.82(a)(10), with what were considered to be prudent (proposed) "conditions and limitations" on making changes to the TNP License Termination Plan without prior NRC approval. The draft conditions and limitations in the initial proposed TNP License Termination Plan submittal, specifically LCA 247, were similar to those that had been and continue to exist for making changes to the approved TNP Decommissioning Plan without prior NRC approval. However, the limitations on changes to the approved TNP Decommissioning Plan had been incorporated into the decommissioning plan itself, rather than being in the TNP License. With indications from the NRC Staff that these conditions for the TNP License Termination Plan would need to be part of the TNP license, the following license condition authorizing implementation of the TNP License Termination Plan was proposed[2]:

(11) License Termination

The licensee shall implement and maintain in effect all provisions of the approved License Termination Plan as described in PGE-1078, "Trojan Nuclear Plant License Termination Plan," and as approved in the SER dated _____. The licensee may make changes to PGE-1078 without prior approval provided the proposed changes do not:

(a) Involve an unreviewed safety question or changes to the technical specifications as specified in 10 CFR 50.59; or

(b) Violate the requirements of 10 CFR 50.82(a)(6).

Other conditions and limitations were added to this proposed license condition as a result of the NRC's review of the TNP License Termination Plan submittal. These additional conditions and why they were added is discussed later in this report.

With respect to the determination of no significant hazards consideration that was included in LCA 247 in accordance with 10 CFR 50.92, the fact that the approved TNP Decommissioning Plan had included accident analyses for decommissioning activities, and the TNP DSAR included accident analyses for operations while permanently shutdown and defueled, made this determination relatively straightforward. Specifically, since the proposed TNP License Termination Plan and the associated LCA 247 did not authorize additional or different plant activities beyond those that already were analyzed and could be conducted under the approved

[2] This proposed license condition was developed and submitted prior to the issuance of the revised 10 CFR 50.59, which eliminated the "unreviewed safety question" terminology.

TNP Decommissioning Plan and the DSAR, then it followed that the proposed license amendment would not involve a significant increase in the probability or consequences of an accident previously evaluated, would not create the possibility of a new or different kind of accident from any accident previously evaluated, and would not involve a significant reduction in a margin of safety.

3.2.2 Proposed License Termination Plan

As discussed in Section 2.3 of this report, guidance for the contents and format of proposed license termination plans is currently provided in RG 1.179, NUREG-1700, and NUREG-1727. However, during preparation of the TNP License Termination Plan, the available guidance for content and format of license termination plans was limited. Specifically, RG 1.179 was only available in draft form (DG-1078) until the end of January 1999, and even in its final form was written such that the required level of detail for various sections was open to considerable interpretation. Similarly, NUREG-1700 was only just issued in draft form for comment in December 1998, and was ultimately not issued in final form until April 2000, well after PGE had submitted the proposed TNP License Termination Plan to the NRC for approval. In the last half of 1998, the NRC began work on draft NUREG-1727, which provides guidance on format and content of decommissioning plans applicable to nuclear materials (e.g., non-power reactor) licensees[3]. This NUREG was published in final form in September 2000, and only shortly thereafter did the NRC clarify that power reactor licensees were to use NUREG-1727 in conjunction with NUREG-1700 during the preparation of license termination plans.

In summary, the limited availability of published guidance during preparation of the TNP License Termination Plan made the planning and development process more subjective, especially with regard to determining the necessary level of detail. Furthermore, a portion of the level of detail that could be interpreted as being necessary in the draft NUREG-1700 and RG 1.179 did not correspond with the 10 CFR 50.82 requirement to submit a license termination plan at least two years before the date that the license is terminated, and appeared to contradict much of the implementation flexibility intended in the development of NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," NUREG-1549, "Decision Methods for Dose Assessment to Comply With Radiological Criteria for License Termination," and DG-4006, "Demonstrating Compliance With the Radiological Criteria for License Termination." Details of these issues and their impacts on the TNP License Termination Plan development and subsequent NRC reviews are discussed later in this report.

3.3 Preparing the Proposed TNP License Termination Plan

As discussed previously, the contents required to be incorporated into a license termination plan are stipulated in 10 CFR 50.82(a)(9)(ii)(A) through (G). The manner in which these requirements were incorporated into the proposed TNP License Termination Plan was primarily the result of the guidance available at the time the proposed TNP License Termination Plan was being prepared, including RG 1.179 and draft NUREG-1700. The following sections were incorporated into the proposed TNP License Termination Plan that was submitted to the NRC for approval.

[3] 10 CFR 50.82(b) governs license termination for non-power reactor licensees, and specifies that decommissioning plans (rather than PSDARs and license termination plans applicable to power reactor licensees) shall be prepared and submitted to the NRC.

3.3.1 Section 1 – General Information

Consistent with the guidance of RG 1.179 and NUREG-1700, this section provided the purpose of and regulatory basis for the TNP License Termination Plan, as well as a brief overview of each section contained in the plan. A brief historical background and a summary description and schedule of major decommissioning/license termination activities also are provided.

3.3.2 Section 2 – Site Characterization

The gross radionuclide inventory at the Trojan site was estimated during Phase I site characterization in 1993 and 1994. The Phase I data were compiled in a TNP Site Characterization Report and were summarized in Section 3.1 of the TNP Decommissioning Plan that was approved by the NRC in 1996. Since 10 CFR 50.82(a)(9)(ii)(A) and the guidance of RG 1.179 and NUREG-1700 specify that a site characterization be included in the license termination plan, the description of the radiological conditions at the TNP site as determined in the Phase I site characterization was reiterated in this section of the proposed TNP License Termination Plan. The TNP Site Characterization Report previously had been made available to the NRC during their review of the TNP Decommissioning Plan. At the request of the NRC Staff, this report was formally submitted on the TNP docket to the NRC during their review of the TNP License Termination Plan.

The Phase I radiological characterization of the TNP site was based on the TNP Site Characterization Plan, which was developed and implemented following permanent shutdown of the plant in 1993 using the guidance available at the time the characterization surveys were conducted. This guidance included Regulatory Guide 1.86, NUREG/CR-5849, and NUREG/CR-5512. Following the development and implementation of the TNP Site Characterization Plan, the revised release criteria of 10 CFR 20, Subpart E, and guidance of NUREG-1575 (MARSSIM) were issued. Although the TNP site characterization was conducted under the previous guidance, PGE has elected to conduct final surveys using the most recent 10 CFR 20.1402 release criteria and the MARSSIM approach of applying derived concentration guideline levels to verify that allowable release criteria are met.

In accordance with the available guidance, the TNP Site Characterization Plan incorporated the following objectives:

1. Determine the initial (post operation) radiological status of the facility;

2. Estimate the site source term and isotopic mixture to support decommissioning cost estimation and decision-making; and

3. Determine the location and extent of any contamination outside the radiologically controlled areas.

In the plan, the primary decision-maker and key team members were identified. Available resources were specified and relevant deadlines for the survey established. To assure representative data, the site characterization plan identified the method for selecting the type and

number of measurements, locating those measurements, and determining the background contribution.

The site characterization process was divided into four areas: structures, systems, activation, and environment. Quality assurance requirements were imposed on the process, which included training and qualifications, instrumentation, procedures, records, and audits and surveillances. These measures, along with quality control methods for data collection, were implemented to assure data quality.

Additional radionuclide inventory data have continued to be gathered since the completion of Phase I site characterization in 1994 as part of routine operational and decommissioning surveys and Phase II site characterization work. The radiological samples and surveys conducted as part of Phase II of the TNP site characterization to support dismantlement and decommissioning of TNP can be described as a more extensive characterization effort to supplement and expand upon information collected during Phase I of the site characterization process. Phase I characterization results were used to develop initial decommissioning plans, schedules, and cost estimates. The detailed results of Phase II efforts not only allow timely verification of or identification of necessary changes to those plans, schedules, and cost estimates, but also provide a basis for individual determinations regarding the need for, extent of, and most effective methods to apply as part of remediation; verification of initial area classifications; and information regarding area-specific radionuclide content to assist in survey design. As stated above, Section 2 of the proposed TNP License Termination Plan presented the results of Phase I TNP site characterization. Phase II site characterization activities were summarized in the final survey plan section – Section 5 – of the proposed TNP License Termination Plan.

3.3.3 Section 3 – Identification of Remaining Site Dismantlement Activities

In accordance with 10 CFR 50.82(a)(9)(ii)(B) and consistent with the guidance of RG 1.179 and NUREG-1700, this section was developed to identify the major dismantlement and decontamination activities that remained at TNP as of early-1999, which was when the proposed TNP License Termination Plan was being developed. This information details those areas and equipment that need further remediation, and allows an estimation of the radiological conditions that may be encountered during remediation. Included herein are schedules for implementation of decommissioning and dismantlement activities, estimates of associated occupational radiation dose, and projected volumes of radioactive waste. The activities discussed in this section are the same plant activities that already were being conducted under the approved TNP Decommissioning Plan and the TNP DSAR.

This section was developed to provide general information and guidance for work package planning and was not intended to be continually updated to reflect equipment removal. This allows decommissioning and dismantlement to progress without requiring numerous and ongoing revisions to the TNP License Termination Plan following its approval by the NRC. However, a table was provided in this section that is updated annually to provide a list of major plant systems and system components that were removed the previous year.

3.3.4 Section 4 – Remediation Plans

In accordance with 10 CFR 50.82(a)(9)(ii)(C) and consistent with the guidance of RG 1.179 and NUREG-1700, this section describes how remediation actions may be applied to various areas on the TNP site, identifies the remediation methodology to be used, and demonstrates that the remediation methodology is adequate to ensure that the site release criteria of 10 CFR 20.1402 are met. The methodology and equations used in this section for calculating remediation levels are from DG-4006, "Demonstrating Compliance with the Radiological Criteria for License Termination," which was finalized and incorporated into NUREG-1727 in September 2000.

3.3.5 Section 5 – Final Survey Plan

The final survey plan description that had been incorporated into the approved TNP Decommissioning Plan had deferred the submittal of survey design and methodology details to later in the decommissioning process when these details would be more tangible. Moreover, the final survey discussion that had been incorporated into the approved TNP Decommissioning Plan was based on guidance available at the time the TNP Decommissioning Plan was submitted. This guidance included Regulatory Guide 1.86, NUREG/CR-5849, and NUREG/CR-5512. Following the NRC's approval of the TNP Decommissioning Plan, the revised release criteria of 10 CFR 20, Subpart E, and guidance of NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," NUREG-1549, "Decision Methods for Dose Assessment to Comply With Radiological Criteria for License Termination," and DG-4006, "Demonstrating Compliance With the Radiological Criteria for License Termination," were issued. Upon issuance of this updated final survey release criteria and design methodology guidance, PGE elected to conduct final surveys using the most recent 10 CFR 20.1402 release criteria and the MARSSIM approach of applying derived concentration guideline levels (DCGLs) to verify that allowable release criteria are met.

Since the license termination plan is required by 10 CFR 50.82(a)(9)(ii)(D) to include detailed plans for the final radiation survey, it was determined that the proposed TNP License Termination Plan submittal would incorporate the latest final survey plan methodology, and the TNP Decommissioning Plan discussion of final survey activities would be updated upon NRC approval of and to be consistent with the TNP License Termination Plan. Thus, the final survey plan contained in Section 5 of the proposed TNP License Termination Plan incorporated the MARSSIM methodology and the guidance of NUREG-1549 and DG-4006 (now NUREG-1727) to demonstrate how the site release criteria of 10 CFR 20.1402 will be satisfied to allow unrestricted use of the TNP site.

The TNP Final Survey Plan describes survey design and methodology that allows comparison of the surface contamination and radionuclide concentration levels of structures, land areas, and plant systems remaining at the time of the final survey to DCGLs calculated using dose models. A DCGL is defined as the concentration of residual radioactivity distinguishable from background radiation which, if distributed uniformly throughout a survey unit, would result in a Total Effective Dose Equivalent (TEDE) of 25 mrem/yr to an average member of the critical group. The average member of the critical group is the individual who is assumed to represent the most likely exposure situation based on the assumptions and parameter values used in the dose model calculation. The DCGLs are calculated based on the peak annual TEDE dose to the

average member of the critical group expected within the first 1000 years after license termination. DCGLs are presented in terms of surface or volumetric radioactivity concentrations and are expressed in units of dpm/100 cm^2 or pCi/g, respectively. The TNP screening DCGLs were calculated using DandD, the NRC's computerized dose modeling software. DandD uses the conceptual and mathematical models developed in NUREG/CR-5512 and the generic input parameter values presented in draft NUREG-1549.

3.3.6 Section 6 – Compliance with the Radiological Criteria for License Termination

The site release criteria which must be satisfied in order to release the 10 CFR 50 licensed area of the TNP site for unrestricted use are specified in 10 CFR 20.1402. Since they directly impact the design of the final survey, these criteria and the required conditions for meeting these criteria were specified in Section 5, "Final Survey Plan," of the proposed TNP License Termination Plan. In accordance with 10 CFR 20 and consistent with the guidance of RG 1.179 and NUREG-1700, the methodologies to be used to meet these criteria also are described in the final survey plan. Therefore, this section as incorporated into the proposed TNP License Termination Plan served only to "point" to the TNP Final Survey Plan section, and was retained to be consistent with the RG 1.179 and NUREG-1700 guidance for license termination plan format and section numbering.

3.3.7 Section 7 – Updated Site-Specific Estimate of Remaining Decommissioning Costs

In accordance with 10 CFR 50.82(a)(9)(ii)(F) and consistent with the guidance of RG 1.179 and NUREG-1700, this section of the proposed TNP License Termination Plan incorporated an updated site-specific estimate of remaining decommissioning costs, a comparison of these estimated costs with the present funds set aside for decommissioning, and a description of the means for ensuring adequate funds to complete decommissioning. Similar to other information (e.g., site characterization results), this information had already been approved by the NRC as part of their approval of the TNP Decommissioning Plan in April 1996, and the decommissioning cost estimate and funding plan had since been periodically updated. However, with the requirement for this information to be submitted in a license termination plan, it was necessary to resubmit this information, as updated, for NRC approval.

3.3.8 Section 8 – Evaluation of Environmental Effects of License Termination

As discussed previously, in 1995 PGE submitted a proposed TNP Decommissioning Plan and Supplement to the Environmental Report, which were approved by the NRC on April 15, 1996. The TNP Supplement to the Environmental Report that had been submitted in conjunction with the TNP Decommissioning Plan and approved by the NRC concluded that decommissioning activities would be accomplished with no significant adverse environmental impacts. The proposed TNP License Termination Plan did not propose any different or additional plant activities beyond those that already were proposed under the approved TNP Decommissioning Plan and DSAR. Therefore, the environmental impacts associated with the license termination activities described in the proposed TNP License Termination Plan were bounded by the

previously approved TNP Supplement to the Environmental Report. Thus, rather than restating the entire previously approved Supplement to the Environmental Report, this section of the proposed TNP License Termination Plan provided the basis for why the previous supplement was bounding. This section also provided a brief evaluation of decommissioning/license termination activities conducted as of January 1999 with respect to public and occupational exposure and radioactive waste volumes to further support the conclusion that the previous supplement was bounding. Thus, this section of the proposed TNP License Termination Plan fulfilled the requirements of 10 CFR 50.82(a)(9)(ii)(G) and was consistent with the guidance of RG 1.179 and NUREG-1700.

3.4 Submittal of the Proposed TNP License Termination Plan

By letter VPN-007-99, dated March 10, 1999, PGE forwarded to the NRC the proposed TNP License Termination Plan, with its format and content as summarized above. This letter also transmitted to the NRC the afore-described LCA 247, which requested amendment of TNP License No. NPF-1 to authorize implementation of the TNP License Termination Plan.

4
NRC REVIEW AND APPROVAL OF THE PROPOSED TNP LICENSE TERMINATION PLAN

4.1 NRC Completeness Review

Upon receipt of the proposed TNP License Termination Plan submittal, the NRC conducted a completeness review of the submittal to determine if sufficient information was provided to allow the NRC to proceed with a detailed technical review. In an NRC letter to PGE, "Completeness Review of Trojan License Termination Plan (TAC No. MA5016)," dated April 29, 1999, the NRC requested that the proposed TNP License Termination Plan be resubmitted with additional detail in Section 5, "Final Survey Plan." None of the other proposed TNP License Termination Plan sections were addressed in the NRC's completeness review letter.

The level of detail provided in Section 5 of the proposed TNP License Termination Plan resulted in part from an unworkable communications flow path between PGE management and the individual NRC Staff reviewers and their management, which in many cases compelled TNP staff to make subjective interpretations of the limited guidance available in final form during preparation of the proposed TNP License Termination Plan. The interpretations that led to the level of detail that was provided in the proposed TNP License Termination Plan submitted in March 1999 were made in part to reconcile apparent contradictions between the level of detail that could be interpreted as being necessary from the guidance, and (1) the level of detail that was actually possible given the actual progress of TNP decommissioning and the schedule required by 10 CFR 50.82 for license termination plan submittal; or (2) the implementation flexibility intended in the final survey plan guidance of NUREG-1575, NUREG-1549, and DG-4006.

4.1.1 Level of Detail Versus Two-Year Requirement

As indicated previously, 10 CFR 50.82(a)(9)(i) states that the "…license termination plan must be submitted at least 2 years before termination of the license date." At this point in the TNP decommissioning process, final survey planning was being conducted in parallel with operational survey data collection and plant area remediation. For areas in which remediation was completed, final survey data collection could begin, and the level of detail that could be interpreted from then draft NUREG-1700 and RG 1.179 was more likely to be available. However, for areas undergoing continuing remediation, some information such as accurate final identification of survey units and specification of reference coordinate systems for each area was not yet finalized.

It was further recognized that any estimation of much of this information would be useful only for preliminary planning – as a starting point – and was certain to undergo significant changes as work proceeded and additional site-specific information was gathered. Submittal of this detailed information as part of the proposed TNP License Termination Plan, which upon approval would be a supplement to the TNP DSAR and a controlled licensing document, would mean that the approved TNP License Termination Plan would continually require extensive and repeated revision as decommissioning and final survey activities progress. This would demand additional costs and resources that would not otherwise be expended. Thus, for some of the necessary level of detail that could be interpreted from the available guidance, a "catch-22" situation existed which would require resolution with the NRC Staff.

4.1.2 Level of Detail Versus NRC Oversight and Intended Flexibility

The MARSSIM approach to final radiation survey and site investigation, along with the guidance of NUREG-1549 and DG-4006, provides an iterative approach that is intended to ensure that efforts and resources expended to remove residual radioactivity are commensurate with the risk it poses. This approach involves continual NRC involvement in decision-making and maximum flexibility to preclude cost expenditures for general activities not required due to site-specific features.

NUREG-1575, MARSSIM, states in the Abstract Summary that the MARSSIM objective "is to describe a consistent approach for planning, performing, and assessing…final status surveys to meet established dose or risk-based release criteria*, while at the same time encouraging an effective use of resources* [emphasis added]." NUREG-1549, Section 1.1, expands on this philosophy by stating that "This framework is designed to assist the licensee, the NRC, and other stakeholders in making decommissioning decisions. By doing so, the process allows the licensee to coordinate its planning efforts with the NRC's input… [and] to optimize cost decisions…." As detailed in draft NUREG-1549, Section 2.2.2, the NRC is expected to be involved "from the very first step through the end of the decision making process."

Contrary to the approach incorporated into the NRC final survey guidance of NUREG-1575 and NUREG-1549 cited above, the level of detail interpreted from draft NUREG-1700 and RG 1.179 involving incorporation of survey unit maps and reference coordinate systems for each survey unit into the license termination plan did not take into consideration ongoing and continuing NRC involvement, nor did it consider the costs and efforts necessary to assemble and maintain preliminary planning data in a controlled licensing document (see footnote in Section 4.1.4 of this report). As stated above, as decommissioning and remediation progress, additional site-specific details have and are expected to continue to surface that would make this initial effort obsolete, and would require repeated and extensive revisions to a controlled licensing document.

4.1.3 Communications Issues

As indicated previously, the communications flow path between PGE management and the individual NRC Staff reviewers and their management was restrictive to the extent that resolution of questions of interpretation and preference was slowed and/or discouraged. Much of this issue stemmed from the transfer of NRC oversight and review responsibility for power

reactor license termination plans from the Office of Nuclear Reactor Regulation (NRR) to the Office of Nuclear Material Safety and Safeguards (NMSS), with the remainder of NRC oversight including the assigned Project Manager being from NRR. Initially, this hierarchy resulted in any PGE-NRC communications being required to go through the NRR Project Manager, with no direct communications between PGE representatives and individual NMSS reviewers and their management. After this was brought to the NRC's attention, this difficulty eased somewhat, in that PGE questions could be directed to the individual NMSS reviewer(s) and their management in telephone conferences set up through the NRR Project Manager. However, these telephone conferences often took anywhere from one to three weeks to plan, schedule, and coordinate to ensure all the NRC participants were available and present. After several discussions with various NRC Staff, the communications flowpath gradually opened to the point at which TNP management could finally communicate directly with the NMSS reviewers and their management while involving the NRR Project Manager, or at least keeping the NRR Project Manager informed.

4.1.4 Resolution of Level of Detail and Communications Issues

The above issues primarily were the result of the fact that the regulation requiring license termination plans was relatively new, as was the associated guidance (as stated previously, much of the guidance was not yet finalized), and the NRC was still in the formative stages of decision making with respect to some of the major issues and concepts of license termination and, in particular, final survey plans. The transfer of oversight and review authority of power reactor final survey and license termination plans from NRR to NMSS only compounded the magnitude of these issues. Thus, by the time the NRC approved the TNP License Termination Plan in early-2001, many of these issues had been resolved[4]. Continual improvements in communication between PGE and the NRC Staff during the TNP License Termination Plan development and approval process fostered hopes for a smooth and continued resolution of license termination issues. However, these improvements in communication have deteriorated since receipt of NRC approval of the TNP License Termination Plan, such that any questions and/or concerns regarding implementing the approved TNP License Termination Plan once again require a lengthy process of formal written communications. This setback is largely attributed to the loss of experience and lessons learned on the NRC's part as a result of personnel changes in the NRC (NMSS) Staff responsible for oversight of TNP license termination and final survey implementation.

In the meantime, the regulatory environment and associated issues as described above resulted in preparation of the proposed TNP License Termination Plan, including the final survey plan incorporated therein, using a reasonable interpretation (with respect to TNP site details available at the time) of adequate detail to demonstrate that PGE is prepared to implement the applicable regulatory guidance of NUREG-1575, draft NUREG-1549, and DG-4006. It was felt that the proposed TNP Licensee Termination Plan submitted on March 10, 1999, provided an adequate

[4] For example, the draft NUREG-1700 that was available during the first year of the NRC's review of the proposed TNP License Termination Plan required licensees to divide survey units and establish reference coordinate systems, and to provide the results in their license termination plans. As a direct result of these issues surfacing during the NRC's review of the proposed TNP License Termination Plan, and with PGE commenting on the draft NUREG-1700, the final NUREG-1700 issued in April 2000 allows licensees to commit to, rather than complete, these actions in their license termination plans.

framework upon which implementing procedures and processes would be based, since it would be these implementing procedures that would direct the collection, processing, and analysis of data.

Thus, subsequent to the receipt of the NRC's letter requesting re-submittal of the proposed TNP License Termination Plan, several telephone communications were held between PGE and NRC Staff, in which the specific detail items requested in the NRC's April 29, 1999, letter were clarified. The additional detail, as clarified, included specifically identifying and characterizing survey units, and providing area maps depicting survey units and a listing of survey unit size, classification, and number of samples per survey unit. The NRC also requested wording in the Final Survey Plan (Section 5) portion of the proposed TNP License Termination Plan regarding "screening DCGLs" to clarify that the screening DCGLs are intended to be used as the principle criteria for releasing the site. Finally, the NRC also requested that additional criteria be added to the proposed license condition in LCA 247 to control changes to the final survey plan portion of the TNP License Termination Plan.

In response to the above request, specifically regarding identifying and characterizing survey units and providing area maps depicting survey units and a listing of survey unit size and classification, TNP management explained to the NRC that since final survey activities at the TNP site were being conducted in parallel with dismantlement and decontamination activities, some areas (e.g., embedded piping and specified systems) had not yet been divided into survey units. Furthermore, since ongoing remediation and other practical considerations had the potential to cause the reconfiguration of several survey units, the final configuration of all survey units was not and could not be firmly established. Thus, it was agreed that the area maps would be provided as supplemental information not formally incorporated into the TNP License Termination Plan. Submittal of the requested detailed maps in this manner precluded the potentially onerous resource commitment to continually conduct extensive and repeated revision of these maps as decommissioning and final survey activities progress.

4.2 Re-submittal of the Proposed TNP License Termination Plan

In response to the NRC Staff's request for re-submittal of the proposed TNP License Termination Plan, and to the clarification provided in the aforementioned telephone communications, PGE re-submitted to the NRC, by letter VPN-054-99 dated August 5, 1999, the proposed TNP License Termination Plan. This letter also transmitted Revision 1 to LCA 247.

4.2.1 LCA 247, Revision 1

In response to the NRC's request in the aforementioned telephone communications, the license condition proposed in LCA 247 was revised to incorporate three additional criteria that specified conditions under which changes to the TNP License Termination Plan would require prior NRC approval. The additional criteria specifically were focused on areas of the final survey design and implementation methodology described in the final survey plan section of the TNP License Termination Plan.

This revision was incorporated into Revision 1 of LCA 247. The revised license condition of LCA 247, Revision 1, read similarly to the original version (see Section 3.2.1 of this report), but with the three additional criteria added to the end, as follows:

(11) License Termination

The licensee shall implement and maintain in effect all provisions of the approved License Termination Plan as described in PGE-1078, "Trojan Nuclear Plant License Termination Plan," and as approved in the SER dated _____. The licensee may make changes to PGE-1078 without prior approval provided the proposed changes do not:

(a) Involve an unreviewed safety question or changes to the technical specifications as specified in 10 CFR 50.59;

(b) Violate the requirements of 10 CFR 50.82(a)(6);

(c) Reduce the coverage requirements for scan measurements;

(d) Increase the radioactivity level, relative to the applicable derived concentration guideline level, at which an investigation occurs; or

(e) Change the statistical test applied to the final survey data to one other than the Sign test or the Wilcoxon Rank Sum test.

4.2.2 Revisions to Proposed TNP License Termination Plan

In response to the NRC's request for PGE to resubmit the proposed TNP License Termination Plan, and with consideration for the subsequent clarification via telephone communications between PGE and NRC Staff, Section 5, "Final Survey Plan," of the proposed TNP License Termination Plan was revised to incorporate some additional detail with respect to survey unit descriptions as they were configured and as the detail was available at that time. This information was provided with the understanding that reconfigurations and continued survey unit design activities would continue in accordance with the methodology, rules, and constraints described in the final survey plan, and pursuant to the TNP License Termination Plan change criteria proposed in LCA 247, Revision 1. To assist the NRC in their review of the final survey plan portion of the proposed TNP License Termination Plan, area maps depicting a "snapshot" of the survey units that had been established as of the date of the re-submittal letter, August 5, 1999, were also provided. As agreed upon in the aforementioned telephone communications as discussed above, these detailed area maps were provided as supplemental information not formally incorporated into the proposed TNP License Termination Plan.

The revised Section 5, "Final Survey Plan," of the proposed TNP License Termination Plan also contained additional simplification and clarification of the use of and methodology used to develop screening DCGLs, and provided the basis for the determination of minimum sample frequency. The screening DCGLs are based on NUREG-5512 dose assessment scenarios and were calculated using the NRC's DandD software with the NUREG-1549 default scenario parameters. No site-specific model or parameter changes were applied. To assist in the NRC's

review of the final survey plan section, the DandD modeling runs used to develop the screening DCGLs were also provided.

4.3 NRC Acceptance Review

In early September 1999, the NRC notified PGE that based on their review of PGE's re-submittal of the proposed TNP License Termination Plan, the NRC had determined that sufficient information had been provided for the NRC to proceed with a detailed technical review. However, the NRC concurrently informed PGE that they had additional questions that would likely result in a request for additional information (RAI), specifically regarding how site-specific DCGLs, if used, would be established, and on details of the TNP decommissioning cost estimate.

With regard to these and other issues, a telephone communication was held between representatives of PGE and NRC Staff on September 28, 1999. The ensuing conference resulted in the resolution of the issue on level of detail of the cost estimate, but resolution of the other issues was deferred. The detail that had been provided in Section 7 of the proposed TNP License Termination Plan was the same that had already been provided to and approved by the NRC (NRR) as part of the approved TNP Decommissioning Plan. Furthermore, the level of detail had been determined to meet a reasonable interpretation of the NUREG-1700 and RG 1.179 guidance for content and format of license termination plans. However, the NMSS Staff reviewers requested significantly more detail, including proprietary developmental cost estimate modeling and detailed unit factor and work package breakdowns and inputs. By letter VPN-095-99, PGE provided the requested information, along with an application for withholding proprietary information from public disclosure[5].

While representatives of the NRC Staff (both NRR and NMSS) were at the TNP site for a site tour and a public meeting[6] on December 7, 1999, the NRC requested that PGE formally submit the TNP Site Characterization Report on the TNP docket. As stated in Section 3.3.2 of this report, the TNP Site Characterization Report previously had been made available to the NRC during their review of the TNP Decommissioning Plan, and the NRC (NRR) had approved the results of this site characterization as part of their approval of the TNP Decommissioning Plan in April 1996. Notwithstanding, by letter VPN-102-99 dated December 27, 1999, PGE formally submitted a copy of the TNP Site Characterization Report on the TNP docket.

4.4 NRC Requests for Additional Information

4.4.1 NRC RAI Dated March 24, 2000

On March 24, 2000, the NRC issued to PGE a letter entitled "Trojan Nuclear Plant License Termination Plan – Request for Additional Information (TAC No. MA6216)." The NRC's RAI

[5] This request was accepted as discussed in NRC to PGE letter, "Request for Withholding Information From Public Disclosure (TAC No. MA6216)," dated March 6, 2000.
[6] A transcript of this public meeting was placed on the TNP Docket No. 50-344 via NRC to PGE letter, "Trojan Nuclear Plant License Termination Plan – Public Meeting Transcript (TAC No. MA6216)," dated January 3, 2000.

consisted of thirty questions, all of which pertained to Section 5, "Final Survey Plan," and Section 2, "Site Characterization." By letter VPN-020-2000 dated May 4, 2000, PGE responded to the NRC's RAI.

In a telephone conference held on August 10, 2000, the NRC informed PGE that they had found PGE's responses to approximately half of the thirty RAI questions to be acceptable, such that the related issues were considered closed. Further discussions were held between representatives of NRC and PGE during an NRC inspection at the TNP site the week of August 14-17, 2000, and during an August 28, 2000, telephone conference. These discussions culminated in a technical meeting (open to the public) on September 6, 2000, at NRC headquarters, at which PGE presented proposed resolution for the issues that remained open as discussed in the August 10, 2000, telephone conference. The more significant of these open issues are summarized as follows:

- *Groundwater* – Provide the basis for why groundwater sampling and analyses were not performed.
- *Area Factors* – Provide area factors that will be used for developing $DCGL_{EMC}$ values, and describe how they were developed.
- *Accessibility* – Provide clarification with regard to how "accessibility" is defined, specifically with respect to the ability to perform final survey measurement coverage consistent with the survey design guidance for the given class of the survey unit;
- *Embedded Piping* – Describe PGE's approach for modeling embedded piping to ensure that the radiological criteria for unrestricted use of 10 CFR 20.1402 are met; and
- *Thirty (30) Static Measurements* – Provide the basis for selecting a value of 30 as the minimum number of static measurements to be taken in a survey unit.

Based on the proposed resolution presented in the September 6, 2000, meeting, PGE received preliminary NRC concurrence with all but one (pertaining to groundwater) of the remaining open RAI questions. By letter VPN-041-2000 dated October 19, 2000, PGE forwarded supplemental information to the NRC to update PGE's May 4, 2000, RAI response, as appropriate, to document the resolution of the resolved RAI questions discussed in the September 6, 2000, meeting. By PGE letter VPN-047-2000 dated November 22, 2000, the remaining ground water issue was resolved. These issues and their resolution are further described below.

4.4.1.1 Groundwater

The proposed TNP License Termination Plan as submitted to the NRC on August 5, 1999, described the basis used during Phase I of the TNP site characterization effort for not conducting ground water sampling. This basis was as described in the FSAR for the TNP when it was operating. Specifically, the FSAR had described how the TNP site is located on an impervious rocky ridge that is bounded on one side and end by the Columbia River and on the other side by an old river channel that has been filled with alluvial sediments. The rock on the ridge is moderately fractured, but the joints have been sealed by impervious materials such that during TNP construction there was no apparent leakage of water from many rain-filled foundation and footing holes over a period of several months. It is apparent, therefore, that ground water does

not have the significance at the TNP site that it might have at others where the plant is less isolated from adjacent ground water supplies and where the soil is permeable.

This basis was supported by water samples that are periodically collected from selected domestic wells that exist in the area as part of the TNP Radiological Environmental Monitoring Program. Levels of tritium and gamma-emitting radionuclides in well water samples consistently have been found to be below the minimum sensitivity requirements of the sampling program.

This issue remained unresolved in VPN-041-2000 dated October 19, 2000. Based on subsequent discussions with the NRC Staff, Section 2, "Site Characterization," of the proposed TNP License Termination Plan was revised to incorporate a summary description of a groundwater monitoring program that would be implemented at the TNP site. The revised Section 2 was submitted to the NRC by PGE letter VPN-047-2000, dated November 22, 2000. The TNP site groundwater monitoring program would be developed based on the specific hydrogeological characteristics of the TNP site, as summarized and updated in an October 2000 hydrogeology evaluation report that was also provided to the NRC in PGE's November 22, 2000, letter. In addition, the proposed license condition in LCA 247, Revision 1, was modified in a Revision 2 of LCA 247 to add an additional provision – related to groundwater monitoring – upon which the NRC's approval of the proposed TNP License Termination Plan would be based.

4.4.1.2 Area Factors

The proposed TNP License Termination Plan as submitted to the NRC on August 5, 1999, did not include area factors, but instead described the methodology that would be used to develop them if needed. This approach was taken since, due to the implementation at TNP of two extensive radiological survey processes – the operational survey and the turnover survey – combined with comprehensive remediation practices designed to identify and resolve any problem areas prior to final survey, the likelihood of problem areas being identified that would require development of area factors during the final survey was determined to be minimal. Furthermore, the development of area factors with little expectation of encountering problem areas during final survey requiring their use represents a considerable resource burden with no offsetting benefit. As described in NUREG-1549, the development of area factors requires intensive manipulation of the dose modeling parameters, and thus would become inordinately time- and labor-intensive. When considered with respect to the minimal expectation of need as described above, PGE determined that the development of area factors in response to specific conditions in the event that they might arise during final survey, rather than to generalized assumptions prior to establishing a specific need, represented the most efficient use of resources. Thus, the proposed TNP License Termination Plan had described the methodology provided in Appendix D of draft NUREG-1549 that would be used if area factor development were required.

Notwithstanding the above, based on subsequent discussions with the NRC Staff regarding this issue, and using verbal guidance provided the NRC Staff, PGE developed site-specific area factors and incorporated them into the proposed TNP License Termination Plan. The area factors for use with volumetric residual radioactivity screening DCGLs were calculated using the residential farming scenario model in DandD, Version 1.0, Build 1.00.02. With the exception of the cultivated area parameter in the DandD residential farming scenario model, which defaults to 2400 m^2, the DandD default model parameter values were not changed.

Area factors for use with surface residual radioactivity screening DCGLs were calculated using RESRAD-BUILD Version 2.37 (August 1998) and reduced using a dose ratio derived from DandD and RESRAD-BUILD. RESRAD-BUILD was used since the building occupancy scenario model in DandD does not allow direct manipulation of the size of the surface area. The surface area (source area) in RESRAD-BUILD defaults to 36 m^2. With the exception of the source area, the RESRAD-BUILD default model parameter values were not changed. Since RESRAD-BUILD is generally less conservative than DandD, the NRC Staff requested that a "dose ratio" reduction factor be conservatively applied to the area factors developed using RESRAD-BUILD. To derive this reduction factor, a DandD dose and a RESRAD-BUILD dose were calculated for each radionuclide using the same radionuclide concentration and default model parameters. The calculated DandD dose was then divided by the RESRAD-BUILD dose to determine the reduction factor that is applied to the area factor derived from RESRAD-BUILD for each given radionuclide. Thus, where RESRAD-BUILD predicts a dose of one-half that predicted by DandD, the area factor is accordingly divided by two, with the minimum area factor being 1.0.

4.4.1.3 Accessibility

The proposed TNP License Termination Plan as submitted to the NRC on August 5, 1999, had discussed how inaccessible surfaces would be handled. However, the NRC was concerned that this wording left too much latitude for applying the definition of "inaccessible" to a given situation, and also did not make clear how the 100 percent scan coverage requirement would be applied to inaccessible surfaces in Class 1 areas. This wording was clarified in the proposed TNP License Termination Plan to clearly state that Class 1 plant surfaces will undergo 100 percent scan coverage, such that inaccessible surfaces in Class 1 survey units would either be made accessible or would be removed. The wording was further clarified to reflect special considerations for surveying inaccessible Class 2 and Class 3 surfaces.

4.4.1.4 Embedded Piping

The proposed TNP License Termination Plan as submitted to the NRC on August 5, 1999, had described how loose and fixed contamination in embedded piping would be measured, but had not described in sufficient detail how any remaining dose resulting from embedded piping sources would be incorporated into the TNP Final Survey Plan dose modeling to verify that the 25 mrem/yr dose requirement of 10 CFR 20.1402 is satisfied. Based on discussions with the NRC Staff, clarification was provided in the proposed TNP License Termination Plan to describe how embedded piping dose is accounted for in the TNP Final Survey Plan dose modeling.

Specifically, dose models based on NUREG/CR-5512 and appropriate to TNP were used to calculate DCGLs, which is the concentration of residual radioactivity distinguishable from background radiation that if uniformly distributed would result in the 10 CFR 20.1402 dose limit of 25 mrem/yr. Two scenarios, building occupancy and residential farming, were applied to develop screening DCGLs for surface and volumetric residual radioactivity at TNP, respectively. Surface residual radioactivity DCGLs are applied to structure surfaces with thin-layer or surface residual radioactivity. Where penetrating radiation from embedded sources is present, the surface residual radioactivity is limited to the non-embedded dose fraction of the screening DCGL value. For embedded piping at TNP, this is the equivalent of 20 mrem/yr, which allows the dose from

the embedded pipe exposure pathway to contribute up to 5 mrem/yr. Based on shielding calculations and the assumption that the uniform residual surface activity on the internal surfaces of embedded pipes is less than or equal to 100,000 dpm/100 cm^2 beta-gamma, the dose contribution from embedded piping at TNP is less than 5 mrem/yr. Therefore, if the average measured residual radioactivity from TNP building surfaces results in a dose of greater than or equal to 20 mrem/yr or the average measured residual radioactivity inside embedded pipes results in a dose of greater than or equal to 5 mrem/yr, an evaluation is performed to determine if the site release dose criterion would be exceeded.

4.4.1.5 Thirty (30) Static Measurements

The MARSSIM methodology provides powerful statistical tools that markedly decrease, with respect to the previous approach described in RG 1.86, the number of static samples that are required to confirm that the site release dose criterion is met. MARSSIM describes the manner in which the number of static measurements that is required in a survey unit is determined.

Rather than calculating the number of samples for each Class 1 and 2 survey unit, PGE has established a conservative value of 30 for the number of samples to be collected in each survey unit. PGE has elected to follow this more standardized approach in order to ensure that the "number of measurements" portion of the survey design is consistently and properly applied in the field (i.e., reduces the opportunities for error during field setup and data collection). The proposed TNP License Termination Plan as submitted to the NRC on August 5, 1999, had described this approach and the basis for its incorporation.

In support of this approach, PGE performed a calculation that verifies that 30 survey measurements provides a sample population of sufficient size to assure statistical confidence in the final survey conclusions. This calculation, RPC 2000-01, "Final Survey Technical Basis Document – Number of Measurements," was submitted to the NRC as part of PGE's response to the NRC's March 24, 2000, RAI. The calculation incorporates survey design goals that include Type I and II decision error values consistent with NRC guidance (default values of $\forall$ and $\exists$ are set at 0.05), as well as a conservative value for contaminant variability. Elevated measurement considerations are also addressed in determining number of measurements. The calculation results demonstrate that based on these survey design goals, 18 or fewer measurements are sufficient to demonstrate with a 95 percent confidence level that a survey unit that should fail does fail. This result verifies the adequacy of the selection of thirty as a standard number of samples per survey unit.

4.4.2 NRC RAI Dated May 10, 2000

On May 10, 2000, the NRC issued a second letter entitled "Trojan Nuclear Plant License Termination Plan – Request for Additional Information (TAC No. MA6216)." This RAI requested that PGE assess how the activities included in the proposed TNP License Termination Plan would impact federally listed and proposed endangered and threatened species, candidate species, and species of concern that had not been considered by the NRC Staff when the TNP Decommissioning Plan was approved. The RAI also requested that PGE assess how the activities

would impact historically significant areas on the TNP site[7]. By PGE letter VPN-026-2000 dated May 18, 2000, PGE provided the requested assessment.

4.5 NRC Approval of the TNP License Termination Plan

On February 6, 2001, the NRC issued an environmental assessment and finding of no significant impact related to LCA 247. On February 12, 2001, the NRC issued Amendment 206 to TNP License No. NPF-1. The amendment added a new license condition that annotates NRC approval of the TNP License Termination Plan, subject to conditions as proposed in Revision 2 to LCA 247[8] (see Section 4.4.1.1 of this report). The new license condition reads as follows:

(11) *License Termination*

The licensee shall implement and maintain in effect all provisions of the approved License Termination Plan as described in PGE-1078, "Trojan Nuclear Plant License Termination Plan," and as approved in the SER dated February 12, 2001, subject to and as amended under the following stipulations:

(i) The licensee may make changes to PGE-1078 without prior approval provided the proposed changes do not:

(a) Require Commission approval pursuant to 10 CFR 50.59;

(b) Violate the requirements of 10 CFR 50.82(a)(6);

(c) Reduce the coverage requirements for scan measurements;

(d) Increase the radioactivity level, relative to the applicable derived concentration guideline level, at which an investigation occurs; or

(e) Change the statistical test applied to the final survey data to one other than the Sign test or the Wilcoxon Rank Sum test.

(ii) The licensee shall determine if the Trojan Nuclear Plant site groundwater contains residual radioactivity from plant operations. The licensee shall make this determination based on the groundwater monitoring program described in the Trojan Nuclear Plant License Termination Plan. If the licensee determines that the site groundwater contains residual radioactivity from plant operations, the licensee shall submit site-specific soil derived concentration guideline levels for Commission review and approval."

[7] There is an archaeological site, a habitation and burial site, on the TNP property.
[8] Due to a typographical error, this LCA is inadvertently numbered as "245" in the NRC's letter forwarding Amendment 206 to TNP License No. NPF-1.

5
IMPLEMENTATION OF THE APPROVED TNP LICENSE TERMINATION PLAN

5.1 TNP License and Licensing Basis Revisions

Following receipt of NRC approval of LCA 247, Revision 2, on February 12, 2001, PGE incorporated Amendment 206, consisting of the aforementioned new license condition, into TNP License No. NPF-1. Thus, the requirement of 10 CFR 50.82(a)(10) stipulating that "the Commission shall approve the plan, by license amendment" was implemented.

As stated previously in this report, 10 CFR 50.82(a)(9)(i) requires that the proposed "license termination plan must be a supplement to the FSAR or equivalent…." Thus, the TNP DSAR was revised to incorporate the approved TNP License Termination Plan. This revision reflected the combining of the approved TNP Decommissioning Plan and the approved TNP License Termination Plan, as described below.

5.2 Incorporation of TNP License Termination Plan, Revision 0, into the TNP Licensing Basis

As discussed in Section 2.1 of this report, much of the content required to be in the TNP License Termination Plan under the 1996 revision of 10 CFR 50.82 was already incorporated into, and thus redundant with, that of the TNP Decommissioning Plan submitted to and approved by the NRC under the previous version of 10 CFR 50.82. For example, the descriptions of the TNP Phase I site characterization results, TNP decommissioning cost estimate and funding plan, and remediation activities were largely the same between the two documents. Due to the extent of the redundancy between the TNP Decommissioning Plan and TNP License Termination Plan, and since this redundancy represented the potential that future facility or procedural changes implemented pursuant to 10 CFR 50.59 and/or 10 CFR 50.82(a)(6) could require revisions to two separate licensing documents, the two documents were combined into one document that meets both the requirements of 10 CFR 50.82(a)(4) for a PSDAR and 10 CFR 50.82(a)(9) for a license termination plan. The result is a single PGE licensing basis document, PGE-1061, "Trojan Nuclear Plant Decommissioning Plan and License Termination Plan (PGE-1078)," which is maintained as a supplement to the TNP DSAR in accordance with 10 CFR 50.82(a)(9)(i).

6
SUMMARY OF LESSONS LEARNED

As discussed in Section 4.1 of this report, the issues encountered during the development of the TNP License Termination Plan primarily were the result of the fact that the regulation requiring license termination plans was relatively new, as was the associated guidance (as stated previously, much of the guidance was not yet finalized), and the NRC was still in the formative stages of decision making with respect to some of the major issues and concepts of license termination and, in particular, final survey plans. The transfer of oversight and review authority of power reactor final survey and license termination plans from NRR to NMSS, and the new concepts and methodologies introduced by the new MARSSIM approach, only compounded the magnitude of these issues. However, by the time the NRC approved the TNP License Termination Plan in early-2001, many of these issues had been resolved.

Resolution of these issues was greatly encouraged by not letting limitations on communications stop the progress of TNP License Termination Plan development. Rather, progress in developing, and ultimately, gaining NRC approval of, the TNP License Termination Plan was the direct result of:

- Staying flexible;
- Maintaining an open and repeated invitation to NRC Staff reviewers for site visits to promote understanding and open communication and to develop trust;
- Proposing solutions, even in the face of little or seemingly contradictory guidance/direction; and
- For level of detail and other regulatory issues:
  - Communicating as much as possible in a positive manner any apparent contradictions between regulatory requirements, the level of detail required by guidance, and the level of detail that was available with respect to the progress of decommissioning;
  - As appropriate, presenting selected information as a “snapshot,” clearly stating that some information is not intended to be continually updated, and/or providing it as supplemental information not part of the license termination plan; and
  - Recognizing that NRC approval of a past submittal containing information meeting similar requirements/guidance may not necessarily mean that it is acceptable under a separate NRC entity’s review (e.g., the level of detail of the TNP site characterization and decommissioning cost estimate approved by NRR as part of the TNP Decommissioning Plan was not adequate for NMSS approval of the TNP License Termination Plan).

Issues surrounding understanding and interpreting the concepts and methodologies introduced by the new MARSSIM approach have continued to be addressed since receipt of the NRC's approval and as PGE has continued to implement the approved TNP License Termination Plan. Continual improvements in communication between PGE and the NRC Staff during the TNP License Termination Plan development and approval process fostered hopes for a smooth and continued resolution of these issues. However, these improvements in communication have deteriorated since receipt of NRC approval of the TNP License Termination Plan, such that any questions and/or concerns regarding implementing the approved TNP License Termination Plan once again require a lengthy process of formal written communications. This setback is largely attributed to the loss of experience and lessons learned on the NRC's part as a result of personnel changes in the NRC (NMSS) Staff responsible for oversight of TNP license termination and final survey implementation.

Target:
Nuclear Power

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