Oregon Department of Energy
625 Marion St. N.E.
Salem OR. 97310

REVIEW OF PGE'S

DECOMMISSIONING PLAN

FOR THE TROJAN NUCLEAR PLANT

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Table of Contents

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I. EXECUTIVE SUMMARY

The Oregon Department of Energy (ODOE), now the Oregon Office of Energy (OOE) and referred throughout this report as "the department", engaged Technical Analysis Corporation (TAC) to review the Decommissioning Plan for Portland General Electric (PGE) Company's Trojan Nuclear Plant (TNP) to evaluate whether the proposed plan complies with Oregon requirements, as specified in Oregon Administrative Rules, Chapter 345, Division 26, abbreviated as OAR 345-26. This report presents the results of the department's review.

Decommissioning a nuclear power plant is the process of removing the facility safely from service and reducing residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license. On January 27, 1993, PGE notified the department and the U.S. Nuclear Regulatory Commission (NRC) of its decision to decommission Trojan. On January 26, 1995, PGE submitted PGE-1061, Trojan Nuclear Plant Decommissioning Plan, to the department and to the NRC in accordance with the Code of Federal Regulations, Title 10, Chapter I, Part 50, Section 82, abbreviated as 10 CFR 50.82.

Pursuant to OAR 345-26-370(1)(b), the department is required to perform a technical review, and produce a staff report containing the department's technical conclusions and recommendations on specific issue raised in the proposed plan. The review of the proposed Decommissioning Plan included site visits by TAC, interviews with members of the plant staff, attendance at meetings of the State of Oregon's Energy Facility Siting Council (EFSC or "the Council"), and an extensive review of the proposed plan and supporting documents.

To approve the decommissioning plan, the Council must find that the plan meets the criteria set forth in OAR 345-26-370. Specifically, to verify that the proposed decommissioning activities will not adversely affect the health and safety of the public or the environment, OAR 345-26-370(2) requires that the Council review the proposed decommissioning plan to ensure that seven essential criteria are met in the proposal. These essential criteria are as follows:

OAR 345-26-370(2)(a)

> *The plan contains criteria for the free release of materials and the area as specified in Table 1 below.* (Table 1 is excerpted from Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors," June 1974, and is reproduced in Appendix B of this report.)

Final release criteria are described in Section 4.2 of the plan. The limits for loose and

fixed surface contamination are the same as those established in Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors, June 1974, which is identical to the state rule. It is the department's conclusion that PGE has satisfied this criterion.

OAR 345-26-370(2)(b)

> *After decommissioning, the exposure rate at one meter from all surfaces in the facility buildings and outdoor areas shall be 5 μR/hr or less above the background radiation level. Background radiation is defined in OAR 345-01-010.*

Final release criteria are described in Section 4.2 of the Decommissioning Plan. The limit for direct exposure is 5 μR/hour above background. Although the plan does not specify that the rate is to be measured at one meter from all surfaces, it endorses NUREG-0586, which does require the measurement at one meter. Furthermore, PGE has committed to conducting the final radiation survey in accordance with guidance in NUREG/CR-5849, which also requires that direct measurements be made at one meter above all surfaces. It is the department's conclusion that PGE has satisfied this criterion.

OAR 345-26-370(2)(c)

> *The plan must contain provisions that require removal from the site of all radioactive waste as defined in ORS 469.300 on a schedule acceptable to the Council. Spent nuclear fuel and other radioactive materials that must be disposed of in a federally approved facility may be stored on the site until such a federally approved facility will take the fuel and these radioactive materials.*

Section 1 of the plan describes the overall schedule for decommissioning, including the removal from the site of all radioactive waste by the year 2001, except for the spent fuel and other waste that is not eligible for shallow land burial in a low level waste site. (Such waste is defined at 10 CFR 61 and referred to herein as "Greater than Class C Waste", or "GTCC "). This schedule includes removing the reactor vessel internals by early 1998; licensing and constructing an interim spent fuel storage facility by mid-1998; and transferring fuel and high-level waste to the interim spent fuel storage facility beginning in 1998.

The schedule also includes removing contaminated systems and components for burial, decontaminating structures, and performing a final radiation survey of the entire site to confirm that the residual radiation levels are below the applicable limits and that the site, with the exception of the interim spent fuel storage facility, is suitable for unrestricted use. This is scheduled to be completed in 2001. The shipment of spent fuel and GTCC waste to a federal repository is scheduled to begin in 1998 and be completed by 2018, based on the existing DOE Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste. It is not known at this time when the Federal government will be prepared to accept spent fuel for permanent storage. However, the interim spent fuel storage facility is required by Council rules to be designed for storage

for at least 40 years.

The department concludes that PGE's schedule for removing all radioactive waste from the site is acceptable, given the uncertainty in the opening of a federal repository. With the contingencies built into the cost analysis and the provisions of OAR 345-26-390(4)(j), PGE's plan for disposing of spent nuclear fuel and GTCC radioactive waste are acceptable. It is the department's conclusion, therefore, that PGE has satisfied this criterion.

OAR 345-26-370(2)(d)

> *The plan must contain an acceptable program for monitoring and controlling effluents to ensure compliance with applicable state and federal limits. This program may be incorporated by reference, if it has previously been approved by the department.*

PGE maintains that the Radioactive Effluent Controls Program and the requirements of the Offsite Dose Calculation Manual (ODCM) provide assurance of their ability to meet this criteria. The department, in consultation with Oregon Health Division and Dr. Brian Dodd of Oregon State University, reviewed and approved the Trojan ODCM as revised in September 1994. They also found that the "requirements set forth in OAR 345-26-330, which requires PGE to implement Radiological Effluent and Environmental Monitoring programs subject to department approval, are met."[1]

This criterion allows incorporation by reference of a program that the department has previously approved. Therefore, this program is incorporated by reference.

OAR 345-26-370(2)(e)

> *The plan must contain a program for radiological monitoring to ensure the environment is not being adversely affected. This program may be incorporated by reference if it has previously been approved by the department.*

PGE maintains that the Radiological Environmental Monitoring Program and the requirements of the ODCM provide assurance of their ability to meet this criteria. The department, in consultation with Oregon Health Division and Dr. Brian Dodd of Oregon State University, reviewed and approved the Trojan ODCM, as revised in September 1994. They also found that the "requirements set forth in OAR 345-26-330, which requires PGE to implement Radiological Effluent and Environmental Monitoring programs subject to department approval, are met."[2] This criterion allows incorporation by reference of a program that the department has previously approved. Therefore, this program is incorporated by reference.

OAR 345-26-370(2)(f)

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1 Oregon Department of Energy, letter from J. Savage to T. Walt, December 12, 1994

2 ibid.

The plan must contain provisions for removal or control of hazardous wastes that are consistent with applicable federal and state regulations.

The plan does contain provisions for the removal or control of hazardous wastes consistent with applicable federal and state regulations. Section 3.6 of the plan, "Nonradioactive Waste Management," states that nonradioactive regulated waste, such as asbestos, polychlorinated biphenyls (PCBs), mercury, and lead, will be controlled by the TNP chemical safety program and that work will be done in accordance with the TNP work control process and approved plant procedures. This program provides for evaluation of regulated substances and approval of methods for their handling and disposal. The plan also states that the removal and disposal of materials will be conducted in accordance with OSHA regulations, and federal and state hazardous waste regulations, as applicable. Our review of these procedures indicate that adequate controls exist to safely handle such materials. It is the department's conclusion that PGE has satisfied this criterion.

OAR 345-26-370(2)(g)

An analysis of decommissioning alternatives shall be provided with the plan, satisfactory to the Council. This analysis will describe the bases for the decommissioning alternative selected, and shall include a comparison of SAFSTOR and DECON as those terms are defined by the U.S. Nuclear Regulatory Commission. The analysis must demonstrate that impacts to public health and safety for the option chosen are bounded by the alternatives analyzed above. The analysis must demonstrate that the alternative chosen protects the environment and the health and safety of the public consistent with state and federal statutes, rules and regulations.

The Decommissioning Alternative Evaluation was submitted to the department along with the Decommissioning Plan on January 26, 1995. The evaluation describes the bases for PGE's selection of DECON and makes an in-depth comparison of SAFSTOR and DECON. PGE's analysis is clearly bounded by the alternative decommissioning methods described in NRC studies in the areas of Low-Level Radioactive Waste Volume, Occupational Radiation Exposure, and Public Radiation Exposure. It demonstrates that DECON is within the guidelines established by the NRC studies, that it adequately protects the environment and the health and safety of the public, and that it is consistent with state and federal statutes, rules, and regulations.

The department recommends that the Council find the Alternatives Evaluation satisfactory because PGE presents reasonable arguments that are validated by site-specific assumptions, estimates, facts, and experience, and because information is provided to allow comparison between the options on an "apples-to-apples" basis. The department's review of the PGE Alternative Evaluation and its compliance with this rule appears in Section VI of this report. The department concludes that PGE has satisfied each aspect of this criterion.

OAR 345-26-370(3)

In addition to the seven criteria in OAR 345-26-370(2)(a) through (g), a further criterion is set forth in OAR 345-26-370(3), as follows:

> *The plan must include an estimate of funding necessary for implementation. The Council shall determine if provisions for funding are adequate to implement the plan.*

Section 5 of the plan includes an estimate of the funding necessary for decommissioning. This funding appears adequate based on the decommissioning cost estimate. The department's review of PGE's funding provisions appears in Section VII of this report. Costs are also discussed in Section VI. The department determined that the decommissioning cost estimate is reasonable, based on the methodology used and our review of its application. Furthermore, the department recognizes the Oregon PUC's analysis and approval of the funding plan presented in the decommissioning plan. It is the department's conclusion that PGE has satisfied this criterion.

Department Conclusion

In summary, the department has concluded that the proposed decommissioning plan meets the criteria set forth in OAR 345-26-370(2)(a) through (g) and OAR 345-26-370(3). The department therefore recommends approval of the plan. Further, the department recommends certain conditions pertaining to the decommissioning of Trojan, which are described in Section IX of this report.

II. INTRODUCTION AND BACKGROUND

A. Introduction

The Oregon Office of Energy (OOE), referred throughout this report as "the department", engaged Technical Analysis Corporation (TAC) to review the Portland General Electric (PGE) Company's Trojan Nuclear Plant Decommissioning Plan. This report presents the results of the department's review, which was conducted to evaluate whether the proposed plan complies with Oregon requirements.

The bases for this review are rules issued by the State of Oregon's Energy Facility Siting Council (EFSC or "the Council") for the decommissioning of nuclear facilities. They are contained in the Oregon Administrative Rules, Chapter 345, Division 26, abbreviated as OAR 345-26. Specifically, OAR 345-26-370 provides criteria for the Council to approve a nuclear facility's decommissioning plan. These criteria are discussed in Section III and are included in Appendix B of this report.

Following this introduction, this report reviews the background of the Trojan Nuclear Plant (TNP) and the decision to decommission the plant prior to the scheduled end of its operating license. This report briefly describes the decommissioning process and two alternative decommissioning methods acceptable to the U.S. Nuclear Regulatory Commission (" NRC" or "the Commission"). Also described are two elements of the overall decommissioning that are being handled separately from the Decommissioning Plan. These are the Large Component Removal Project (LCRP) and the Independent Spent Fuel Storage Installation (ISFSI). In addition, we briefly describe the regulatory requirements for decommissioning.

Section III evaluates the plan's compliance with Council standards. Section IV describes the content of the Decommissioning Plan and summarizes the proposed activities. Section V presents the department's evaluation of PGE's safety analysis of decommissioning. Section VI presents a detailed analysis of the PGE Alternative Evaluation required by OAR 345-26-370(2)(g). Section VII examines PGE's decommissioning cost analysis. Section VIII presents the public comments that were expressed at the March 29, 1995 public meeting in St. Helens, Oregon. Section IX provides the department's recommendations regarding the Decommissioning Plan. Section X lists the documents reviewed, referenced, or used as a basis for the department review of the Trojan Decommissioning Plan.

B. Trojan Background

TNP is a single nuclear unit located in northwest Oregon on the Columbia River approximately 42 miles north of Portland. TNP is operated by PGE and co-owned with the Eugene Water & Electric Board/Bonneville Power Administration (EWEB/BPA) and Pacific Power & Light/Pacificorp. The plant architect and construction contractor was the Bechtel Corporation.

TNP achieved initial criticality in November 1975 and began commercial operation in May 1976. The reactor output was rated at 3411 megawatts thermal with an

approximate net electrical

output of 1130 megawatts electrical.[3] The Nuclear Steam Supply System consisted of a Westinghouse pressurized water reactor and a four loop Reactor Coolant System.

Leading up to the decision to permanently cease operations, PGE extended a scheduled outage in 1991 because it had discovered numerous flaws in the steam generator tubes. After much analysis and repair work, the plant resumed operation in February 1992. On November 9, 1992, the plant was shut down due to new steam generator tube leakage. This was the final shutdown after an operating lifetime of approximately 17 years.

The decision to permanently shut down was primarily due to financial and reliability concerns relating to steam generator tube degradation. PGE reviewed plant operation and economics, and the continuing uncertainty regarding steam generator performance and related NRC requirements. On January 27, 1993, PGE notified the department and the NRC[4] of its decision to permanently cease power operations. On May 5, 1993, the NRC amended the Trojan Facility Operating License (NPF-1) to a Possession Only License ("POL").[5] On January 26, 1995, just short of two years from the notification of their decision to permanently shut down the facility, PGE submitted PGE-1061, Trojan Nuclear Plant Decommissioning Plan, hereinafter referred to as the Decommissioning Plan, to the NRC and to the department.

Since closing the plant, PGE has removed all the spent fuel from the reactor and placed it in the onsite spent fuel pool, decreased the size of the Trojan staff, and received relaxation of NRC licensing requirements that are no longer applicable to Trojan. On March 31, 1995, the NRC issued Amendment 194 to the license, replacing the

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[3] U.S. Nuclear Regulatory Commission, NUREG-0020, Licensed Operating Reactors-Status Summary Report, V.15, pp.2-301

[4] Portland General Electric Company, letter from K.L.Harrison to J.M.Taylor, U.S. Nuclear Regulatory Commission, Cessation of Nuclear Plant Operations, January 27, 1993

[5] U.S. Nuclear Regulatory Commission, letter from M.T.Masnik to J.E.Cross, Portland General Electric Company, Issuance of Amendment No. 190 for Facility License No. NPF-1 to Possession-Only License for the Trojan Nuclear Plant, May 5, 1993

operating Technical Specifications in their entirety with the Permanently Defueled Technical Specifications .[6]

C. Decommissioning

Radiation from the radioactive materials inherent in a nuclear power plant creates a potential health hazard to workers in the plant, people outside the plant, and the environment. Radiation arises mostly from the operation of the plant. However, when the plant permanently closes, the radioactivity does not go away immediately. It slowly decreases or decays over time. The radioactivity of some short-lived radioactive materials diminishes quickly. After a short delay, a few weeks or months, this portion of the plant's radioactive material inventory decays away. Long-lived isotopes decay more slowly, with some radiation existing at hazardous levels for decades or even centuries.

[6] U.S. Nuclear Regulatory Commission, letter from M.T.MASNIK to S.M.Quennoz, Issuance of Amendment for Trojan Nuclear Plant (TAC No. M87167), March 31, 1995

At the end of a commercial nuclear facility's useful life, decommissioning and termination of the NRC operating license is a desired objective. In the Code of Federal Regulations, decommissioning a nuclear power plant is defined as the process of removing the facility safely from service and reducing residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license.[7] Decommissioning generally takes between six and sixty years to accomplish, depending on the alternative selected and the various options available within those alternatives.

Federal regulations at 10 CFR 50.82 allow decommissioning to be deferred for up to a maximum of 60 years. The NRC analyzed the impacts of decommissioning in its Generic Environmental Impact Statement (GEIS), also entitled NUREG 0586. The GEIS considered three alternative scenarios - one where decommissioning is performed immediately, one where decommissioning is deferred for 25 years, and one where the delay is 60 years. The GEIS found the impacts from all three cases to be acceptable. The NRC has determined that hybrids or combinations of these scenarios are also acceptable. To distinguish between immediate decommissioning and deferred decommissioning, the GEIS coined two acronyms, DECON and SAFSTOR.

DECON refers to prompt decommissioning. The equipment, structures, and portions of a facility and site containing radioactive contaminants are removed or decontaminated to a level that permits the property to be released for unrestricted use shortly after cessation of operations.

SAFSTOR refers to delayed decommissioning. In this alternative, the facility is placed and maintained in a condition that allows the nuclear facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use.[8]

It is useful to view these two alternatives as the end points on a continuum. At one end is DECON where decontamination, dismantlement, and release of the site for unrestricted use occurs soon after the cessation of plant operations. At the other end is SAFSTOR where these same decommissioning activities are deferred to allow for radioactive decay. The alternative selected can fall anywhere on this continuum, because conditions will vary for every nuclear plant. NRC studies, for example, address various SAFSTOR periods of 10, 30, 60, and 100 years. Major factors that can influence the choice of decommissioning method for a particular plant include the number of years the plant operated, burial costs and the availability of waste disposal sites, fuel management costs, the availability of funds and interest rates on borrowing money, plans for site use, and other site specific factors.

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7 10 CFR 50.2, Definitions

8 U.S. Nuclear Regulatory Commission, NUREG-0586, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, August 1988, p.2-6

With DECON, decontamination and dismantlement of the structures, systems, and components occurs relatively soon after permanent shutdown of the facility. The primary advantage is that termination of the nuclear plant license and the release of the site for unrestricted use can happen within a relatively short time period, approximately 6 years for a large commercial nuclear plant such as Trojan. This shorter term method of decommissioning eliminates the need for long-term security, maintenance, surveillance, and radiation protection measures that are necessary under SAFSTOR to protect the health and safety of the public. An additional advantage of the shorter time period for DECON is the availability of a work force that is highly knowledgeable about the facility. Because DECON does not defer any decommissioning activities, however, this method requires a higher initial commitment of funds, higher occupational radiation exposure, and more waste disposal space than SAFSTOR.[9]

With SAFSTOR, a large portion of the decontamination and dismantlement activities are deferred for up to 60 years. PGE analyzed two options: a 25 year case and a 60 year case. The primary advantage of deferring these activities is reduced occupational radiation exposure due to the radioactive decay that takes place over the SAFSTOR period. This radioactive decay also results in less radioactive waste disposal space being required at the end of the SAFSTOR period. Deferred decontamination and dismantlement can also result in a reduction in the initial outlay of decommissioning funds.[10]

In its Decommissioning Plan, PGE asserts that one great disadvantage of SAFSTOR is the longer term need for security, maintenance, radiation monitoring, and environmental monitoring to ensure the health and safety of the public during the SAFSTOR period. Another disadvantage is the potential unavailability or greatly increased cost of low level radioactive waste disposal sites at the end of the SAFSTOR period. Yet another disadvantage of the longer SAFSTOR period is the inevitable lack of people who are knowledgeable about the facility's design and construction. And lastly, as with any extended time period, there are regulatory uncertainties in the future which, although they are not foreseeable at this time, may impact the SAFSTOR process after it is well underway.[11]

PGE selected the DECON alternative.[12] The principal reasons for this selection were that DECON was less expensive than other SAFSTOR options, and it minimized the potential for increased radioactive waste burial costs or unavailability of a burial site.

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9 ibid., pp.2-6 to 2-11

10 ibid.

11 ibid.

12 Portland General Electric Company, Decommissioning Alternative Evaluation for the Trojan Nuclear Plant, January 26, 1995, p.1

PGE also determined that radiation exposure, low-level radioactive waste volume, and the environmental impact associated with DECON were within acceptable limits consistent with state and federal regulations.

The overall decommissioning program for Trojan, including parts of the program not described in the Decommissioning Plan, has six principal elements, summarized as follows:

(1) Preparation

Preparation for decommissioning began when PGE decided to close the plant. This phase has included deactivation and lay-up of plant systems; extensive planning; preparing engineering specifications, work plans, and procedures; and procuring special equipment and negotiating service contracts.

(2) Large Component Removal Project (LCRP)

The LCRP is described in PGE-1062, Trojan Nuclear Plant Large Component Removal Plan, July 7, 1994, and is not covered in the Decommissioning Plan. It involved the removal and shipment of the four steam generators and the pressurizer from the containment building. The process of removing these large components required the cutting and removal of large sections of primary coolant piping, pipe supports, concrete walls, and other equipment. It also required that an opening be cut in the containment wall to allow the components to be moved outside and transported off-site. PGE disposed of these components in the radioactive waste disposal facility operated by U.S. Ecology on the Hanford reservation in Washington. The LCRP was completed in October 1995.

PGE's wished to conduct the LCRP prior to having the Decommissioning Plan approved in order to take advantage of lower burial costs available at the Hanford site through 1995. PGE has predicted a significant increase in radioactive waste disposal costs in coming years. This has already occurred at other U.S. radioactive waste disposal facilities. PGE reasoned that since these large components had to be removed and disposed of sometime during the decommissioning process, they should complete it prior to the end of 1995 to realize a significant cost savings. PGE predicted additional cost savings by proceeding with an early LCRP if they used current plant people to do most of the work. If the LCRP occurred at a much later time during decommissioning, knowledgeable plant personnel would likely be gone, thereby forcing the Company to hire contractors at much higher cost. PGE estimated that the LCRP

would reduce the overall cost of decommissioning by $4.5 million.[13]

[13] Portland General Electric Company, PGE-1062, Trojan Nuclear Plant Large Component Removal Plan, July 7, 1994, p.4-15

Since the removal of these large components involved opening the containment building to the outside, Council approval was required in advance. On June 24, 1994, the Council adopted rules in OAR 345-26[14] to provide the standards and process by which the LCRP could be approved and conducted prior to Council approval of the Decommissioning Plan. On July 7, 1994, PGE transmitted PGE-1062, Large Component Removal Plan,[15] to the department and the Council for approval. On the same date, PGE informed the NRC of its intention to proceed with the project.[16] The department engaged TAC to conduct an independent review of the LCRP to evaluate whether the proposed plan complied with Oregon requirements, as specified in OAR 345-26. TAC presented the results of their review in October 1994,[17] and on November 18, 1994, the Council approved the plan via an amendment to OAR 345-26-370. PGE began the project shortly thereafter.

The LCRP was delayed by court challenges at the State and Federal level. The legal issues in these court challenges are outside the scope of this report. However, the project was completed as scheduled. Department observations of PGE's performance during this project provided useful insight into PGE's likely performance during the rest of decommissioning. In particular, department findings on the adequacy of PGE's radiation protection program and the reliability of its cost and occupational exposure estimates are based in part on the observations made during this project.

(3) Independent Spent Fuel Storage Installation (ISFSI)

The spent nuclear fuel is currently stored in the Trojan spent fuel pool. Spent nuclear fuel is highly radioactive and continues to produce heat long after it has been removed from the reactor due to the radioactive decay. The spent fuel pool and the associated spent fuel cooling system remove the decay heat from the spent fuel. The pool may also be used for short term storage of the reactor vessel internals. These internals are not eligible for disposal at a low-level waste site and are classified as "Greater Than Class C" waste (GTCC)[18].

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14 OAR 345-26-370(8)

15 Portland General Electric Company, letter from T.D.Walt to D.Stewart-Smith, Oregon Department of Energy, Large Component Removal Plan, July 7, 1994

16 Portland General Electric Company, letter from S.M.Quennoz to U.S. Nuclear Regulatory Commission, Large Component Removal Plan, July 7, 1994

17 Technical Analysis Corporation, Review of PGE's Large Component Removal Plan for Trojan Nuclear Plant, October 11, 1994

18 10 CFR 61.55 defines GTCC waste as "not generally acceptable for near-surface disposal ... and must be disposed of in a geologic repository.

Part of DECON will be the decontamination and dismantlement of the spent fuel pool and related support systems after the removal of spent fuel from the pool. PGE plans to transfer the fuel and GTCC waste to an interim, onsite, dry storage facility made up of several shielded casks. These casks will protect the fuel and GTCC waste from damage and include radiation shielding to protect workers, the public, and the environment until it can be transferred to a federal repository. This dry storage facility is referred to as the Independent Spent Fuel Storage Installation (ISFSI).

The Decommissioning Plan describes the ISFSI only as it affects the planning and scheduling of decommissioning activities. The construction, operation, and decommissioning of the ISFSI will be described in a separate document. The federal licensing requirements for an ISFSI are described in 10 CFR 72. State acceptance criteria for an ISFSI described in OAR 345-26-390.

On October 26, 1995 the Council amended OAR 345-26-390 to allow Council consideration of spent fuel storage in a facility other than the Spent Fuel Pool. The amended rule became effective November 3, 1995. OAR 345-26-390 requires PGE to submit a detailed plan for the ISFSI, sets forth acceptance criteria for an ISFSI plan, and requires final Council approval of the plan, via a separate rulemaking process.

PGE plans to begin construction of the ISFSI in 1996 and transfer the spent fuel and GTCC waste to it in 1998, following a transition period of approximately six years from shutdown to allow for reduction of decay heat.[19] When all federal requirements under 10 CFR 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste," have been met, the NRC will issue PGE a license for operating the storage facility. This license will remain in effect until the ISFSI is decommissioned.

Permanent disposal of the spent nuclear fuel and GTCC waste is ultimately the responsibility of the Federal Government. The U.S. Department of Energy (DOE) is developing a permanent disposal facility for this high-level radioactive waste, but progress has been slow. The spent fuel and GTCC waste could remain in interim storage at Trojan for many years. Therefore, OAR 345-26-390 requires a design life of at least 40 years.

Eventually the ISFSI casks used for dry storage may also be used to transport the spent fuel and GTCC waste off-site for permanent disposal. The target completion date for offsite shipment is 2018, based on the schedule called for in the existing DOE Contract for Disposal of Spent Nuclear Fuel and/or High-Level

[19] 10 CFR 961, Appendix E, requires a minimum period of five years.

Radioactive Waste.[20] PGE must address the decommissioning of the ISFSI in its ISFSI plan, as required by 10 CFR 72.

(4) Reactor Vessel Internal Removal Project

Removal of the reactor vessel internals will begin after NRC and Council approval of the Decommissioning Plan. This project is scheduled to begin in early 1997 and be completed by early 1998. Components removed with the reactor vessel internals that are classified as GTCC waste in accordance with 10 CFR 61 will be stored in the spent fuel pool and later transferred to the ISFSI. This project is a major element of decommissioning and is described in the Decommissioning Plan.

(5) Decontamination and Dismantlement

Following transfer of the spent fuel to the ISFSI in 1998, full scale decontamination, dismantling, and removal of the remaining contaminated structures and systems will begin. Contaminated systems, components, and structural materials will be decontaminated or removed, packaged, and shipped to an offsite burial facility. PGE plans to complete this effort by 2001.

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[20] Portland General Electric Company, Decommissioning Alternative Evaluation for the Trojan Nuclear Plant, January 26, 1995, p.13

Following decontamination and dismantlement, PGE will perform a “final radiation survey” of the site to confirm that the residual radiation levels are below the limits set by applicable NRC and Oregon rules and that the site, with the exception of the ISFSI, is suitable for unrestricted use.[21] It is expected that since all sites and many materials, including building materials, are naturally radioactive to some extent, a “background” radiation will remain, approximately equal to the radiation at the site before the plant was built.

Successful completion of the decommissioning activities and the final radiation survey, as prescribed in 10 CFR 50.82, will allow the NRC to terminate the operating (10 CFR 50) license. This is scheduled to occur in 2001. An Interim Spent Fuel Storage Facility license under 10 CFR 72 will remain in effect until the ISFSI is decommissioned, currently projected for 2018. The Site Certificate will remain in effect for at least as long as spent fuel remains onsite.

The decontamination and dismantlement activities and the final radiation survey are the major elements of decommissioning and are described in the Decommissioning Plan.

(6) Site Restoration

After shipment offsite of spent fuel and Greater than Class C waste, all facilities with no further value will be dismantled and the entire site made available for unrestricted use. This phase of decommissioning is scheduled to begin in 2018. The definition of the term “decommissioning” does not include the removal or disposal of equipment or structures that are not contaminated with radioactive materials. Therefore, the Decommissioning Plan does not address in detail additional site restoration activities beyond what is necessary to allow unrestricted access to the site. The plan also does not describe the decommissioning or site restoration of the ISFSI site. This will be described in a separate document.

[21] 10 CFR 50.82(f)(2)

Decommissioning activities, with the exception of certain activities permitted under the facility's operating license and/or 10 CFR 50.59, must be governed by a decommissioning plan approved by the NRC, and in Oregon, the Council. 10 CFR 50.82 states that application "for authority to surrender a license voluntarily and decommission its facility ... must be made within two years following permanent cessation of operations.... Each application for termination of license must be accompanied, or preceded, by a proposed decommissioning plan."[22]

On January 26, 1995, PGE submitted their Decommissioning Plan to the NRC in accordance with the requirements of 10 CFR 50.82. The stated objective of this 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."[23]

D. Regulatory Requirements

The two agencies with primary responsibility for reviewing the decommissioning plan are the Oregon Energy Facility Siting Council and the U.S. Nuclear Regulatory Commission for decommissioning. The applicable regulations of these two agencies are identified as follows:

1. Oregon Energy Facility Siting Council

The Council has established rules for nuclear power plant decommissioning, which are contained in Oregon Administrative Rules, Chapter 345, Division 26, abbreviated as OAR 345-26. The stated purpose of these rules is "to assure that the construction, operation and retirement of facilities are accomplished in a manner consistent with the protection of the public health, safety, and welfare and the protection of the environment."[24]

The applicable rules for decommissioning a nuclear facility are contained in OAR 345-26-370. These require the Council to review the decommissioning plan for approval based on a technical review of the plan and an evaluation as to the adequacy of funding for the estimated cost of the decommissioning program. These criteria are included in Appendix B of this report. In addition, the Council may require the decommissioning plan to be modified as a condition for approval or decline to approve the plan.

2. U.S. Nuclear Regulatory Commission

The NRC regulatory responsibilities for nuclear power plants include "protecting public health and safety, protecting the environment, protecting and safeguarding nuclear materials and nuclear power plants in the interest of national security,

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22 10 CFR 50.82(a)

23 Portland General Electric Company, PGE-1061, Trojan Nuclear Plant Decommissioning Plan, January 26, 1995, p.1-2

24 OAR 345-26-005

and assuring conformity with antitrust laws. Agency functions are performed through standards setting and rulemaking; technical reviews and studies; conduct of public hearings; issuance of authorizations, permits, and licenses; inspection, investigation, and enforcement; evaluation of operating experience; and confirmatory research."[25]

[25] 10CFR1.11(b)

The NRC bases its requirements for plants that have been permanently shut down on the federal license for the plant, which the NRC does not terminate until the utility completes the decommissioning program with a satisfactory final radiation survey.[26] As with the Oregon requirements, the NRC requires that a decommissioning plan be developed by the utility and approved by the NRC.[27] On January 26, 1995, PGE submitted PGE-1061, Trojan Nuclear Plant Decommissioning Plan, in accordance with 10 CFR 50.82. (See Appendix A of this report for the text of 10 CFR 50.82.)

3. Coordination of NRC and Department Regulatory Programs

The department and NRC coordinate their Trojan nuclear safety regulatory programs in accordance with a Memorandum of Understanding.[28] This agreement focuses principally on the separate inspection programs at Trojan carried out by the two organizations.[29] Besides frequent interactions at the plant site between department inspectors and NRC inspectors, the department often has a representative at NRC meetings regarding Trojan, and the NRC occasionally sends a representative to Council meetings regarding Trojan. Furthermore, Council rules direct that the department "to the extent practicable, coordinate its technical review with that of the U.S. Nuclear Regulatory Commission."[30]

4. Requirements of Other Agencies

During packaging and transport of low level waste to the burial site, several state and federal agencies will be involved. TAC's Review of PGE's Large Component Removal Plan for Trojan Nuclear Plant of October 11, 1994, provided a list (Table I-1) of regulatory approvals required for packaging and transportation of radwaste, including transportation by river barge and by roads. The same list is

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26 10 CFR 50.82(f)(2)

27 10 CFR 50.82(a)

28 Memorandum of Understanding between the NRC and the State of Oregon, January 1980

29 Technical Analysis Corporation, Evaluation of Oregon's Regulatory Program at the Trojan Nuclear Power Plant, September 20, 1991, and references cited in that report

30 OAR 345-26-370(1)(c)

reproduced as Appendix C to this report. Existing PGE administrative controls will be used to ensure that these regulatory requirements are met. The department monitors these activities as necessary to ensure compliance.

III. EVALUATION OF COMPLIANCE WITH COUNCIL CRITERIA

OAR 345-26-370(2) sets forth the criteria for Council approval of the decommissioning plan. Specifically, to verify that the proposed decommissioning activities will not adversely affect the health and safety of the public or the environment, OAR 345-26-370(2) requires that the Council review the proposed decommissioning plan to ensure that seven essential criteria are met in the proposal. An additional criterion is specified in OAR 345-26-370(3), which requires a Council finding concerning the adequacy of provisions to fund the decommissioning plan.

The department's conclusions on compliance with these eight criteria are as follows:

A. Acceptable Surface Contamination Levels — OAR 345-26-370(2)(a)

The plan contains criteria for the free release of materials and the area as specified in Table 1 below. (Table 1 is excerpted from NRC Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors," June 1974, and is reproduced in Appendix B of this report.)

Final release criteria are described in Section 4.2 of the plan. The limits for loose and fixed surface contamination are the same as those established in Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors, June 1974, which is identical to the state rule. It is the department's conclusion that PGE has satisfied this criterion.

B. Exposure Rate — OAR 345-26-370(2)(b)

After decommissioning, the exposure rate at one meter from all surfaces in the facility buildings and outdoor areas shall be 5 μR/hr or less above the background radiation level. Background radiation is defined in OAR 345-01-010.

Final release criteria are described in Section 4.2 of the Decommissioning Plan. The limit for direct exposure is 5 μR/hour above background. Ultimately, the final survey described in Section IV of this report will constitute final verification that this limit is not exceeded. Although the plan does not specify that the rate is to be measured at one meter from all surfaces, it is consistent with the NRC's Generic Environmental Impact Statement (GEIS or "NUREG-0586"), which does stipulate measurements at one meter. Furthermore, PGE has committed to conducting the final radiation survey in accordance with guidance in NUREG/CR-5849, which also requires that direct measurements be made at one meter above all surfaces. Section IV.F of this report discusses in detail the department's review of the PGE survey plan and concludes that it is adequate to demonstrate compliance with this rule. It is the department's conclusion that PGE has satisfied this criterion.

C. Radioactive Waste Removal — OAR 345-26-370(2)(c)

The plan must contain provisions that require removal from the site of all radioactive waste as defined in ORS 469.300 on a schedule acceptable to the Council. Spent nuclear fuel and other radioactive materials that must be disposed of in a federally

approved facility may be stored on the site until such a federally approved facility will take the fuel and these radioactive materials.

Section 1 of the plan describes the overall schedule for decommissioning, including the removal from the site of all radioactive waste by the year 2001, except for the spent fuel and high-level waste. This schedule includes the completion of the LCRP in 1995; removing the reactor vessel internals by early 1998; licensing and constructing the ISFSI by mid-1998; and transferring fuel and high-level waste to the ISFSI beginning in 1998.

The schedule also includes removing contaminated systems and components for burial, decontaminating structures, and performing a final radiation survey of the entire site to confirm that the residual radiation levels are below the applicable limits and that the site, with the exception of the ISFSI, is suitable for unrestricted use. This is scheduled to be completed in 2001. The shipment of spent fuel and "Greater than Class C" (GTCC) waste to a federal repository is scheduled to begin in 1998 and be completed by 2018, based on the existing DOE Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste. However, progress on creating a permanent disposal facility has been slow. By some estimates, the scheduled opening of a federal repository has already been pushed back from 1998 to at least 2010. A delay in shipping spent fuel and GTCC waste could affect the scheduled completion date of 2018. However, the Council rules include requirements for PGE in the event that a federal repository is unavailable at the end of the design life of the ISFSI dry storage casks. OAR 345-26-390(4)(j) reads as follows: "The [PGE ISFSI] plan shall discuss the options available if the expected lifetime is reached and no Federally licensed permanent High Level Waste site is available."[31] Additionally, under these rules PGE is responsible for addressing the issue of schedule delays in shipping spent fuel and GTCC waste in the ISFSI plan. PGE expects to submit the ISFSI plan to the Council early in 1996.

Although neither PGE nor the Council can predict with certainty the timing of a Federal high level waste site, the department concludes that PGE's schedule for removing all radioactive waste from the site is acceptable because it provides for removal of low level waste by a date certain and on a timely basis. The department believes, given the uncertainty in the opening of a federal repository, the contingencies built into the cost analysis and the provisions of OAR 345-26-390(4)(j), that PGE's plan for disposing of spent nuclear fuel and other high-level GTCC radioactive waste is acceptable. It is the department's conclusion, therefore, that PGE has satisfied this portion of the criterion.

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[31] Oregon Department of Energy, Hearing Officer's Report and Amendment of Rules on Storage of Spent Nuclear Fuel (OAR 345-26-370 and OAR 345-26-390), September 1, 1995

Section 3.3 of the plan describes the program for radioactive waste management, including spent fuel management, handling of wastes, and process control programs. The department previously reviewed and approved the Offsite Dose Calculation Manual, Radioactive Effluent Controls Program, and Radiological Environmental Monitoring Program.[32] In addition, the department's review of the other portions of the program for radioactive waste management found them to contain effective programmatic controls. It is the department's conclusion that PGE has satisfied this portion of the criterion.

D. Effluent Monitoring and Control — OAR 345-26-370(2)(d)

The plan must contain an acceptable program for monitoring and controlling effluents to ensure compliance with applicable state and federal limits. This program may be incorporated by reference, if it has previously been approved by the department.

PGE maintains that the Radioactive Effluent Controls Program and the requirements of the Offsite Dose Calculation Manual (ODCM) provide assurance of their ability to meet this criteria. The department, in consultation with Oregon Health Division and Dr. Brian Dodd of Oregon State University, reviewed and approved the Trojan ODCM as revised in September 1994. The department also found that the "requirements set forth in OAR 345-26-330, which requires PGE to implement Radiological Effluent and Environmental Monitoring programs subject to department approval, are met."[33] Accordingly, this program is incorporated by reference.

E. Environmental Radiological Monitoring — OAR 345-26-370(2)(e)

The plan must contain a program for radiological monitoring to ensure the environment is not being adversely affected. This program may be incorporated by reference if it has previously been approved by the department.

PGE maintains that the Radiological Environmental Monitoring Program and the requirements of the Offsite Dose Calculation Manual (ODCM) provide assurance of their ability to meet this criteria. The department, in consultation with Oregon Health Division and Dr. Brian Dodd of Oregon State University, reviewed and approved the Trojan ODCM, as revised in September 1994. The department also found that the "requirements set forth in OAR 345-26-330, which requires PGE to implement Radiological Effluent and Environmental Monitoring programs subject to department approval, are met."[34] Accordingly, this program is incorporated by reference.

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32 Oregon Department of Energy, letter from J.Savage to T.D.Walt, Portland General Electric Company, December 12, 1994

33 ibid.

34 ibid.

F. Removal or Control of Hazardous Wastes — OAR 345-26-370(2)(f)

The plan must contain provisions for removal or control of hazardous wastes that are consistent with applicable federal and state regulations.

The plan does contain provisions for the removal or control of hazardous wastes consistent with applicable federal and state regulations. Section 3.6 of the plan, "Nonradioactive Waste Management," states that nonradioactive regulated waste, such as asbestos, polychlorinated biphenyls (PCBs), mercury, and lead, will be controlled by the TNP chemical safety program and that work will be done in accordance with the TNP work control process and approved plant procedures. This program provides for evaluation of regulated substances and approval of methods for their handling and disposal. The plan also states that the removal and disposal of materials will be conducted in accordance with OSHA regulations, and federal and state hazardous waste regulations, as applicable. Our review of these procedures indicate that adequate controls exist to safely handle such materials. It is the department's conclusion that PGE has satisfied this criterion.

G. Analysis of Decommissioning Alternatives — OAR 345-26-370(2)(g)

An analysis of decommissioning alternatives shall be provided with the plan, satisfactory to the Council. This analysis will describe the bases for the decommissioning alternative selected, and shall include a comparison of SAFSTOR and DECON as those terms are defined by the U.S. Nuclear Regulatory Commission. The analysis must demonstrate that impacts to public health and safety for the option chosen are bounded by the alternatives analyzed above. The analysis must demonstrate that the alternative chosen protects the environment and the health and safety of the public consistent with state and federal statutes, rules and regulations.

The Decommissioning Alternative Evaluation was submitted to the department along with the Decommissioning Plan on January 26, 1995. The evaluation describes the bases for PGE's selection of DECON and makes an in-depth comparison of SAFSTOR and DECON. Section VI of this report analyzes this evaluation in detail and finds it in compliance with OAR 345-26-370(2)(g). The department found that PGE's analysis is clearly bounded by the alternative decommissioning methods described in NRC studies in the areas of Low-Level Radioactive Waste Volume, Occupational Radiation Exposure, and Public Radiation Exposure. It demonstrates that DECON is within the guidelines established by the NRC studies, that it adequately protects the environment and the health and safety of the public, and that it is consistent with state and federal statutes, rules, and regulations.

The department recommends that the Council find the Decommissioning Alternative Evaluation satisfactory, because PGE presents reasonable arguments in support of its choice of decommissioning alternative that are validated by realistic, site-specific assumptions, estimates, facts, and experience. The information provided in the

evaluation demonstrates that the options were considered on an “apples-to-apples” basis. In comparing options, PGE considered the factors that most directly affect public health and safety and the environment, and has compared these factors with the most recent generic studies done by the NRC. For these reasons, the department recommends that the Council find the PGE alternative analysis to be satisfactory.

The department concludes that PGE has satisfied each aspect of this criterion.

H. Estimate of Funding — OAR 345-26-370(3)

The plan must include an estimate of funding necessary for implementation. The Council shall determine if provisions for funding are adequate to implement the plan.

Section 5 of the plan includes an estimate of the funding necessary for decommissioning. This funding appears adequate based on the decommissioning cost estimate. The department's review of PGE's funding provisions appears in section VII of this report. The department determined that the decommissioning cost estimate is reasonable, based on the methodology used and our review of its application. Furthermore, the department recognizes the Oregon PUC’s analysis and approval of the funding plan presented in the decommissioning plan. It is the department’s conclusion that PGE has satisfied this criterion.

IV. DESCRIPTION OF PGE'S DECOMMISSIONING PLAN[35]

A. Organization of the Decommissioning Plan

The Decommissioning Plan was prepared in accordance with 10 CFR 50.82(b) and the guidance provided in Draft Regulatory Guide DG01005, Standard Format and Content for Decommissioning Plans for Nuclear Reactors. The plan is divided into the following nine sections:

1. Summary of Plan
2. Choice of Decommissioning Alternative and Description of Activities
3. Protection of Occupational and Public Health and Safety
4. Proposed Final Radiation Survey Plan
5. Decommissioning Cost Estimate and Funding Plan
6. Technical Specifications and Environmental Protection Plan
7. Quality Assurance Provisions
8. Physical Security Plan
9. Fire Protection Program

Each section, except Section 3.4, Event Analysis, and Section 5, Decommissioning Cost Estimate and Funding Plan, is briefly described in the following paragraphs in the order in which they appear. The department's evaluations of Decommissioning Plan Sections 3.4 and 5 are described in Sections V and VII, respectively, of this report.

B. Summary of Plan

Section 1 of the plan includes a summary of the overall decommissioning project, a brief description of major activities, a schedule of activities, and a summary of the cost estimate and funding plan. The following paragraphs briefly describe this portion of the plan, except for decommissioning costs and funding, which are described in section VII of this report.

Trojan decommissioning is divided into two broad periods: (1) transition, and (2) decontamination and dismantlement. The transition period already began with PGE's decision to close the plant in January 1993, and it will continue until the spent fuel is stored in the ISFSI, which is scheduled to be completed in mid-1998. The transition period includes deactivation and lay-up of plant systems; extensive decommissioning planning; preparing engineering specifications, work plans, and procedures; procuring special equipment and negotiating service contracts; completing the LCRP; removing the reactor vessel internals; licensing and constructing the ISFSI; and transferring fuel and high-level waste to the ISFSI.

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[35] To eliminate duplication and provide maximum clarity, some of the descriptions in this section are paraphrased from PGE-1061, Trojan Nuclear Plant Decommissioning Plan, January 26, 1995.

During the transition period, limited decommissioning activities involving hardware, such as deactivating systems and dismantling the steam generators and pressurizer (LCRP), were allowed prior to NRC and the Council approval of the plan. Other activities, such as the removal of the reactor vessel internals, will begin after NRC and Council approval of the plan. Components removed with the reactor vessel internals that are classified as Greater than Class C waste in accordance with 10 CFR 61 will be stored in the spent fuel pool until transferred to the ISFSI.

The second period, decontamination and dismantlement, includes removing contaminated systems and components for burial, decontaminating structures, and performing a "final radiation survey" of the entire site to confirm that the residual radiation levels are below the applicable limits and that the site, with the exception of the ISFSI, is suitable for unrestricted use.[36] Successful completion of the decommissioning activities and the final radiation survey, scheduled for the year 2001, will allow the NRC to terminate the 10 CFR 50 Facility Operating (Possession Only) License NPF-1. The Site Certificate, however, will remain in effect for at least as long as spent fuel remains onsite.

After completion of decontamination and dismantlement activities, the shipment of spent fuel and high-level waste offsite, and termination of the license, nonradiological site remediation activities will be conducted. During this phase, all facilities with no further value will be dismantled and the entire site made available for unrestricted use. This is scheduled to begin in 2018 and conclude in 2019. The definition of "decommissioning" does not include the removal or disposal of equipment or structures that are not contaminated with radioactive materials. Therefore, the Decommissioning Plan does not address in detail additional site restoration activities beyond what is necessary to allow unrestricted access to the site.

A summary schedule for decommissioning and site restoration activities is reproduced here from Section 1 of the Decommissioning Plan:

January 1993 - Mid 1998	Transition period
Late 1994 - Late 1995	Large Component Removal Project
Late 1996 - Mid 1998	Decontam. and dismantle. planning
Late 1996 - Mid 1998	Complete planning/building an ISFSI
Early 1997 - Early 1998	Reactor Vessel Internals Removal
Mid 1998	Transfer spent fuel to the ISFSI
Mid 1998 - Late 2001	Full-scale decontam. and dismantle.
Late 2001	Complete final radiation survey
Late 2001 - Mid 2018	Caretaking

[36] 10 CFR 50.82(f)(2)

Mid 2018 - Late 2019 Demolish buildings

C. Choice of Decommissioning Alternative and Description of Activities

The choice of decommissioning alternative is discussed in Section VI of this report in conjunction with the description of PGE's Decommissioning Alternative Evaluation. A description of general activities is summarized in the preceding section (Section IV.B) of this report. The LCRP and ISFSI are discussed in Section II.C.

In addition to a general overview of decommissioning activities and methods, Section 2 of the plan gives a summary description of the decontamination and dismantlement activities planned for each system and structure. For example, systems are described in terms of: (1) the components that have to be removed, (2) location of components, (3) physical considerations in the removal, (4) relative degree of contamination, and (5) special considerations that are anticipated. Section 2 gives projections on occupational exposures and radwaste. It also provides a description of PGE's decommissioning organization, including the qualifications and responsibilities of key staff members and the responsibilities of the Independent Review and Audit Committee. Also described is the training program for workers and controls on the use of contractors.

The following paragraphs contain additional information or clarification about material in Section 2 of the Decommissioning Plan that resulted from our review. Most of the following information came from PGE responses[37] to the department's written requests for information (RAI's) of March 6, 1995 and June 19, 1995. Unless otherwise stated, quotes or statements credited to PGE come from the written responses to the RAIs. Some of the questions and responses provided have been edited for clarity or to avoid duplication with information found elsewhere in this report.

1. Definition of Administrative Procedures and Controls

The terms "administrative procedures" and "administrative controls" are used throughout the Decommissioning Plan. We asked if these terms applied only to those "procedures, programs, and manuals" listed in Permanently Defueled Technical Specifications (PDTS) Section 5.7, which are subject to strict review and approval requirements, or did they include procedures and controls that are not subject to the same requirements as those defined in the PDTS.

PGE responded that all of the "procedures used at Trojan, whether they are required by PDTS or not, are screened in accordance with the requirements of 10 CFR 50.59." Furthermore, the review and approval process of all Trojan procedures is controlled by the same administrative program.

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[37] Portland General Electric Company, letters from C.P.Yundt to D.Dietrich, Technical Analysis Corporation, Response to Request for Additional Information, May 18, 1995 and August 10, 1995

2. High-Level Waste Storage in the Spent Fuel Pool

Section 2.2.2 states that "spent fuel and high-level waste will be stored in the spent fuel pool until 1998." We asked PGE to specify what high level waste was planned to be stored in the spent fuel pool, what was the anticipated quantity, and how would this be controlled?

PGE defines "high-level waste" for decommissioning as "material that was generated or used at the Trojan facility which is not eligible for near surface disposal as specified in 10 CFR 61." As used in the Decommissioning Plan, high-level waste other than spent fuel consists of rod cluster control assemblies, burnable poison rod assemblies, neutron sources, thimble plugs, miscellaneous spent fuel assembly hardware, and activated reactor vessel internals. PGE states that "reactor vessel internals are conservatively anticipated to result in less than 49,000 lbs of radioactive waste which will not be eligible for near surface disposal." Additionally, Section 2.2.7 of the plan gives an estimate of 340 ft^3 for the "Greater Than Class C" waste expected to be stored in the spent fuel pool and later in the ISFSI.

3. Containment Isolation

Section 2.2.4.3 of the plan describes the capability to isolate containment during dismantlement. During some activities, such as the removal of containment penetrations, this capability will require installing new closures. The department requested PGE to describe the protective measures that would be used to restrict airborne radioactivity or preclude high risk activities while a containment penetration was open.

PGE responded that "work activities which occur within Radiological Control Areas are controlled by Radiation Work Permits which specify the scope of work that may be performed and provide the specific radiological controls that are implemented for the work activity consistent with ALARA[38]. For those activities which are determined to have the potential to create airborne radioactivity, health physics controls will be implemented. These controls typically involve tenting of the area and providing HEPA filtration and respiratory requirements for workers." (See Section IV.D.2 for an evaluation of the Radiation Protection and ALARA programs.)

4. Avoiding the Weakening of Structures during Dismantlement

Section 2.2.4.3 states that "dismantlement activities will be carefully reviewed to

38 ALARA stands for "As Low As Reasonably Achievable", and is fully defined at 10 CFR 20.1003

ensure they do not impact the safe storage of fuel.... Work packages will include specific steps to physically protect the systems, structures, and components supporting spent fuel storage..." The department requested PGE to describe the administrative controls or measures that would be taken to provide assurance that dismantlement activities did not weaken other structural members, walls, earthquake supports, pipe supports, etc.

PGE responded with a list of administrative controls for dismantlement activities that ensure these activities do not impact the facility's ability to safely store the spent fuel. They also stated that "engineering reviews of modifications include structural and seismic reviews as well as reviews of effects on other systems as appropriate."

The department verified that these administrative controls are in place. Plant procedure TPP 30-5, Defueled Plant Modifications (Rev 3, May 1, 1995),[39] requires that various structural engineering reviews be considered for design modifications, including the evaluation of loads (seismic, wind, thermal, and dynamic) and structural requirements (equipment foundations and pipe supports). It also requires that Structural Interface Reviews be conducted when a modification involves "work in or affecting safety-related structures, such as by the addition or removal of significant weight, new penetrations, or new attachments...."[40] Procedure NPEP 200-18, Plant Modification Structural Interface Control (Rev. 1, April 25, 1995) requires the Project Manager, Civil/Seismic to periodically review the cumulative effects of modifications to initiate appropriate corrective action.[41] The department also reviewed an example of the application of these controls in the design modification package[42] for the rolling steel door installed in the containment opening for the LCRP. As a result, the department concludes that the controls on maintaining structural integrity as a result of design modifications are adequate.

5. Radwaste Volume Reduction

The department requested PGE to describe the volume reduction techniques that might be used to reduce costs, low-level radwaste volume, trips to waste sites, and radiation exposure.

PGE responded that potential health physics practices to reduce the volume of radioactive waste generated, in addition to "minimizing the material that is

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39 Portland General Electric Company, TPP 30-5, Defueled Plant Modifications Implementation, Rev. 3, May 1, 1995

40 Portland General Electric Company, NPEP 200-18, Plant Modification Structural Interface Control, Rev. 1, April 25, 1995

41 ibid., p.3

42 Portland General Electric Company, Defueled Plant Modification Request (DPMR) 93-015

introduced into contaminated areas," include incineration, metal melt, compaction, and surface cleaning. The department verified through interviews with PGE representatives that incineration and metal melt, if used, would take place offsite with qualified and licensed vendors.

6. Control of Chemicals

Section 2.2.4.7 states, "Chemicals ... will be controlled in accordance with the plant chemical safety program." Since this program is not specifically referenced in the QA program, PGE-8010, or listed in PDTS 5.7.1, the department asked PGE to describe the review, approval, 10 CFR 50.59 requirements, and other administrative controls, such as audits, that would be in effect for this program.

PGE responded that procedures for this program are reviewed in accordance with plant administrative controls, part of which requires a screening for applicable requirements of 10 CFR 50.59. They also stated that the basis for the control of chemical hazards is in OR-OSHA regulations. In addition, the chemical control program is audited annually by QA.

7. Radiation Exposure Projections

Section 2.2.6 of the plan describes the Decommissioning Exposure Projections. The department requested PGE to provide the bases for these projections and explain how these projections were adjusted for decay.

To estimate the projected radiation exposures for the majority of decommissioning tasks, PGE used the reference study performed by TLG Services, Inc. This study used site-specific estimates of the radioactive content of each system, based on radiological surveys, along with estimates of the time required to do each discrete task to determine the likely exposure for each task during decommissioning. The methods and assumptions for this study were reviewed and found satisfactory, and the department concurs with the results.

The projections were adjusted for decay from the start of decommissioning activities using Cobalt-60, which is the primary contributor to radiation exposure. PGE stated that "the reduction in personnel exposure from contaminated and/or activated areas and components during activities performed during DECON is assumed to be equal to the reduction in Cobalt-60." The department concurs with this response.

D. Protection of Occupational and Public Health and Safety

Section 3 of the plan is divided into six portions. Five of those are briefly described here: Facility Radiological Status, Radiation Protection Program, Radioactive Waste Management, Occupational Safety, and Non-Radioactive Waste Management. Section

3.4 of the plan, Event Analysis, is described in Section V of this report.

1. Facility Radiological Status

Section 3.1 of the plan describes the historical and current radiological status of the plant, and PGE's radiological program for decommissioning. The industry guidelines for this aspect of decommissioning are described in NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination. The department reviewed this NUREG and found it to be satisfactory as guidance in describing the radiological surveys to be performed during decommissioning.

The NUREG defines five types of surveys to be conducted by the licensee and one by the NRC.[43] These surveys and their purposes are described as follows.

(1) Background Survey. To provide a benchmark for determining the status of the site for unrestricted access following the final radiation survey. This survey is determined by measurements and/or sampling at locations onsite or in the immediate vicinity which are unaffected by site operations.

(2) Scoping Survey. To identify the potential radionuclide contaminants onsite, the relative ratios of nuclides, and the general extent of contamination.

(3) Characterization Survey. To more precisely define the extent and magnitude of contamination for the purpose of planning the decontamination effort.

(4) Remediation Control Surveys. To measure the effectiveness of decontamination efforts in reducing residual radioactivity to acceptable levels.

(5) Final Survey. To determine the final condition of the site after decontamination activities to demonstrate that all radiological parameters satisfy the established limits for releasing the site for unrestricted access.

(6) Confirmatory Survey. To confirm the adequacy and accuracy of PGE's final survey. This survey is performed by the NRC and is usually limited to spot-checking conditions at selected site locations, comparing findings with those of PGE, and performing independent statistical evaluations of the data in the final survey. The NRC uses the confirmatory survey in supporting a decision to terminate a license and release the facility for unrestricted use.

PGE's TNP site characterization is planned to be completed in three phases. Phase I, scoping survey / site characterization, combines the first three surveys described in NUREG/CR-5849 (background, scoping, and characterization). This was completed and issued on February 2, 1995, as the TNP Radiological Site

[43] U.S. Nuclear Regulatory Commission, NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination, June 1992, pp.2.5-2.9

Characterization Report and generally referred to as the Site Characterization Report. Phase II will consist of surveys to support decontamination and dismantlement activities. They match the Remediation Control Surveys defined in NUREG/CR-5849. Phase III meets the requirements of the Final Survey defined in NUREG/CR-5849. (See Section IV.F of this report for a discussion of PGE's proposed final radiation survey plan.)

Section 3.1 describes the results of the Phase I surveys and their impact on decommissioning activities. Data from these surveys provided a basis for estimating decommissioning costs. They were used as input to the cost estimate study performed by TLG Services, Inc. Phase I surveys were also used to estimate occupational radiation exposures and low level waste volume, and to determine background radiation. In addition to this section of the plan, we also reviewed the Site Characterization Report, which follows the criteria of NUREG/CR-5849.

PGE divided the Phase I surveys into four areas: structures, systems, activation, and environment.

(1) Structures

The department reviewed PGE's surveys of site structures to verify that sufficient measurements were taken in the appropriate locations. PGE representatives concluded that structures on the secondary (non-nuclear) side were generally below the cleanup criteria and would not require extensive remediation. The department concurs with this finding. Certain areas near the Refueling Water Storage Tank (RWST) could not be surveyed accurately and will not until the tank has been cleaned. The department found the site structure surveys to be an appropriate basis for estimating those areas of the site which need further decontamination.

(2) Systems

The department reviewed PGE's plant system surveys to verify that they were done in a comprehensive and logical manner. Surveys included measurements of direct radiation, loose surface swipes, and metal scrapings. PGE divided plant systems into four categories: "contaminated," "potentially contaminated," "indeterminate," or "free of contamination." The department found the system surveys to be an appropriate basis for estimates of low-level waste volume and radiation content of contaminated systems.

(3) Activation

Activated component analyses were used to estimate the radiation levels and radioactive material content of components such as the reactor vessel internals and primary shield wall, and to estimate the amount of "Greater than Class C" waste. These analyses were performed with industry standard computer codes

by TLG Services, Inc. The department reviewed samples of the input values and found that they were consistent with plant operating history. The department also independently verified the close correlation between the estimated and actual radioactive content (measured through concrete bore samples) of the primary shield wall. (See Sections IV.E.1 and IV.E.3.)

(4) Environment

Environmental surveys provide a basis for determining if the cleanup criteria in OAR 345-26-370(2)(a) and (b) are met. The environmental surveys measured background radiation and sampled the radioactive material content in soil, water, sediment, and pavement, to measure the impact of TNP operations on the environment.

Two types of surveys were performed to determine the extent of remediation required: "biased" and "unbiased." Biased surveys were taken in areas believed to be potentially affected by plant operations, where there was suspected or known contamination. Unbiased surveys were taken at locations randomly selected locations within the PGE owner controlled area.

To identify areas potentially affected by Trojan operations, PGE reviewed the plant operating history, including operating records, event reports, radiological occurrence reports, and conducted interviews with plant personnel who had worked at Trojan during its operating history. The department reviewed a sample of these reports and verified that locations that may have been affected by plant operations were included in the biased surveys. Based on the random and biased surveys, PGE concluded that no radioactive material requiring remediation was present in the various materials sampled. Preliminary results indicated that levels of radioactivity in the environment were less than the Decommissioning Plan's cleanup criteria.

As stated in NUREG/CR-5849, background surveys are required as a benchmark. The guidelines for residual radioactivity at decommissioned sites are presented in terms of radiation levels or radioactive material concentrations above background for the area. Typically, this type of survey is performed prior to commencing licensed operations so that the data is unaffected by radiation emanating from those operations. The Site Characterization Report, however, indicates that preoperational background data was not used for the background survey at Trojan. A PGE representative explained during a site interview that preoperational background data of radioactive contaminants in soil and ground water were not used because of atmospheric nuclear weapons testing during the preoperational period. The radioactive content of the surrounding environment has actually decreased since reactor operations began because of the radioactive decay of Cesium 137 and Strontium 90. For more accurate background data, soil and water samples were collected during the Phase I environmental surveys from unaffected areas on the Trojan site remote from

where radioactive materials were used. Additionally, soil and water samples were taken in Rainier, OR, Kalama, WA, and other areas near the site. The preoperational data were used only to validate that the background samples were reasonable.

Background surveys were taken at a variety of locations offsite to account for the differences in natural radiation from the different types of rock and soil in the area. The background measurements had a sample mean of 7 μR/hr with a standard deviation of 1 μR/hr. However, the measured soil radionuclide concentrations had unacceptably high variances. NUREG/CR-5849 specifies that surveys be performed to a 95% confidence level. For background surveys, OAR 345-01-010 (3)(b) also requires a 95% confidence level. In order to meet these confidence level requirements, PGE must take additional samples. A PGE representative stated that additional samples would be taken at the time of the final radiation survey. The department finds this acceptable.

In conclusion, the department found that PGE's Site Characterization Report meets the criteria of NUREG/CR-5849 and is an acceptable report of facility radiological status appropriate for use in estimating remediation requirements and background radiation levels.

2. Radiation Protection Program

Section 3.2 of the plan describes the Radiation Protection and ALARA (As Low As Reasonably Achievable) programs, which comply with requirements and guidance in 10 CFR 20, 10 CFR 50, and Regulatory Guides 8.8 and 8.10. This Section describes the organization, responsibilities, instrumentation, monitoring, and controls associated with radiation protection.

The requirements for and implementation of PGE's Radiation Protection Program, including ALARA, were previously reviewed in our report of October 11, 1994, entitled, Review of PGE's Large Component Removal Plan for Trojan Nuclear Plant.

In summary, NRC regulations[44] require PGE to control the radioactivity onsite and to limit and control any radioactivity that leaves the site. These controls must provide radiation and contamination protection for the public, the environment, and people onsite. NRC regulations and other guidance documents establish limits for radiation doses and dose rates to people and the environment and the concentration of radioactive materials in effluents. The NRC has also adopted the principle of ALARA, which is a philosophy of limiting radiation exposures (both public and occupational) even below the limits of the regulations. The NRC further defines ALARA as "making every reasonable effort to maintain exposures

[44] 10 CFR 20 and 10 CFR 50, Appendix I

to radiation as far below the dose limits in this part [of the regulations] as is practicable consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to the utilization of nuclear energy and licensed materials in the public interest."[45]

PGE described its commitments for radiological control in the Defueled Safety Analysis Report, and the company has developed detailed implementing procedures regarding radiological protection. Furthermore, PGE's radiation protection controls and records are performed under their QA program. The department reviewed these controls as part of its review of LCRP activities,[46] and found them to be satisfactory.

As part of its review of the Decommissioning Plan, the department reviewed PGE's procedure TPP 20-2, Radiation Protection Program (Rev. 4, December 30, 1993), and interviewed PGE personnel responsible for implementation of this program. Additionally, NRC inspection reports of Trojan for 1994 and 1995 that the NRC inspection program gave PGE's Radiation Protection and ALARA programs high marks. Five of the reports covering the last two years specifically targeted these programs. The NRC inspectors found that PGE's program was well-documented, appropriately staffed, afforded appropriate oversight, implemented in a quality manner, and adequate to ensure the health and safety of employees and the public.

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45 10 CFR 20.1003

46 Technical Analysis Corporation, Review of PGE's Large Component Removal Plan for Trojan Nuclear Plant, October 11, 1994, pp.17-20

The NRC also inspected specific work activities and had similar conclusions. An NRC team inspection conducted in August and September 1994 concluded that "the licensee appeared to have projected suitable resources for ensuring radiological control safety during the LCR project."[47] For large bore pipe cuts on the primary system in January and February 1995, the NRC concluded that contamination controls were "excellent," and that radiation protection technicians were "knowledgeable about work activities, dose rates in the work areas, and licensee procedures."[48]

The department concludes that PGE's radiation protection and ALARA programs contain effective programmatic controls. They are adequate to maintain public, occupational, and environmental radiation exposures within established limits and according to the ALARA principle. The department has paid particular attention to the radiation protection program during critical activities of the LCRP, and because of the extreme importance of radiation controls and ALARA, the department will continue this practice continue for other decommissioning activities.

3. Radioactive Waste Management

Section 3.3 of the plan describes the program for radioactive waste management, including spent fuel management, handling of wastes, and process control programs. The processing and disposal of gaseous, liquid, and solid radioactive waste will be managed in accordance with the Radiation Protection Program, Process Control Program, Offsite Dose Calculation Manual (ODCM), Radioactive Effluent Controls Program, and Storage Tank Radioactivity Monitoring Program. The department previously approved the ODCM and Radiological Environmental Monitoring Program.[49] Our review found the other portions of the radioactive waste management program to contain effective programmatic controls.

4. Occupational Safety

Section 3.5 of the plan, Occupational Safety, briefly discusses PGE's commitment to a safe and healthy working environment.

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47 U.S. Nuclear Regulatory Commission, Inspection Report 50-344/94-04, October 24, 1994, p.11

48 U.S. Nuclear Regulatory Commission, Inspection Report 50-344/95-02, March 15, 1995, p.5

49 Oregon Department of Energy, letter from J.Savage to T.D.Walt, Portland General Electric Company, December 12, 1994

5. Nonradiological Waste Management

Section 3.6 of the plan, Nonradioactive Waste Management, states that nonradioactive regulated waste, such as asbestos, polychlorinated biphenyls (PCBs), mercury, and lead, will be controlled by the Trojan Nuclear Plant chemical safety program and that work will be done in accordance with the TNP work control process and approved plant procedures. This program provides for evaluation of regulated substances and approval of methods for their handling and disposal. The plan states that the removal and disposal of materials will be conducted in accordance with OSHA regulations, and federal and state hazardous waste regulations, as applicable. Our review of these procedures indicate that adequate controls exist to safely handle such materials.[50]

E. Questions and Answers on Section 3 of the Plan

The following paragraphs contain additional information or clarification about material in Section 3 of the Decommissioning Plan (except for Section 3.4) that resulted from our review. Most of the following information came from PGE's responses to questions in our March and June RAIs. Unless otherwise stated, quotes or statements credited to PGE come from the written responses to the RAIs. Some of the questions and responses provided have been edited for clarity or to avoid duplication with information found elsewhere in this report.

1. Radioactivity in Containment Concrete Walls

Section 3.1.2.1 of the plan provides information on concrete bore samples taken in the containment building. We asked PGE to explain what was meant by "detectable radioactivity was found at various depths," and how would the volume of radwaste be affected by radioactive decay?

PGE responded that radioactivity was dispersed in concrete depending on the level of neutron irradiation from reactor operations. The Site Characterization Report states: Samples of containment concrete were collected by core boring at four locations ... the reactor shield wall, reactor vessel missile shield, secondary shield wall and containment dome. ... The bores were segmented and counted for radioactivity using gamma isotopic analysis. The cores were used to validate the neutron activation analysis ..., to determine depth of penetration of activation products in concrete structures... and to estimate the area extent and levels of fixed surface contamination.[51]

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50 Portland General Electric Company, TPP 14-13, Chemical Safety Program, Rev. 1, September 10, 1992

51 Portland General Electric Company, Trojan Nuclear Plant Radiological Site Characterization Report, Rev. 1, February 2, 1995, paragraph 2.2.1

PGE also stated that "some minor reduction in volume may occur due to decay. However, the controlling radionuclide is Eu-152 with a half-life of 14 years. Therefore, the volume would not be significantly reduced."

2. Radioactive Content of Contaminated Systems

As the result of a question on the radioactive content of contaminated systems, we reviewed PGE calculation RPC 93-027, Primary System Activity Scoping Estimates.[52] This calculation was used as a basis for determining the estimated radioactive content of the Reactor Coolant System (RCS) and the Chemical and Volume Control System (CVCS). From this review the department concluded that although the calculation was based on a single sample, the method, other assumptions, and inputs were appropriate and reasonable. PGE also reported that "subsequent samples and calculation indicate that RPC 93-027 has shown that assumptions made based on this sample resulted in highly conservative values for the steam generators."

3. Activation Radioactive Content of Primary Shield Wall

TLG Services provided PGE with data estimating the neutron-induced (activation product) radionuclide inventory of the primary shield wall. To verify the accuracy of TLG's calculations, PGE took actual measurements with concrete core bore samples, and reported in the Site Characterization Report that a close correlation existed between the estimated and actual radioactive content. The department confirmed this close correlation by making an independent calculation of the radioactive content of two of the longer-lived nuclides (Co-60 and Eu-152) in the shield wall.

4. Administrative Controls for Airborne Contamination

Section 3.2 of the plan describes the Radiation Protection Program. The department requested PGE to describe the administrative controls they planned to use to ensure airborne contamination would be monitored in areas where permanently installed detectors had been deactivated or where burning, cutting, or disassembly activities could release particulate or gaseous radioactivity in spaces not normally monitored for airborne contamination.

PGE provided the procedural references for the administrative controls in this area, which were reviewed and found satisfactory. Additionally, PGE stated that "air sampling is required whenever work which could cause the generation of airborne radioactivity is performed. Local grab sampling equipment or

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[52] Portland General Electric Company, RPC 93-027, Primary System Activity Scoping Estimates, April 19, 1994

continuous air monitors are available to measure airborne radioactivity."

5. <u>Uncertainty in Eventual Disposal of Spent Fuel</u>

Because there is a great deal of uncertainty in the announced schedule for the opening of a federal repository for spent fuel and high-level radioactive waste, the department asked PGE questions about the consequences of a delay in the eventual disposal of spent fuel.

a. What are your decommissioning contingency plans if DOE fails to meet their contractual obligations?

PGE responded that "by constructing an ISFSI and moving the spent fuel out of the spent fuel pool, the Trojan plant can be fully decommissioned. Management of the spent fuel can then be transferred to a 10 CFR 72 license [independent storage of spent fuel] which will allow termination of the 10 CFR 50 license [reactor operations] following the final site survey. With the spent fuel in the ISFSI, the impact of any USDOE delay will be minimized." The department concurs with this conclusion.

Furthermore, the Council rules (as filed and effective on November 3, 1995) for the ISFSI include requirements for PGE in the event that a federal repository is unavailable at the end of the design life of the ISFSI dry storage casks. The new OAR 345-26-390(4)(j) reads as follows: "The [PGE ISFSI] plan shall discuss the options available if the expected lifetime is reached and no Federally licensed permanent High Level Waste site is available."[53] Additionally, under these rules PGE is responsible for addressing the issue of schedule delays in shipping spent fuel and GTCC waste in the ISFSI plan. PGE expects to submit the ISFSI plan to the Council early in 1996.

b. What effect would a delay on shipping spent fuel and GTCC waste offsite have on decommissioning costs and radiation exposure?

PGE responded that funding for spent fuel management is included in the cost estimate and funded by the Decommissioning Trust through the year 2018. Beyond 2018, "requirements for additional funding ... would need to be addressed in the future when USDOE's capabilities are better defined." Any increased costs would be proportional to the yearly O&M costs of the ISFSI, which in 2018 are about $3 million (in 1993 $). "An extension of the inservice life of the ISFSI would result in a proportionate increase in the low radiation exposure associated with surveillance and maintenance of the ISFSI." The department concurs with this conclusion.

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[53] OAR 345-26-390(4)(j)

F. Proposed Final Radiation Survey Plan

Section 4 of the plan describes the proposed "final radiation" survey that will determine the condition of the site after decontamination activities are complete and, if the release criteria are met, will allow release of the site for unrestricted access and termination of the license in accordance with 10 CFR 50.82 and applicable state regulations. PGE will follow the guidance in NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination, to develop the final radiation survey plan. As previously reported, the department reviewed this NUREG and found it satisfactory as guidance in describing the radiological surveys to be performed during decommissioning.

Final release criteria are described in Section 4.2 of the plan. Limits for loose and fixed surface contamination are established in Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors, June 1974. This is identical to Council rule OAR 345-26-370(2)(a), a copy of which is attached as Appendix B to this report.

The limit for direct exposure is 5 μR/hour above background, which meets Council rule OAR 345-26-370(2)(b). Although the plan does not specify that the rate is to be measured at one meter from all surfaces, it is consistent with NUREG-0586,[54] which does stipulate measurement at one meter. Furthermore, PGE has committed to conducting the final radiation survey in accordance with the guidance in NUREG/CR-5849,[55] which also requires that direct measurements be made at one meter above all surfaces.

Total concentrations in soil and water in terms of Total Effective Dose Equivalent (TEDE) are limited to less than 15 mrem/year, based on guidance in NUREG-1500.

The following paragraphs contain additional information or clarification about material in Section 4 of the Decommissioning Plan that resulted from our review. Most of the following information came from PGE's responses to questions in our March and June RAIs. Unless otherwise stated, quotes or statements credited to PGE come from the written responses to the RAIs. Some of the questions and responses provided have been edited for clarity or to avoid duplication with information found elsewhere in this report.

1. How "Final" is the Final Radiation Survey?

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54 U.S. Nuclear Regulatory Commission, NUREG-0586, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, August 1988, p.2-12

55 U.S. Nuclear Regulatory Commission, NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination, June 1992, p.6.8

Once the plant is decontaminated and decommissioned, the fuel is removed from the site and the Site Certificate is terminated, PGE will have no legal obligation to continue radiation monitoring. The department asked PGE a series of questions on the confidence of the final radiation survey.

a. What assurance can you provide that the final radiation survey will be adequate to assure a dose rate of less than 15 mrem per year for the indefinite future?

PGE stated that they followed the guidelines for acceptable radionuclide concentrations found in NUREG/CR-5512, Residual Radioactive Contamination From Decommissioning (October 1992). NUREG/CR-5512 provides a generic modeling analysis of the potential radiation doses resulting from "unrestricted release of slightly radioactive material" in buildings and soil following decommissioning. It addresses the major exposure pathways of direct exposure to radiation, and inhalation and ingestion of radioactive materials. The level of residual radioactive material remaining at the site is one input to NRC computer models that are used to determine the projected radiation exposure to the public over the next 1000 years using three site scenarios. The modeling analysis is used to estimate the annual total effective dose equivalent (TEDE) to persons occupying the site after decommissioning.

In addition to the PGE survey , the NRC or the Council may also perform confirmatory surveys.

b. What assurance is there that subsurface contamination will not resurface after the final radiation survey?

PGE responded that "the acceptance criteria for subsurface contamination is based on the assumption that the contamination will either resurface or move into the ground water. The dose models [NRC models described in question (a) above], in fact, predict both resurfacing of the radioactivity and movement to the ground water." The department finds this to be a conservative assumption.

c. Since the ISFSI will be on site until at least 2018, how can there be a final radiation survey in 2001? How will the site be "released" for unrestricted use in 2001?

PGE responded that "a phased release survey will be conducted. The area to be affected by the ISFSI will be released at an earlier date. A separate decommissioning plan / final survey will be required for the 10 CFR 72 ISFSI area." PGE representatives stated on September 19, 1995, that plans for a "final survey" on the site of the ISFSI prior to its construction were being discussed with the NRC and that a confirmatory survey by the NRC would probably follow. In addition, final and confirmatory surveys would also be conducted at the termination of the ISFSI (10 CFR 72) license, sometime after 2018.

d. Since 10 CFR 72 permits up to 25 mrem at the uncontrolled area

boundary for the ISFSI, how can an annual dose rate of 15 mrem/yr TEDE be verified without being masked by the higher dose rate due to the ISFSI?

PGE responded that they "will conduct the final release survey of the areas that will be affected by the fuel storage in the ISFSI prior to movement of the fuel from the Spent Fuel Pool to the ISFSI. Areas of the present site that will have radiation levels due to ISFSI fuel storage that interferes with final site survey will be surveyed prior to fuel movement."

The department concurs with this decision and recommends that the schedule and scope of this survey be provided to the department in advance of the fuel transfer, and that the survey results be provided to the Council. Furthermore, the fuel transfer out of the spent fuel pool should be contingent on a finding by the Council that areas potentially affected by spent fuel storage have been adequately surveyed and meet the release criteria of OAR 345-26-370(2)(a) and (b).

2. Below Grade Radiation Measurements

Section 4.3 of the plan says that PGE will follow the guidance in NUREG/CR-5849 to develop the final radiation survey. In addition to this guidance, the department asked PGE to provide information on how below grade areas would be surveyed to determine that they met the release criteria before being filled.

PGE responded that "below grade areas will have representative samples taken from either randomly selected locations and/or select locations based on potential past releases. Sampling will be completed prior to filling of below grade areas. Allowable below grade radioactivity levels for areas will be based on modeling using approved computer dose models and may be different than allowable above grade limits. However, the same release criteria will be used throughout the facility." This statement was added to the 11/95 Update to the plan.

3. 95% Confidence Limit for Final Radiation Survey

PGE reported that for the final radiation survey "current plans are to use a 95% confidence limit. Preliminary data will be collected and evaluated to determine the minimum sample number to meet the statistical acceptance criteria." The 95% confidence level is consistent with the requirement for background radiation surveys in OAR 345-01-010(3)(b), and a statement of intention to use the 95% confidence level was added to the plan in the 11/95 Update.

G. Decommissioning Cost Estimate and Funding Plan

Section 5 of the plan describes decommissioning costs and funding. The department's review of these issues is presented in Section VII of this report.

H. Technical Specifications and Environmental Protection Plan

Section 6 of the plan describes the Permanently Defueled Technical Specifications, which is Appendix A to the Facility Operating (Possession Only) License NPF-1, and the Environmental Protection Plan, which is Appendix B to the license. These documents were not part of the department's review.

I. Quality Assurance Program

Section 7 of the plan describes PGE's Quality Assurance Program. Quality assurance (QA) is defined in 10 CFR 50, Appendix B, as "all those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service." QA is further defined in the nuclear industry as "the systematic actions necessary to provide adequate confidence that ... work is performed according to plan." [56] Quality Control (QC) is defined in 10 CFR 50, Appendix B, as being part of QA and comprising "those quality assurance actions related to the physical characteristics of a material, structure, component, or system which provide a means to control the quality of the material, structure, component, or system to predetermined requirements."

10 CFR 50, 10 CFR 71[57], and PGE's license[58] require Trojan to have a QA program. The QA and QC programs at Trojan are the primary responsibility of the Nuclear Oversight Department. PGE's written program to meet these requirements is described in topical report PGE-8010, Nuclear Quality Assurance Program for Trojan Nuclear Plant,[59] which is referenced in Section 7 of the plan. We interviewed several members of the Nuclear Oversight Department, and we reviewed PGE-8010 and many of the subtier QA and QC procedures and directives that implement the program. Although the QA program has been significantly reduced in scope since the plant was operating, the department concludes that the written program is adequate to ensure that activities affecting public health and safety are performed properly, by qualified persons, and in accordance with approved procedures.

The following paragraphs contain additional information or clarification about material applicable to the QA program and Section 7 of the Decommissioning Plan that has

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56 U.S. Nuclear Regulatory Commission, NUREG/CR-5884, PNL-8742, Revised Analyses of Decommissioning for the Reference Pressurized Water Reactor Power Station, October 1993, p.7.14

57 10 CFR 71, Subpart H, Quality Assurance for Packaging and Transportation of Radioactive Material

58 U.S. Nuclear Regulatory Commission, License No. NPF-1, Amendment No. 190, May 5, 1993, Section 2.C(4)

59 Portland General Electric Company, PGE-8010, Nuclear Quality Assurance Program for Trojan Nuclear Plant, Rev. 17, September 8, 1994

resulted from the department's review. Most of the following information came from PGE's responses to questions in our March and June RAIs. Unless otherwise stated, quotes or statements credited to PGE come from the written responses to the RAIs. Some of the questions and responses provided have been edited for clarity or to avoid duplication with information found elsewhere in this report.

1. QA Audit Activities and Frequencies During Decommissioning

The department requested PGE to provide a list of the activities that would be audited by the QA organization during decommissioning and the scheduled frequency for these audits. Section 2.3.2 of the plan states that audits of designated activities will be provided in accordance with the Technical Specifications. However, unlike the former operating Technical Specifications, the Permanently Defueled Technical Specifications (PDTS), do not provide a schedule of audit activities.

PGE responded that the audit schedule is specified in Regulatory Guide 1.33 and other regulations. Specifically, they provided frequencies for the following audit areas:

Corrective Actions.....6 months
Training and Qualifications.....12 months
Quality -Related Organizations & Activities.....24 months

PGE also provided a copy of the 1995-1996 Integrated Audit/Surveillance Schedule, which presented a two year schedule of internal audits and surveillances, and external supplier audits and surveillances.[60] The scheduled internal audits included the following audited areas and frequencies:

Special Nuclear Material.....12 months
Technical Specifications.....12 months
Emergency Plan..... .12 months
Security/Fitness for Duty.....12 months
Radiation Protection..... 24months
Chemistry..... 24 months
Radwaste..... 24 months
Licensing..... 24 months
Quality Assurance/Corrective Actions.....24 months
Maintenance..... 24 months
Administrative Services..... 24 months
Operations..... 24 months

[60] Portland General Electric Company, memorandum from D.L.Nordstrom to S.M.Quennoz, 1995-1996 Integrated Audit/Surveillance Schedule, July 5, 1995

Purchasing/Material Control.....24 months
Engineering..... 24 months
Independent Review and Audit Committee.....24 months
Fire Protection ..... 24 months

Regulatory Guide 1.33 specifies a 6 month frequency for audits of corrective actions, yet the PGE schedule lists the frequency for this area as 24 months. Representatives of PGE explained that the audit listed as "Quality Assurance / Corrective Actions" covers only the programmatic issues for corrective actions. The "results of actions taken to correct deficiencies," required by Regulatory Guide 1.33, are audited by the Nuclear Oversight Department during their audits of each department. Therefore, corrective actions are audited at least semi-annually. Similarly, audits of training and qualifications of personnel are performed during the audits of the departments, and, therefore, are audited at least annually.

One audit on the PGE schedule combined Radiation Protection, Chemistry, Radwaste, and Special Nuclear Materials into a single two year audit. Special Nuclear Materials, however, is required to be audited annually and appeared twice on the schedule. Also, in addition to biennial audits of the Radiation Protection Department, surveillances of radiation protection practices are conducted several times a year.

Responding to a specific question about auditing areas that may not be designated as "quality-related," PGE stated that "decommissioning activities involving radioactively contaminated systems, structures and components are audited because these activities are considered part of the Radiation Protection Program, are related to radioactive waste shipment and may involve radioactive effluents. These decommissioning activities are audited as part of specific departmental audits as well as audits of the Radiation Protection Program. In addition to audits, Nuclear Oversight also performs surveillances and inspections of work in progress, evaluations of suppliers of quality-related parts and services, and reviews of quality-related procedures."

2. <u>QA/QC Involvement with Decommissioning Activities</u>

Section 7 of the plan states that the "Nuclear Quality Assurance Program ... provides controls for quality-related activities pertaining to the operation, maintenance, design, modification, and decommissioning of TNP." It further states that "quality-related items and activities ... are defined in PGE-8010." The department asked PGE to define the level of involvement of QA/QC personnel (Nuclear Oversight Department) and programmatic controls for work packages that were not expressly defined as "quality-related" but could impact quality-related areas.

PGE responded that "procedures provide for putting Nuclear Oversight

notification points in quality-related and non-quality-related work packages to give QA/QC an opportunity to perform a surveillance of the activity. These controls and the work packages created under these controls are verified during audits of the department(s) responsible for the process. These controls are consistent with those applied during plant operation." The department verified that these controls are contained in quality procedure QP 17-11, Nuclear Oversight Surveillance of Nuclear Division Activities (Rev. 1, April 5, 1994).

To evaluate the degree of involvement of QA/QC personnel and programmatic controls in work packages that were not designated as "quality-related" but could potentially impact a quality-related system, structure, or component, we reviewed a recent design change package[61] for installing a smaller capacity pump in the Component Cooling Water System (CCW). The purpose of this system is to remove heat from the Spent Fuel Pool (SPF) Cooling System. The CCW system is not quality-related, however, because the Defueled Safety Analysis Report (DSAR) shows that adequate SFP cooling could be maintained in the event of a CCW pump failure. However, we found that QA and QC were involved in review of the design change. In addition, we reviewed the associated maintenance request[62] and safety evaluation[63] for this work. Although not required by procedure or regulation, QA/QC personnel and practices were involved in every phase of the work package appropriate to assuring that adequate quality practices were being used. Furthermore, the records of this work were designated and maintained as quality records.

Our interviews with members of the plant staff also found that QA/QC staff members routinely take part in the daily plant staff meetings, ensuring a high level of involvement in plant activities and work packages.

In addition to our review, the department examined the NRC inspection reports for 1994 and 1995, and found that the NRC inspection program gave PGE's Quality Assurance and Quality Control programs high marks. Five of the reports covering the last two years specifically targeted these areas. NRC inspectors found that the QA/QC personnel were qualified, and the audits and surveillances were probing and technically comprehensive. They also found that corrective actions to audit and surveillance findings were adequately addressed, and that follow-up on the effectiveness of previous corrective actions was routinely performed. The most recent NRC team inspection of the auditing program at

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61 Portland General Electric Company, Defueled Plant Modification Request (DPMR) 94-008-1

62 Portland General Electric Company, Maintenance Request MR-6201, March 21, 1995

63 Portland General Electric Company, Safety Evaluation 94-049, January 25, 1995

Trojan concluded that “the self-assessment function was in compliance with Technical Specifications and that the program provided an honest appraisal of the various areas audited. There was evidence that the QA function had been functioning effectively and indeed provided senior PGE management with valuable information to ensure the safety of plant activities.”[64]

In conclusion, the Quality Assurance and Quality Control programs appear effective in assessing plant performance through a comprehensive program of reviews, audits, surveillances, and involvement in plant staff meetings. Though not specifically required by federal or state regulations or guidelines, the department recommends that PGE managers and personnel responsible for establishing and maintaining the quality assurance and quality control programs continue to take a proactive role in decommissioning activities, including the review of decommissioning activities before they take place to evaluate potential quality concerns.

J. Physical Security Plan

[64] U.S. Nuclear Regulatory Commission, Inspection Report 50-344/94-04, October 24, 1994, p.14

Section 8 of the plan describes the Physical Security Plan, which references topical report PGE-1017, "Trojan Nuclear Plant Security Plan (Defueled Condition)." This plan was previously reviewed and approved by the Council[65] and the department[66], as well as by the Oregon Health Division (Department of Human Resources) and Columbia County Emergency Services. Consequently, the Physical Security Plan was not part of this review.

K. Fire Protection Program

Section 9 of the plan describes the Fire Protection Program, which references topical report PGE-1012, "Trojan Nuclear Plant Fire Protection Program." The department reviewed the event scenarios evaluated in Section 3.4 of the plan dealing with fire and explosions, but the Fire Protection Program was not part of this review. (See Section V.D.3 of this report.)

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65 Energy Facility Siting Council, Minutes, Approval of the Trojan Security Plan, November 17-18, 1994

66 Oregon Department of Energy, letter from C.A.Ervin to J.E.Cross, Portland General Electric Company, September 1, 1993

V. EVALUATION OF PGE'S EVENT ANALYSIS[67]

A. Importance of PGE's Event Analysis

Section 3.4 of the plan "presents the results of evaluations and analyses of postulated decommissioning events and evaluates the potential for adverse effects on public health and safety. This evaluation includes postulated events that could be significantly different from accidents that have previously been evaluated for plant operations or maintenance. The analyses consider events related to decommissioning activities, loss of support systems, internal events, and external phenomena."[68]

The Event Analysis in the plan is critically important to the decommissioning process not only because it analyzes potential accidents but because it analyzes accidents that are different from those evaluated in the Defueled Safety Analysis Report ("DSAR"). The DSAR is the analysis upon which the NRC bases its decision to grant the NRC license. It analyzes all events involving nuclear fuel. However, the Decommissioning Plan analyzes for all other types of event scenarios. In effect, when the plan is approved, it will be an adjunct document to the DSAR. This is significant because NRC regulations at 10 CFR 50.59 permit PGE to make some changes to plant equipment or procedures, provided these changes do not constitute an "unreviewed safety question" An unreviewed safety question is defined at 10 CFR 50.59 as follows:

> *"A proposed change ... shall be deemed to involve an unreviewed safety question (i) if the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis may be increased; or (ii) if a possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report may be created; or (iii) if the margin of safety as defined in the basis for any technical specification is reduced."*

Under 10 CFR 50.59, the Event Analysis is part of the regulatory basis for administrative review of PGE procedures and modifications because, once approved, it is part of the DSAR.

B. PGE's Event Analysis Methodology

The evaluation methodology presented in Section 3.4 of the plan is generally based on the methodology used in NUREG/CR-0130, Technology, Safety and Costs of

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67 To eliminate duplication and provide maximum clarity, some of the descriptions in this section are paraphrased from PGE-1061, Trojan Nuclear Plant Decommissioning Plan, January 26, 1995

68 Portland General Electric Company, PGE-1061, Trojan Nuclear Plant Decommissioning Plan, January 26, 1995, p.3-54

Decommissioning a Reference Pressurized Water Reactor Power Station, June 1978. This document was developed by Battelle Pacific Northwest Laboratory for the NRC to provide information to support the development of standards for decommissioning. It presents the types of activities that could occur during decommissioning and the accident scenarios for these types of activities. This document is well researched and represents the industry standard on the technology of decommissioning. One advantage of PGE using this document is that the referenced pressurized water reactor used in the study was Trojan.

C. Limiting Event & Criteria

The limiting event for the decommissioning event analysis, both in the 1978 Battelle study and at PGE, was determined to be an airborne release of radioactive material. PGE determined that the potential consequences of an accidental airborne release of radioactive material would result in greater calculated doses at the Exclusion Area Boundary than an accidental liquid release. (See paragraph H.3 of this Section for an evaluation of this determination.) Consequently, only events with the potential for airborne releases are discussed in detail in Section 3.4 of the plan.

The Exclusion Area is defined in 10 CFR 100.3 as "that area surrounding the reactor, in which the reactor licensee has the authority to determine all activities including exclusion or removal of personnel and property from the area." As further defined in the DSAR, "the exclusion area boundary coincides with the site boundary on the Oregon side of the river and extends across the Columbia River to the east where the Washington shore of the river forms the eastern boundary."[69]

The event analyses with the potential for airborne radioactive releases were grouped into four categories:[70]

(1) Decommissioning activity events, including decontamination, dismantlement, and material handling events
(2) Loss of support systems, including loss of offsite power, cooling water, and compressed air
(3) Fires and explosions, including bottled gas
(4) External events, including winds, earthquakes, flooding, volcanoes, and toxic chemicals

Each of the events was evaluated for its potential offsite radiological consequences and to ensure that the resulting doses at the Exclusion Area Boundary would be less than 0.5 rem Total Effective Dose Equivalent (TEDE). The basis for the site boundary dose limit of 0.5 rem TEDE is the EPA Protective Action Guides[71] for intermediate term

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69 Portland General Electric Company, Defueled Safety Analysis Report, October 1993, p.2.1-2

70 ibid., p.3-55

71 U.S. Environmental Protection Agency, EPA 400-R-92-001, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents,

releases as agreed to with the Oregon Health Division (Department of Human Resources). The limiting release quantity used as a benchmark to ensure that a postulated event did not exceed this 0.5 rem limit is 2.07 Ci (curies) released to the atmosphere. We reviewed the calculation that established this 2.07 Ci limit. (See paragraph H.3 of this Section.)

The assumptions used in the decommissioning event analyses are listed in Section 3.4.3.2 of the plan. The department reviewed these assumptions and found that they followed the acceptable methodology and were appropriately conservative. (See paragraphs H.4 and H.5 of this Section for further comments on the assumptions.)

D. Descriptions of the Event Scenarios

1. Decontamination and Dismantlement Events

Decontamination methods typically use liquids to remove radioactivity from surfaces. The events analyzed in this category included leakage of decontamination equipment and accidental spraying of liquids containing concentrated contamination.

Large scale chemical decontamination is not anticipated by PGE, but limited application may be used on systems or tanks to reduce radiation dose rates prior to dismantlement or general area decontamination. Chemical decontamination is typically performed by recirculation of a decontamination solution through a system until analysis of samples indicates that the desired decontamination level has been achieved. There is normally no interface between the circulating solution and the air outside the system.

Since decontamination solutions are generally heated to $80^{o}C$, the event scenarios assume that any leak would be released in a vapor state, which is a conservative assumption since liquid does not present a significant airborne release potential. Other assumptions are that chemical decontamination of any system will not exceed a week of continuous operation, a leak rate of 1 gallon per minute may go undetected, the decontamination solution density is the same as water, airborne droplet concentrations due to leaks are 10 mg/m^3, and for spray type leaks, a maximum of 0.3% of the solution will be in the size range that could be transported as airborne activity.

Several event scenarios were postulated, including liquid streams, drops, and sprays. Also postulated were events in which a decontamination solution was sprayed onto a surface, such as the spent fuel pool walls. In none of these postulated events did the airborne contamination exceed the 2.07 Ci limit cited above. Our review of these event analyses verified the reasonableness of the

assumptions used and the results obtained.

Liquid radioactive wastes generated during decommissioning will be filtered and/or demineralized in a liquid radwaste system to ensure liquid releases remain within the limits established by the license, the Off-Site Dose Calculation Manual, and 10 CFR 20.

Dismantlement activities include segmenting components or structures by cutting, disassembly, or some other destructive method (sawing, grinding, plasma cutting, or explosives). Such activities can dislodge contamination or release airborne activation products. The potential for a release near the established limit in disassembly operations is minimal, and any airborne releases during the cutting of activated metal components would be limited to small fractions of material. However, because the reactor vessel internal componentsare highly radioactive, their dismantling will be performed under water.

The dismantlement of the Reactor Coolant System (RCS) piping was considered to provide the bounding analysis for the generation of airborne activity. Other than the reactor vessel internals, the RCS contains the highest concentration of radioactive contamination. An event analysis was performed in accordance with the guidelines of NUREG/CR-0130 using conservative values, including the maximum number of cuts, highest measured contamination, largest pipe diameter, and widest kerf (cut width). The result was 0.71 Ci, which is far below the limiting value of 2.07 Ci. Based on this analysis, PGE concluded that dismantlement activities involving piping systems would not result in exceeding the 0.5 rem TEDE. The department concurs with this conclusion.

The most conservative (in this case, the largest release) calculation for radioactive release due to concrete removal activities was based on the removal of the primary shield wall, which contained an estimated 351 Ci of total activity one year after plant shutdown. Event scenarios were postulated on drilling and using explosives. The worst case analysis was determined to be the use of explosives since that is assumed to have the greatest potential for an airborne release. NUREG/CR-0130 states that "the airborne concentration of dust or liquid droplets is assumed to be 10 mg/m^3. For blasting operations, the airborne concentrations are assumed to be a factor of 10 higher, or 100 mg/m^3."[72] The result of this event scenario was an airborne release of 0.0023 Ci, which is far below the limiting value of 2.07 Ci. (See paragraphs H.5, H.6, and H.7 of this Section for further comments on explosives.)

Other dismantling activities evaluated included material handling events, such as

[72] U.S. Nuclear Regulatory Commission, NUREG/CR-0130, Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station, June 1978, Appendix J, p.J-3

the dropping of contaminated components, concrete rubble, filters, or packages of particulate material. The major assumption used was that 10% of the contained activity becomes dislodged when dropped, and 1% of that, or 0.1% of the total, becomes airborne. PGE used the extremely conservative assumption that the entire activity of the RCS, 221 Ci, is contained within a single dropped component. The result of such a scenario is that 0.221 Ci is released, still far below the limit of 2.07 Ci. Other drop scenarios released less contamination and were therefore bounded by the 2.07 Ci limit.

2. Loss of Support Systems

Loss of support systems, including electric power, cooling water, and compressed air, were evaluated. In each of the scenarios evaluated, the worst case release was smaller than releases from other types of events. In no case did a loss of support system result in a release of radioactive material in excess of the established 2.07 Ci limit. Our review of these event analyses verified the reasonableness of the assumptions and results.

3. Fires and Explosions

Fire protection features are described in Section 9 of the plan and in topical report PGE-1012, "Trojan Nuclear Plant Fire Protection Program." The department reviewed the event scenarios dealing with fire and explosions. The Fire Protection Program has been in place at Trojan since the plant was closed in 1993, and was not reviewed for this report. However, one significant action taken by the plant staff since the plant was shutdown was to reduce the amount of combustibles in the facility, including removing oil from nonessential equipment and reducing electrical loads.

The worst case fire scenario postulated was a fire in the Low-Level Radioactive Waste Storage building. The analysis of this scenario showed that the airborne contamination did not exceed the EPA's Protective Action Guides, and therefore required no offsite protective actions. The department did not review the analysis or calculation used for this event, however, we found the assumptions and results reasonable, and we accept the findings as reported. The Oregon Health Division (Department of Human Resources) staff did review the calculation used in this determination as part of their review of PGE's Emergency Plan.[73] They found the calculation to be accurate and agreed with its conclusions. They also stated in correspondence to the department that two of the assumptions used in the calculation were not as conservative as they would have preferred; however, they accepted the results.

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[73] Oregon Health Division (Department of Human Resources) letter from N.Goevelinger to D.Stewart-Smith, Oregon Department of Energy, Potential Ingestion Doses From a Rad-Waste Building Fire as Calculated in PGE Document TDW-257-93TF, August 31, 1993

For explosion events, PGE assumed that the maximum explosion would be from stored, bottled gas. The plan references NUREG/CR-5759, which concludes that the risk to plant safety from the explosion of portable bottles is not significant. In addition, we reviewed the analysis of a bottled gas explosion given in Appendix J of NUREG/CR-0130[74], and we agree with the conclusion reached in that document that the total atmospheric release from the worst case explosion of bottled gas would not exceed the established limits. (See paragraphs H.5, H.6, and H.7 of this Section for further comments on explosion events.)

4. External Events

[74] U.S. Nuclear Regulatory Commission, NUREG/CR-0130, Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station, June 1978, Appendix J, p.J-41

Accident scenarios resulting from external events were evaluated in the plan. These scenarios included events caused by earthquakes, flooding, tornadoes and extreme winds, volcanoes, lightning, and toxic chemicals. Each of these accident scenarios was previously addressed in the Defueled Safety Analysis Report (DSAR) for its potential impact on the storage and handling of spent fuel. The department reviewed the bounding analyses that PGE included in the DSAR[75] and reported our conclusions in a previous report to the Council.[76]

More significantly, PGE evaluated these events in terms of expected changes to occur in structures during decommissioning that could change the assumptions or bases for the previous accident analyses. These changes included the containment opening, various structural modifications, lifting of heavy components in the Fuel Handling Building, and the transportation of contaminated components outside the containment. PGE concluded that the postulated event scenarios did not jeopardize the structural integrity of the buildings or result in events that exceeded the airborne release limit. The department addressed these in its report on the LCRP, and concluded that the assumptions and results were reasonable.

Some events or the additional consequences of events, such as lightning or the breaching of a door during high winds, were also found to be bounded (shown to cause less release of radioactive material) by other events previously analyzed in the plan. For example, lightning events are bounded by a loss of offsite power or fire event, a possible consequence of flooding was bounded by the loss of offsite power, and toxic chemical events were bounded by the material handling event scenario. Our review verified the reasonableness of the assumptions and results.

E. Radiological Occupational Safety

Section 3.4.5 of the plan discusses the implementation of the Radiation Protection Program to minimize the consequences of radiological events during decommissioning activities onsite. (See Section IV.D.2 of this report for the department's evaluation of PGE's Radiation Protection and ALARA programs. The department's conclusion was that PGE's programs for radiation protection and ALARA contain effective programmatic controls.)

In this section, PGE has also committed to onsite emergency response capability in order to minimize occupational exposure during an emergency. However, PGE's Emergency Plan was previously reviewed and approved by the department[77] and the

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75 Portland General Electric Company, Defueled Safety Analysis Report, October 1993

76 Technical Analysis Corporation, Evaluation of PGE's Request to Reduce Insurance Limits, February 14, 1994

77 Oregon Department of Energy, letter from C.A.Ervin to J.E.Cross, Portland

Council[78], in consultation with the Oregon Health Division and Columbia County representatives. Consequently, the Emergency Plan was not part of this review.

F. Offsite Radiological Events

[78] General Electric Company, September 1, 1993
Energy Facility Siting Council, Minutes, Approval of Proposed Revisions to the TNP Permanently Defueled Emergency Plan, February 17, 1995

Section 3.4.6 of the plan discusses offsite radiological events related to the shipment of radioactive materials. Because of the detailed and prescriptive federal regulations in 10 CFR 72 regarding low-level radioactive waste transportation, the Council has elected to not promulgate separate transportation rules. Therefore, Section 3.4.6 was outside the scope of this review. However, as part of our review of the LCRP,[79] the department reported PGE's evaluation that the potential for natural phenomena, such as tornadoes or surge flooding, to damage the components during shipment has a low probability, and that none of these severe natural phenomena would cause loss of structural integrity of the components. Furthermore, their analysis shows that no loss of structural integrity would occur in a collision.[80] However, similar to the Council's requirements for the LCRP, the department recommends that PGE submit to the department, the Oregon Health Division (Department of Human Resources), and Columbia County a comprehensive safety and emergency plan for transporting radwaste during decommissioning.[81] In the event that radwaste shipments must travel on highways in other counties in Oregon, the plan should provide for consultation with those affected counties. This plan should also require coordination between state and federal agencies with emergency responsibilities prior to radwaste shipments.

G. Nonradiological Events

Section 3.4.7 of the plan states that "no decommissioning events were identified that would be initiated from nonradiological sources that could significantly impact public health and safety." Furthermore, the plan states that hazardous materials and wastes will be controlled by the Hazardous Material Control Program and the Chemical Work Permit Program using approved plant procedures. Our review of these procedures indicated that they contain provisions for review of all materials brought onto the site to decide if they are hazardous or otherwise present a risk to workers or the environment and that adequate controls exist to safely handle such materials.

H. Questions and Answers on PGE's Event Analysis

The following paragraphs contain additional information or clarification about material in Section 3.4 of the Decommissioning Plan that has resulted from the department's

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79 Technical Analysis Corporation, Review of PGE's Large Component Removal Plan for Trojan Nuclear Plant, October 11, 1994, pp.26-27

80 Portland General Electric Company, letter from T.D.Walt to D.H.Beckham, Technical Analysis Corporation, Response to Request for Additional Information, September 1, 1994, Enclosure pp.1-4

81 OAR 345-26-370(9)(d) and (r)

review. Most of the following information came from PGE's responses to questions in the department's Requests for Additional Information (RAI) of March 1995 and June 1995. Unless otherwise stated, quotes or statements credited to PGE come from the written responses to the RAIs. Some of the questions and responses provided have been edited for clarity or to avoid duplication with information found elsewhere in this report.

1. Decommissioning Event Analyses Versus the DSAR

The regulatory bases for a defueled plant are contained in the Defueled Safety Analysis Report (DSAR), which evaluates accidents involving the storage and handling of spent fuel. The department asked PGE to explain the basis of Section 3.4 of the plan as it relates to the DSAR and whether any analyzed decommissioning events altered the assumptions addressed in that document.

PGE responded that the event scenarios described in Section 3.4 of the plan "were not within the scope of events evaluated in conjunction with the development of the Defueled Safety Analysis Report." Accident scenarios involving the storage and handling of spent fuel are not within the scope of the Decommissioning Plan, but are addressed in the DSAR. The spent fuel is to be transferred to an ISFSI. "Potential accidents involving the transfer of spent fuel to the ISFSI and potential interactions with decommissioning activities will be addressed as part of the license submittal for construction and operation of an ISFSI in accordance with 10 CFR 72."[82] It should be noted that the same standard for events, the EPA Protective Action Guides, apply to all events regardless of whether they are analyzed in the DSAR or Decommissioning Plan.

Since the Decommissioning Plan uses DECON and dry cask storage of the spent fuel, it relies on approval of the ISFSI by the Council and the NRC. In the unlikely event that the ISFSI event analysis revealed an accident that did not meet the EPA Protective Action Guides, PGE would have to consider an alternate decommissioning method and submit a change to the Decommissioning Plan. No actions have been taken thus far that would preclude taking the plant into a wet SAFSTOR condition should the ISFSI not be approved, and the department recommends that PGE take no actions that would preclude this option until the ISFSI is approved.

PGE stated that decommissioning activities did not change the assumptions used in the DSAR. "Decommissioning activities which have the potential to adversely impact the safe storage of fuel must be reviewed in accordance with the requirements of 10 CFR 50.59. The questions required in the 50.59 process specifically require that any activity which would result in an increase in the probability of an accident or increase the consequence of an accident previously

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82 Portland General Electric Company, PGE-1061, Trojan Nuclear Plant Decommissioning Plan, January 26, 1995, p.3-54

analyzed must receive prior NRC approval. Also if the activity has the possibility to create an accident not previously analyzed, then prior NRC approval must be obtained."

2. Engineering and Administrative Controls for Radioactive Liquid Inventories

The department requested PGE to describe the engineering and administrative controls for handling radioactive liquid inventories, including the use of temporary systems and the reviews of design changes.

PGE responded that all decommissioning activities involving radioactively contaminated systems, structures, and components are considered quality-related. The engineering and administrative controls for these activities are the same as when the plant was operating. Radioactive wastes will be controlled in accordance with existing procedures under the Radiation Protection Program. All wastes to be discharged will be sampled and handled in accordance with the Off-Site Dose Calculation Manual (ODCM) and the Permanently Defueled Technical Specifications (PDTS). With regard to tank storage of radioactive liquids, PGE stated that "administrative controls will be implemented to limit the amount of contaminated liquid being generated to be within the capacity of the storage capacity of these retention facilities." The department recommends that this commitment be a condition for Council approval of the Decommissioning Plan.

PGE stated that they plan to "continue to utilize the installed liquid radwaste processing equipment including tanks and monitoring equipment as long as reasonably possible during decommissioning activities.... When the installed system cannot be used, appropriate equivalent controls can be established using portable/temporary tanks and/or monitoring systems to ensure the same ODCM requirements can be met. The installation of alternate storage or monitoring systems would constitute a facility design change and require a 10 CFR 50.59 review." A discussion of the engineering features and administrative controls to be used regarding temporary tanks and systems was added to the plan in the 11/95 Update.

3. Airborne Radioactive Release as the Limiting Accident

The department requested PGE to provide the basis for their conclusion in Section 3.4.2 of the plan that the potential consequences of an accidental liquid release are less than the calculated doses at the Exclusion Area Boundary from an accidental airborne release of radioactive material.

PGE responded that liquid radioactive inventories are controlled by a "defense in depth" engineering strategy provided by physical barriers, such as containments and drains. Also, administrative controls, such as limits to prevent overfilling a

tank, make liquid releases less likely than airborne releases. In addition, PGE provided several calculations supporting their conclusion that airborne releases are the limiting accident for the release of radioactive materials.

The department reviewed three calculations used to support this conclusion. Calculation RPC 94-002 determined the limiting concentration of radioactive material for a tank outside of a building. Calculation RPC 93-019 determined the maximum dose resulting from an airborne release due to a fire. Calculation RPC 94-008 determined that a release of 2.07 Ci directly to the atmosphere would result in a 0.5 rem dose at the site boundary. The results of RPC 94-008 were used as the limiting basis for all event analyses that had the potential for an airborne release. As a result of this review, the department concludes that the methods, assumptions, and results of these calculations are reasonable and satisfactory.

4. Assumptions Used in Accident Analyses

a. Section 3.4.3.2 of the plan presents several assumptions used in the event analyses. Assumption 4 states that "conservative meteorological conditions (Pasquall class F with wind speed 1.13 m/sec) and release elevations are assumed." The department requested PGE to provide an explanation as to why these values were considered conservative.

PGE responded that NRC Regulatory Guide 1.25 specifies the use of Pasquall class F for stability classification as conservative, and the 1.13 m/sec wind speed was determined by the NRC to be an acceptable assumption for the Trojan site. (See Trojan Final Safety Analysis Report, Section 2.3.4.)

b. Assumption 5 states that isotopic concentrations found in the primary side of the steam generators were (a) "conservative for contaminated components and activation of concrete components," and (b) that "credible events did not result in the airborne release of these materials." The department requested PGE to provide the bases for these conclusions.

PGE responded that the "mixture of radionuclides found in the primary (steam generator) coolant system has the greatest number of fission and activation products." As a result, the total effective dose equivalent (TEDE) to a member of the public would be maximized in an airborne release of these materials. The conclusion that an airborne release of these materials was not credible was based on the fact that the "radioactivity is distributed ... as an integral part of the component. The simple dropping of the activated component would not result in the airborne dispersal of the material."

5. Dismantling the Primary Shield Wall

Section 3.4.4.2.2 of the plan discusses the removal of concrete with explosives. Since the limiting accident was determined to be an airborne release of

radioactive material, we did an extensive review of the PGE developed scenario in which the primary shield wall is dismantled using explosives. PGE performed an analysis which concluded that the maximum activity that could be airborne would be 0.0023 Ci, which is well below the established limit of 2.07 Ci for maintaining Exclusion Area Boundary exposures below 0.5 rem. We did a verification of this calculation and concluded that: (1) PGE's analysis was not as reasonably conservative as it could have been, and (2) with the use of more conservative assumptions, the maximum activity that could become airborne was still far below the established limit of 2.07 Ci.

The major difference between PGE's calculation and ours was the determination of releasable radioactive content. PGE used the average density for radioactive material of 0.397 μCi/g, as though activation was spread evenly throughout the entire primary shield wall. They assumed that the concrete that becomes airborne dust contains this average density of radioactive material. We assumed that since the activity is concentrated near the inner portion of the wall, only that portion of the wall releases airborne activity as a result of explosives. The Site Characterization Report reveals that approximately 60% of the total shield wall radioactive content is contained within the first 6 inches of the wall. The average density of that portion of the wall five years after shutdown is approximately 2.9 μCi/g,[83] which is considerably higher than the average density assumed by PGE.

Using this higher concentration of radioactive material plus the other assumptions that were used by PGE in Section 3.4.4.2.2, the maximum airborne activity would be approximately 0.016 Ci, which is about 7 times greater than PGE's result but still well below the 2.07 Ci limit.

The analysis in this section assumes that the entire containment air volume is contaminated with suspended material and is released to the environment. The analysis does not assume contamination control methods which would reduce the concentration of radioactive material suspended in the containment air. However, PGE stated that such methods would include tenting, use of High Efficiency Particulate Air filters, and dust minimization by spraying water on the area. Department staff observed the use of water spray to minimize the spread of contaminated concrete dust during the Large Component Removal Project. Department staff observed that this technique was effective in reducing airborne contamination and that PGE was careful in the monitoring and collection of all contaminated water generated with this technique. The department concurs that PGE's decision not to assume these measures in its analysis is conservative.

Therefore, the department concurs with the end result of PGE's calculation that dismantling the primary shield wall with explosives would not result in an airborne release in excess of the established limit.

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83 Portland General Electric Company, Trojan Nuclear Plant Radiological Site Characterization Report, Rev. 1, February 2, 1995, Table 4.7.30

6. Explosion With the Containment Open

In dismantling the primary shield with explosives, the event scenario given in Section 3.4.4.2.2 assumes that the containment is initially closed and that only one containment volume of dust with radioactive material is released. The department asked if this was a credible scenario since it is conceivable that the temporary door would be blown open and more than one volume of containment atmosphere released.

PGE responded that their scenario has the temporary door fail during the blast, but stated that the short term energy release of the blast would not result in generation of more than a single containment volume.

7. High Explosives as a Limiting Event

a. Since high explosives may be used to fracture concrete during dismantlement activities, the department asked PGE why an accidental detonation of high explosives was not evaluated as a limiting event.

PGE responded that the "amount of radioactivity and contamination levels resulting from the accidental detonation of high explosives would be significantly lower than used in the analysis." They stated that the "evaluation in the decommissioning plan [Section 3.4.4.2.2, Removal of Concrete] places explosives in the position where they could generate the maximum airborne activity level. An accidental explosion of explosives stored away from contaminated systems or structures or during handling yields significantly lower airborne levels." Furthermore, the OSHA regulation for explosives limits the storage of explosives in terms of maximum quantities and minimum distances.

b. The department requested PGE to provide an outline of the criteria that would be used to control the use and storage of explosives.

PGE responded that "explosives, if used for decommissioning, will be handled and used under strict guidelines and procedures." When used in dismantlement activities, "controls would have to be implemented to limit the quantity available for use to a quantity whose explosive potential would not exceed that assumed in the bounding accident or the Decommissioning Plan would have to be revised and receive prior NRC approval." Furthermore, PGE stated that "explosives will not be stored near contaminated structures, systems or components. Also, it is not likely that explosives would be used until the majority of equipment and systems had been removed from the facility."

PGE also provided references to the two regulations that will be incorporated in their administrative controls for using and storing explosives: Code of Federal Regulations 29 CFR 1910, Subpart H, Hazardous Materials and Oregon OAR 437-02-109, Explosives and Blasting Agents, which implements the OSHA rules.

PGE stated that explosives, if used, will be handled by qualified individuals with training and/or experience to perform the required tasks, and that these qualifications will be reviewed by the plant manager or his designee.

It should be noted that PGE representatives stated in interviews that explosives are only one option for dismantling the primary shield wall. PGE is also exploring other options such as a mechanical splitting of the shield wall using an expanding concrete which is poured into drilled holes.

I. Conclusions on PGE's Event Analysis

In general, the review methodology used to evaluate PGE's decommissioning event analyses consisted of the following:

Do the event analyses follow the guidelines of the accepted methodology?
Do the event analyses follow PGE's procedures?
Do the events analyzed encompass all probable event scenarios?
Are assumptions appropriately conservative?
Are calculations accurate?
Are all postulated events below the limits of the EPA Protective Action Guides?

The answer to all these questions was yes. The appropriate methodology was used, the number and type of events analyzed appeared adequate, sample calculations were verified to be accurate, and in none of the postulated events were limits exceeded. The department found one assumption in a major calculation that was not as conservative as possible, but it was adequately conservative to show that the credible accident scenario was well within the EPA Protective Action Guidelines. The Oregon Health Division reached similar conclusions after reviewing the calculation for a postulated fire in the Low-Level Radioactive Waste Storage building.

PGE concluded that its event analysis supported a finding of compliance with all applicable state and federal requirements. The department concurs with this conclusion. Based on the conservative assumptions used in the analyses and the department's review of the methods used in projecting event consequences, the department believes that the postulated accidents for the decommissioning process have low probability, are few in number, and would not result in radiation releases requiring any offsite actions.

Throughout Section 3.4 of the plan, PGE stressed the importance of detailed planning and the implementation of administrative and engineering controls on all decommissioning activities. PGE's administrative and engineering controls, particularly on the review and approval of procedures and design changes, are essentially the same as when the plant was operating. As such, the department finds such practices more than adequate for all decommissioning activities.

The department also concurs with PGE's emphasis in this important area of controlling activities. One cautionary note, however, with the emphasis that PGE has placed on the need for detailed planning and the implementation of administrative and engineering controls is that such controls must be rigorously adhered to. The department found in Section IV.I of this report that the implementation of the QA program provided an adequate system of internal checks on these controls. To provide additional assurance, however, the department's inspection program should continue to periodically verify adherence to the QA program.

Two further findings support the adequacy of PGE's event analysis. The first is that all decommissioning activities involving contaminated systems, structures, and components are considered quality-related. The second is that, as reported in Section IV.D.2 of this report, PGE's programs for radiation protection and ALARA contain effective programmatic controls.

VI. PGE'S DECOMMISSIONING ALTERNATIVE EVALUATION

A. State Requirement

Oregon Administrative Rule OAR 345-26-370(2) sets forth the criteria for Council approval of the Decommissioning Plan. The department evaluated the plan for compliance with these criteria in Section III of this report. However, criterion OAR 345-26-370(2)(g) is more detailed and complex than other criteria in subparts (a) through (f). This section, therefore, evaluates PGE's compliance with OAR 345-26-370(2)(g) in greater detail. OAR 345-26-370(2)(g) states that:

> *An analysis of decommissioning alternatives shall be provided with the plan, satisfactory to the Council. This analysis will describe the bases for the decommissioning alternative selected, and shall include a comparison of SAFSTOR and DECON as those terms are defined by the U.S. Nuclear Regulatory Commission. The analysis must demonstrate that impacts to public health and safety for the option chosen are bounded by the alternatives analyzed above. The analysis must demonstrate that the alternative chosen protects the environment and the health and safety of the public consistent with state and federal statutes, rules and regulations.*

B. Decommissioning Alternatives

In NRC NUREG-0586, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, the NRC defined two methods of decommissioning, DECON and SAFSTOR. Those definitions are presented in Section II.C.

DECON involves the complete decontamination, dismantlement, and, if necessary, removal of equipment and structures containing radioactive contaminants shortly after permanent cessation of operations. SAFSTOR involves some "mothballing" of the facility and deferring decommissioning activities for several years until a portion of the plant's radioactivity has decayed to nonhazardous levels. This is then followed by decommissioning activities similar to those in DECON, including decontamination, dismantlement, and, if necessary, removal of equipment and structures containing radioactive contaminants. Both methods reduce the residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license.

As stated in Section II.C, the primary advantage of DECON is that termination of the nuclear plant license and the release of the site for unrestricted use happens within a relatively short time period, approximately 6 years for a large pressurized water reactor. This eliminates the need for long-term security, maintenance, surveillance, and radiation protection that are necessary under SAFSTOR to protect the health and safety of the public. An additional advantage of DECON is the availability of a work force that is highly knowledgeable about the facility. Furthermore, according to studies done by the NRC, the cost of the DECON alternative is less than for any of the various SAFSTOR options.

The primary disadvantages of DECON are that because this method does not defer any decommissioning activities, it requires a higher initial commitment of funds, higher occupational radiation exposure, and more waste disposal space than SAFSTOR.

The SAFSTOR method defers a large portion of the decontamination and dismantlement activities for up to 60 years. The primary advantage of this deferment is the reduced occupational radiation exposure that occurs during decontamination and dismantlement due to the radioactive decay that takes place over

the relatively long SAFSTOR period. This radioactive decay also results in less burial space being required at the end of the SAFSTOR period for radioactive waste disposal. Deferred decontamination and dismantlement can also result in a reduction in the initial outlay of decommissioning funds.

PGE has stated that the major disadvantage of SAFSTOR is the long-term need for security, maintenance, radiation monitoring, and environmental monitoring to ensure the health and safety of the public during the SAFSTOR period. Another disadvantage is that at the end of the SAFSTOR period there will be few people available who are knowledgeable about the facility's design and construction. Additional potential disadvantages may be the unavailability and/or high cost of low level radioactive waste disposal sites at the end of the SAFSTOR period. Another unknown and possible disadvantage are the regulatory uncertainties that go with any extended time period.

C. PGE's Decommissioning Alternative Evaluation

On January 26, 1995, PGE submitted to the department along with their Decommissioning Plan a report entitled, Decommissioning Alternative Evaluation for the Trojan Nuclear Plant. This document serves as PGE's "analysis of decommissioning alternatives" in accordance with OAR 345-26-370(2)(g).

The results of that analysis was PGE's selection of DECON as the preferred method for decommissioning. One reason for this selection was the determination that DECON was less expensive than other options. DECON minimized the exposure to risks involving increases in costs of radioactive waste burial. Moreover, PGE determined that radiation exposure, low-level radioactive waste volume, and the environmental impact associated with DECON were within acceptable limits consistent with state and federal statutes and rules.[84] Finally, the DECON method alleviates concerns regarding the potential unavailability of a burial site in future years.

Supporting the conclusion of PGE's analysis on alternative decommissioning methods was a DOE study performed by Sandia National Laboratories and Los Alamos National Laboratory that was presented at an American Nuclear Society meeting in November 1994 and reported in Nuclear News in February 1995. The authors of this study reviewed documents and interviewed representatives of Fort St. Vrain, Pathfinder, Rancho Seco, Shoreham, and Trojan nuclear facilities. They concluded that "every utility contacted felt that prompt decontamination and dismantlement ... was the least costly [Decontamination and Dismantlement] option, provided that adequate funding and low-level and high-level waste repositories were available." They stated that for the utilities in the study, "[Low Level Waste] disposal costs represent the major portion of—and uncertainty in—projected decommissioning costs."[85]

D. PGE's Basis for Selecting DECON

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84 Portland General Electric Company, Decommissioning Alternative Evaluation for the Trojan Nuclear Plant, January 26, 1995, p.1

85 S.R.Fischer, W.L.Partain, and T.Sype, "Lessons Learned From Commercial Experience With Nuclear Plant Deactivation To Safe Storage," Nuclear News, February 1995, pp.34-37

In the late 1970s Battelle Pacific Northwest Laboratory performed several detailed studies[86] on the technology, safety, and costs involved with decommissioning nuclear facilities. The results of these studies were incorporated into the NRC's August 1988 NUREG-0586, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, referred to as the GEIS report.[87] The GEIS evaluated several alternative decommissioning methods and concluded that both DECON and SAFSTOR were reasonable and acceptable alternatives for decommissioning a pressurized water reactor (PWR) such as Trojan. The use of this study as a basis for PGE's selection of a decommissioning alternative is particularly relevant because Trojan was selected as the "reference PWR" for the study.

In 1993 the NRC contracted Battelle Pacific Northwest Laboratory to update the analyses that they had previously performed to support the GEIS. The updated analyses reflected changes in the regulatory requirements and changes in the available options for low-level radioactive waste disposal and spent fuel management. The NRC published the results of the updated analyses in draft form in October 1993.[88] PGE based their Decommissioning Alternative Evaluation primarily on these two reports: the August 1988 GEIS report and the updated October 1993 draft GEIS report.

The findings in the GEIS included estimates for parameters such as occupational radiation exposure, public exposure, and low level waste volume. For a specific plant such as Trojan, exposures or waste volumes that exceed the values in the GEIS would be outside the bounds of the NRC's analysis. OAR 345-26-370(2)(g) therefore requires that impacts from Trojan decommissioning be within the bounds of impacts previously analyzed by the NRC in the GEIS.

E. Analysis of PGE's Decommissioning Alternative Evaluation

The department reviewed the original 1988 GEIS and the revised 1993 GEIS analyses, and verified the accuracy and appropriateness of PGE's use of the numbers and conclusions from these documents in establishing the bases for PGE's own estimates. In the Decommissioning Alternative Evaluation, PGE compared the results of various DECON and SAFSTOR scenarios from both NRC studies to its own

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86 U.S. Nuclear Regulatory Commission, NUREG/CR-0130, Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station, June 1978

87 U.S. Nuclear Regulatory Commission, NUREG-0586, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, August 1988

88 U.S. Nuclear Regulatory Commission, NUREG/CR-5884, PNL-8742, Revised Analyses of Decommissioning for the Reference Pressurized Water Reactor Power Station, October 1993

estimates for the Trojan decommissioning in four areas: (1) decommissioning costs, (2) low-level radioactive waste volume, (3) occupational radiation exposure, and (4) public radiation exposure. The department summarized this comparison on Tables VI-A, VI-B and VI-C of this report.

Table VI-A compares the DECON estimates for the two Battelle studies to the PGE estimates. Table VI-B compares the 25-30 year SAFSTOR estimates from the earlier Battelle study to the PGE estimates. Table VI-C compares the two 60 year SAFSTOR estimates from the 1993 revised GEIS to the PGE estimates. The four variables are listed on the left side of each table. The costs provided in these tables are only NRC mandated decommissioning costs, which include decommissioning planning, decontamination and dismantlement (including Large Component Removal) and license termination. The non-NRC mandated costs, which include site restoration, finance charges, ISFSI construction and decommissioning, and ISFSI operation and maintenance, are not included in this analysis.

Tables VI-A, VI-B and VI-C also compare estimates of occupational exposure and public exposure. The regulations for occupational radiation exposure are contained in 10 CFR 20. They are very detailed and are the product of a lengthy Federal rulemaking process and several years of public discussion at the national level. Oregon adopted these standards at OAR 333 Division 120 and OAR 345-26-390(4)(h).

Occupational Exposure: 10 CFR 20 sets forth the allowable radiation exposure to individual workers. The limit is 5 rem to any individual worker per year. However, PGE procedures include an administrative limit of 1 rem to individual workers in a year. The Federal regulatory limits are consistent with the recommended limits of the International Commission on Radiological Protection (ICRP). The ICRP is an international organization affiliated with the World Health Organization and the United Nations International Atomic Energy Agency, and was established to recommend radiation safety limits and protocols. In addition, the Congressionally chartered National Council on Radiation Protection and Measurement (NCRP) makes similar recommendation to the U.S. government and to agencies such as NRC and EPA.

Cumulative exposure to groups of people is measured in person rem. Person rem is the sum of exposure to all workers at the plant in a given period of time. 10 CFR 20 does not include an explicit limit for person rem. Instead, 10 CFR 20 requires that exposures be "As Low As Reasonably Achievable" (ALARA), a term which is defined at 10CFR 20.1003. Licensees must demonstrate compliance with this requirement by implementing an "ALARA program" in which radiation protection staff analyzes each job or project and determines how to do the job for the least exposure. PGE's radiation protection and ALARA program and its compliance with 10 CFR 20 are addressed in Section IV.D of this report.

Public Exposure: PGE estimates the total public exposure from the proposed plan at 4.8 person rem. This estimate is based on methodlogy in section 11 of NUREG 0130 "Technology, Safety, and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station" . The exposure is due to low level waste shipments by truck. Public health and safety is assured with respect to low level waste transportation by Federal regulations at 49 CFR 173 and 10 CFR 71. PGE is required to comply with 49 CFR 173 and 10 CFR 71 by State and Federal law. In adopting the Oregon rules for decommissioning, the Council declined to issue state specific transportation regulations, based on rulemaking testimony by the NRC that the Federal regulations cited above adequately protect public health and safety.

Finally, Tables VI-A, VI-B and VI-C compare low level waste volume. Low level waste volume has a direct effect on environmental impact, and an indirect effect on public radiation exposure, because most public radiation exposure is due to low level waste transportation.

TABLE VI-A

Comparison of PGE's and NRC's DECON Estimates

	1988 GEIS	1993 REVISED ANALYSES	PGE
Decommissioning Cost (1993 $millions)	130.9 - 152.8	124.60	197.00
Low-Level Rad Waste Volume (ft^3)	647,402	246,920	313,000
Occupational Exposure (person-rem)	1215.00	931.20	591.00
Public Exposure (person-rem)	21.00	—	4.80

TABLE VI-B

Comparison of PGE's and NRC's 25-30 Year SAFSTOR Estimates

	1988 GEIS	1993 REVISED ANALYSES	PGE 2018 SAFSTOR
Decommissioning Cost (1993 $millions)	148.40	—	250.00
Low-Level Rad Waste Volume (ft^3)	647,402	—	313,000
Occupational Exposure (person-rem)	333.00	—	245.00
Public Exposure (person-rem)	3.00	—	4.80

TABLE VI-C

Comparison of PGE's and NRC's 60 Year SAFSTOR Estimates

	SAFSTOR1 [a]	SAFSTOR2 [b]	PGE
Decommissioning Cost (1993 $millions)	171.70	229.40	293.00
Low-Level Rad Waste Volume	26,945	246,920	145,000

(ft^3)			
Occupational Exposure (person-rem)	315.30	321.60	233.00
Public Exposure (person-rem)	—	—	2.20

[a] SAFSTOR1, from the revised analyses, assumes that most radioactive materials, except for the reactor vessel, associated insulation, and bioshield wall, will decay to "free releasable" levels within 60 years.

[b] SAFSTOR2, from the revised analyses, assumes that most radioactive materials will not decay to "free releasable" levels within 60 years. Therefore, the volume remains the same as for DECON.

For comparison, the 1988 GEIS estimated a LLRW Volume of 64,600 ft^3 for a 50 year SAFSTOR.

OAR 345-26-370(2)(g) requires that impacts from the option selected by PGE be within the bounds of impacts previously analyzed in the GEIS. The department found that the option selected by PGE is within the bounds of the GEIS by comparing the parameters shown on Tables VI-A, VI-B and VI-C.

Low Level Waste Volume : PGE's plan states that the volume of low level waste disposed under the proposed plan will be approximately 313,000 cubic feet. The GEIS projects low level waste volume of 647,000 cubic feet for DECON. PGE's projected low level waste volume is clearly less than the generic estimate made by the NRC and is therefore bounded by it.

Occupational Exposure: PGE estimated the occupational exposure under the proposed plan to be 591 person-rem. The estimates in the GEIS range from 1215 person rem for DECON to 333 for SAFSTOR. The PGE estimate of occupational exposure for DECON is, therefore, bounded by the GEIS estimate for the same option.

Public Exposure: PGE estimates that the public exposure for DECON is 4.8 person rem. Most of this is due to low level waste shipments by truck. The GEIS estimates that public exposure for the same option is 21 person rem. The exposure projected under the PGE plan is less than the exposure projected in the GEIS and is therefore bounded by it.

In summary, these tables suggest that PGE's projections compare favorably with the generic NRC projections in all areas except cost. Predicted low-level waste volumes, public exposures, and occupational exposures are all within the range or less than the numbers provided in the GEIS.

To evaluate the cost differences for DECON, the department requested from PGE a description of the major contributors to the differences between their estimate of $197 million (for the cost of NRC mandated activities) and the GEIS estimate of $124.6 million for DECON (see Table VI-A).

PGE responded that only the revised GEIS estimate of $124.6 million made in 1993 by Battelle presented a meaningful comparison, due to the proximity of development dates and the enhancements in the revised study over the original 1988 study. PGE described the major contributors as follows:

a. Radwaste Burial Volume

There are significant differences between the PGE and revised GEIS study estimates of LLRW volume. PGE reported that the revised GEIS did not account for approximately 75,000 cubic feet of contaminated electrical cable and components. In addition, the study did not account for the disposal costs of contaminated pipe supports, 7,000 linear feet of stainless steel pipe, or 56,000 cubic feet of carbon steel pipe. On the other hand, the revised GEIS assumed the removal of contaminated concrete to a depth of 1 inch, versus 1 centimeter in the PGE study. The combined total of these differences accounts for the difference of approximately 66,000 cubic feet between the two studies, as shown on Table VI-A.

b. Radwaste Burial Rate

The revised GEIS used a rate of $55 per cubic foot (including special fees and taxes). The PGE cost estimate included an escalated radwaste burial rate (radwaste burial costs are assumed to increase faster than inflation) that averaged out to approximately $79 per cubic foot. With the given estimated volumes, this would account for a difference of over $11 million. [($79 x 313,000 ft^3) - ($55 x 246,920 ft^3)]

c. Corporate Overhead

The revised GEIS included payroll but not corporate overhead, which PGE estimated at approximately $7 million for their projected costs.

d. Unit Cost Factor Assumptions

The revised GEIS study did not take into consideration the removal costs of contaminated pipe supports, which PGE stated would add $5 million to its own estimate. The revised GEIS also used different cost assumptions in areas such as concrete washing, metal cleaning, and metal removal. It also assumed all pipe removal to be handled in 15 foot sections, which PGE said was too large and impractical. No dollar figure was given for these items.

e. Undistributed Cost

PGE included costs for consulting services, the Decommissioning Advisory Board, and NRC fees, which were not included in the Battelle estimate. No dollar figure was given for these items.

f. Staffing

Battelle assumed a crew of 27 workers per shift. PGE used an average of 35 workers per shift, similar to actual experience at Shippingport during decommissioning. No dollar figure was given for this.

g. Shipping

Battelle assumed that the pressurizer would be shipped in its own container without grouting the interior. However, PGE filled the pressurizer with grout to prevent the

release of any internal contamination in the event of an accident. Battelle further assumed the four steam generators would be shipped two per barge. In the Trojan Large Component Removal Project, all components were shipped one per barge.

One additional difference between the Battelle and PGE estimates for DECON is the use of contingencies. Battelle used a 25% contingency across the board. PGE used different contingencies for different parts of its analysis. The average contingency added to the PGE estimate was approximately 15.4%.[89]

In summary, even though Trojan was used as the reference PWR in the Battelle revised GEIS for the NRC, the assumptions used in PGE's cost determination were less generic and more site-specific. PGE incorporated specific methods and site-specific considerations beyond the scope of either of the two GEIS studies, and PGE's cost determination was far more detailed than either. The department did not receive a detailed breakdown of the cost differences; however, it appears from the information it received that the difference between PGE's cost figures and those in the NRC studies is reasonable and justified. PGE's cost analysis is discussed in greater detail in Section VII of this report.

The department asked PGE representatives to explain differences between the cost estimates of DECON and SAFSTOR from PGE's own studies. The difference between $197 million for DECON and $250 million for the 25 year SAFSTOR us made up primarily of two items: a $7 million increase in decontamination and dismantlement costs, and an increase of approximately $45 million in burial costs. PGE assumed burial costs escalate at 10% per year for the first 20 years and then level off to increase at 1% per year thereafter. Table VI-D shows a comparison of approximate burial costs for the three options PGE studied:

TABLE VI-D

Comparison of PGE's Estimates Of Burial Costs

PGE ALTERNATE	LLRW VOLUME	BURIAL COST	TOTAL BURIAL COST
DECON	313,000 FT^3	\$79 / FT^3	\$24.8M
25 YEAR SAFSTOR	313,000 FT^3	\$223 / FT^3	\$69.8M
60 YEAR SAFSTOR	145,000 FT^3	\$305 / FT^3	\$44M

89 Portland General Electric Company, memorandum from H.Chernoff to J.D. Woessner, Technical Analysis Corporation, Determine Average Contingency in Decommissioning Plan Cost Estimate, September 21, 1995

According to interviews with PGE representatives, the difference between $197 million for DECON and $293 million for the 60 year SAFSTOR is also made up primarily by two items: a $20 million increase in burial costs (see Table VI-D), and an increase of approximately $80 million in plant surveillance costs, which includes staffing, security, maintenance, radiation and environmental monitoring for an additional 40 years or roughly $2 million per year. When comparing costs that are 60 years apart, it should be noted that the costs estimates shown are not present valued.

F. Questions and Answers on the Alternative Evaluation

The following are selected questions from our interviews of PGE representatives and from our Requests for Additional Information (RAIs) of March 6, 1995,[90] and June 19, 1995,[91] hereinafter referred to as the March and June RAIs, and PGE's responses to those interview questions and the RAIs.[92] These questions and responses provide additional information or further clarification regarding PGE's selection of DECON. Some of the questions and responses have been edited for clarity or to avoid duplication with information found elsewhere in this report.

1. Bases for Low-Level Radwaste Volume Estimates

The department asked PGE to provide the bases for the amounts of low level radioactive waste (LLRW) estimated for the DECON, 25 year SAFSTOR, and 60 year SAFSTOR options.

In an interview conducted at Trojan, a PGE representative presented a reference study performed by TLG Services, Inc. as the bases for LLRW estimates. Site-specific data, based on radiological surveys, were used to determine the amount of radioactive waste that would be generated for each plant system and structure during DECON. These figures were then extrapolated to account for a 60 year SAFSTOR. The 25 year SAFSTOR was assumed to result in the same amount of LLRW due to the presence of long-lived radionuclides. The methods and assumptions for this reference study were

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90 Technical Analysis Corporation, letter from D.H.Beckham to H.Chernoff, Portland General Electric Company, Request for Additional Information, March 6, 1995

91 Technical Analysis Corporation, letter from J.D.Woessner to H.Chernoff, Portland General Electric Company, Request for Additional Information, June 19, 1995

92 Portland General Electric Company, letters from C.P.Yundt to D.Dietrich, Technical Analysis Corporation, Response to Request for Additional Information, May 18, 1995 and August 10, 1995

reviewed and found satisfactory, and the department concurs with the results.

2. Reduction of Radwaste for SAFSTOR

The Decommissioning Alternative Evaluation presents the assumption that the volume of low level radioactive waste (LLRW) is 70% lower for 60 year SAFSTOR than for DECON.[93] A table in the same document, however, lists 313,000 ft^3 for DECON and 149,000 ft^3 for SAFSTOR, which represents a reduction of 52% rather than 70%. The department requested clarification on this apparent contradiction and the analysis that determined the 70% reduction in LLRW.

PGE could not provide a basis for its assumption of a 70% reduction beyond responding that the number was determined "in recognition of the presence of long lived radionuclides such as Ni-63, Pu-239, and Pu-249 in many plant systems that contain radioactivity." Furthermore, a record of the calculation that determined a LLRW volume of 149,000 ft^3 for SAFSTOR was not available. As a result of the department's inquiry, PGE recalculated the LLRW volume expected for SAFSTOR, including LCRP and the reactor vessel internals. The result was 145,000 ft^3, which was essentially the same as the original calculation (149,000 ft^3) considering the variability within the assumptions.

[93] Portland General Electric Company, Decommissioning Alternative Evaluation for the Trojan Nuclear Plant, January 26, 1995, p. 15

The analysis was based on an estimated inventory of radionuclides that reflected actual conditions. PGE used a study performed by TLG Services, Inc.[94] with site-specific data, based on radiological surveys, to determine the amount of radwaste that would be generated for each plant system and structure during DECON. The TLG figures were then modified to account for a 60 year SAFSTOR period using the inventory of radionuclides from PGE's Radiological Site Characterization Report.[95]

The department checked the reasonableness of the assumptions used by PGE in this calculation. One assumption was that systems and structures with low level external contamination will decay to "free releasable" in 60 years. Examples of systems and structures in this category are electrical cabling, heating and ventilation ducting, the Turbine Building, and the Main Steam Support Structure. Another assumption was that systems with higher levels of internally deposited radioactivity or with high levels of Ni-63 or transuranics will remain radioactive and require disposal after 60 years.

The department concludes that the results of the new calculation are reasonable, and that the original assumption of a 70% reduction in LLRW volume was in error. A more accurate figure would be a 54% reduction in LLRW volume between DECON and a 60 year SAFSTOR.

Partially as a result of this apparent error in percent reduction of LLRW volume and misplacing the record of calculation, the department recommends that PGE treat all records which provide the basis for the decommissioning alternative selection or the basis for decisions affecting the decommissioning process as quality records.

3. Analysis of Radiation Exposures for Alternatives

Most radiation exposure resulting from decommissioning is occupational exposure. Therefore, the department requested PGE to provide its analysis of occupational radiation exposures for DECON, 30 year SAFSTOR and 60 year SAFSTOR.

In an interview at Trojan, a PGE representative presented the reference study performed by TLG Services, Inc. as the basis for the occupational radiation exposure estimate for DECON. As with low level waste, this study used site-specific estimates of the radioactive content of each system to estimate the time required and likely exposure for discrete tasks during DECON.

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94 TLG Services, Inc., Decommissioning Cost Study for the Trojan Nuclear Plant, May 1994

95 Portland General Electric Company, Trojan Nuclear Plant Radiological Site Characterization Report, Rev. 1, February 2, 1995

PGE provided the bases for the estimates for the SAFSTOR options in their response to an RAI.[96] The radiation exposure for each of the various portions of the SAFSTOR decommissioning, including placing the plant in a SAFSTOR condition, conducting the LCRP, moving the spent fuel into the ISFSI, maintenance of SAFSTOR, and decontamination and dismantlement, were determined using the GEIS report, NUREG/CR-0130, plus site specific data and experience. The methods and assumptions used in these determinations were reviewed and found to be reasonable.

In addition, PGE provided a comparison of occupational exposures for the three alternative methods of decommissioning. The following activities and occupational exposures were determined to be common to all three options.

Preparation for DECON or SAFSTOR	23 person rem
Large Component Removal Project	138 person rem
Fuel Transfer to ISFSI/DOE	58 person rem
Total Dose Common to the Three Options	219 person rem

Subtracting 219 person rem from the total estimates for each option gave a comparison between them for occupational exposures.

DECON	591 - 219	= 372 person rem
25 year SAFSTOR	245 - 219	= 26 person rem
60 year SAFSTOR	233 - 219	= 14 person rem

The SAFSTOR options considered by PGE include LCRP and still present a significant difference in occupational exposure compared to DECON. However, when compared to the occupational exposure of an operating nuclear plant, the difference is not significant. The difference between DECON and 60 year SAFSTOR of 358 person-rem is roughly equivalent to annual occupational exposure from an operating nuclear plant. For example, the total plant whole body exposures at Trojan were 258 person-rem in 1990 and 567 person-rem in 1991.[97]

It should be noted also that the projections for occupational exposure during DECON may be high. As of October 23, 1995, near the completion of the LCRP, the actual occupational exposure for the project was 53 person-rem, which is less than half of the 138 person-rem projected in the PGE LCRP plan.

Public radiation exposure will be small compared with occupational exposures,

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96 Portland General Electric Company, letter from C.P.Yundt to D.Dietrich, Technical Analysis Corporation, Response to Request for Additional Information, September 11, 1995

97 Portland General Electric Company, fax from M.Mullen to J.D.Woessner, Technical Analysis Corporation, Response to Decommissioning Plan Questions, October 3, 1995

regardless of the option selected. For the selected DECON option, PGE projects total public exposure of 4.8 person-rem, over a period of about 4 years. Most of this is due to low level waste shipments by truck. PGE projects that the exposure is approximately the same for the 25 year SAFSTOR option, because the waste consists chiefly of longer lived isotopes which do not decay significantly after 25 years.

Public exposure projections are based on methodology from NUREG 0130. NUREG 0130 uses a value of 1.25×10^{-5} person-rem per kilometer for waste shipments by truck. This is equal to .0125 millirem divided by the number of people on the highway in a given kilometer. For comparison, the average radiation exposure to all people in the U.S. from naturally occurring sources is more than 100 millirem per year. Therefore, the exposure to the public from low level waste shipments is equivalent to less than one-hundredth of a percent of the average exposure from naturally occurring radiation.

Moreover, PGE states that the volume of low level waste and the exposure to the public due to low level waste shipments by truck is not reduced appreciably after 25 years, because the waste consists largely of longer lived isotopes which do not decay significantly in a 25 year period. Therefore, with respect to public exposure from low level waste transportation, the selection of DECON versus SAFSTOR makes little difference.

4. Estimated Versus Actual Exposures, Schedules, and Costs

To assess how accurate PGE has been in estimating occupational radiation exposures, keeping within costs, and maintaining work schedules, the department asked for a comparison of PGE's actual numbers in these areas on the LCRP to the estimates presented in PGE-1062, Large Component Removal Plan.

As discussed in the preceding portion of this report on Analysis of Occupational Exposures for Alternatives, paragraph 3, the actual occupational exposure for the LCRP was less than half of projected, while area dose rates were remaining similar to those used in projections. LCRP expenditures through August were approximately $10.1 million as compared with estimated expenditures of $13.6 million for the same period. Working hours were running above projected estimates due to a court stay of approximately 15 days in September.

The department inquired as to how projections on occupational exposures were made. If the projections were based on worst case scenarios, as is commonly done in some situations in the industry, how could the effectiveness of their programs be determined? And specifically, how could the effectiveness of the ALARA (As Low As Reasonably Achievable) program be measured?

PGE responded that "the ALARA program used the radiation estimate for the job that is based on the completion of the work without any contingency. Realistic man-hour and dose rates are used to determine the exposure estimate. Significant review of the man-hour estimates by work task/group are completed to ensure they are realistic and not inflated. The best estimates are always used to compare to actual exposures rather

than using worst case scenarios. The Radiation Protection Department at Trojan is responsible for the ALARA estimates for work in radiologically controlled areas and is independent of the work groups performing the work activities."

Why then were the LCRP occupational exposure numbers running half of what was projected? In an interview a PGE representative gave the following reasons.

- The RTD (Resistance Temperature Detector) bypass loops on the reactor coolant system piping were removed early in the project, thereby eliminating one of the highest sources of radiation dose.
- The lessons learned in removing each of the four steam generators were applied to the next one, thereby providing successive dose savings on each steam generator. PGE reported that the learning curve in reducing occupational exposure on this project was steeper than they anticipated.

This PGE representative also stated that the actual ALARA estimate for the LCRP occupational exposure was 114 person-rem and that the 138 person-rem projected in the LCRP included an applied contingency factor.

As a result of reviewing these areas, the department recommends that PGE submit quarterly reports to the department on the actual versus projected status of occupational radiation exposures, decommissioning costs, and activity schedules during decommissioning. Even though all of this information is available for review at Trojan, the sensitive and significant nature of the material warrants that it be submitted quarterly to the department so that trends can be detected.

5. <u>If the ISFSI is not Approved</u>

Since construction and operation of the ISFSI requires approval by the NRC and the Council, the department asked PGE to describe contingency plans for an alternate decommissioning method if the ISFSI was not approved. What other options were considered? And, what were the estimated cost differences between decommissioning with wet fuel storage and dry fuel storage?

PGE responded that "no formal plans or estimates have been prepared for contingencies if an ISFSI cannot be licensed. Although wet fuel storage is possible while decommissioning, some structures and systems could not be decommissioned until fuel material has been transferred to the U.S. Department of Energy. Significant decommissioning activities can be accomplished without affecting the systems required to support wet fuel storage."

To the question of other options, PGE responded that it considered wet SAFSTOR. Under this scenario, PGE stated that the spent fuel would remain in the pool until it was transferred to USDOE, which was assumed to occur in 2018. At that time, decontamination and dismantlement would begin. They stated that the cost and scope of this decontamination and dismantlement would be essentially identical to dry SAFSTOR; however, the wet SAFSTOR option would be approximately $157 million more expensive

than dry SAFSTOR, primarily due to increased fuel management costs ($114 million) and burial costs associated with a delay until after 2018.

PGE stated that they also studied a partial prompt DECON option in which major decontamination and dismantling would occur while the fuel remained in the spent fuel pool until it was shipped offsite in 2018. They stated that "while some benefit could be realized by minimizing the amount of LLRW exposed to disposal cost escalation, the significant increase for maintaining the spent fuel pool makes this option undesirable."

The department reviewed PGE's estimates and found them to be reasonable. At the present time, the risk of the ISFSI not being approved by the NRC appears minimal. ISFSI's have been licensed in at least seven other states. In Oregon, public comment at rulemaking hearings has indicated little opposition. Furthermore, no actions have been taken thus far that would preclude taking the plant into a wet SAFSTOR condition in the event that the ISFSI was not approved. Therefore, the likelihood that a contingency plan to keep the spent fuel pool will be needed is minimal. However, the department recommends that PGE take no actions that would preclude wet SAFSTOR until the matter is resolved.

6. Making Comparisons Between Alternatives

In the department's evaluation of PGE's selection, we wanted to know exactly what each alternative provided so that adequate comparisons could be made. For example, DECON includes ISFSI and LCRP; but in the Decommissioning Alternative Evaluation, it was not clear what each SAFSTOR option included.

PGE responded that the DECON and SAFSTOR alternatives contain "the same scope of work relative to radioactive decontamination." All the alternatives include LCRP and the Reactor Vessel Internal Removal Project, and both of these are performed in the same time frame (1995-1997) for the alternatives. The ISFSI is also a common feature to all alternatives except wet SAFSTOR. Also, the ISFSI construction and transfer of fuel from the spent fuel pool is assumed to occur for the remaining alternatives in the same time frame (1995-1998).

G. Conformance of the Decommissioning Alternative with OARs

OAR 345-26-370(2)(g) constitutes six distinct requirements. These are described in the following paragraphs along with the department's conclusions on how well PGE's analysis, as presented in their Decommissioning Alternative Evaluation of January 26, 1995, meet those requirements.

1. *An analysis of decommissioning alternatives shall be provided with the plan...*

PGE's Decommissioning Alternative Evaluation was submitted to the department along with the Decommissioning Plan on January 26, 1995. This evaluation serves as PGE's analysis of decommissioning alternatives. It is the department's conclusion that PGE has satisfied this portion of the criterion.

2. ***[The analysis shall be] satisfactory to the Council.***

PGE's Decommissioning Alternative Evaluation presents through, reasonable arguments that are validated by site-specific assumptions, estimates, facts, and experience. The evaluation contains the information needed to compare options on an "apples-to- apples" basis. The PGE evaluation compares the decommissioning options using the same parameters as the NRC used in its Generic Environmental Impact Statement. The differences in public radiation exposures are small, and were calculated using NRC approved methodologies. Furthermore, PGE's experience with the LCRP suggests that occupational exposure may be less than predicted. The department recommends that the Council find the PGE alternative analysis to be satisfactory.

3. ***This analysis will describe the bases for the decommissioning alternative selected...***

PGE's evaluation describes the bases for the alternative method selected by providing extensive references to the two NRC studies which define those bases. The evaluation shows that the selection of DECON was based on a combination of least cost, acceptable public health and safety impact, and the availability of experienced personnel. The department concludes that PGE has satisfied this portion of the criterion.

4. ***[The analysis] shall include a comparison of SAFSTOR and DECON as those terms are defined by the U.S. Nuclear Regulatory Commission.***

PGE's evaluation includes a detailed comparison of SAFSTOR and DECON as those terms are defined by the NRC. The department concludes that PGE has satisfied this portion of the criterion.

5. ***The analysis must demonstrate that impacts to public health and safety for the option chosen are bounded by the alternatives analyzed above.***

PGE's evaluation is bounded by the DECON and SAFSTOR scenarios described in two NRC studies in the areas of Low-Level Radioactive Waste Volume, Occupational Radiation Exposure, and Public Radiation Exposure as demonstrated in Tables III-A, III-B, and III-C. It is the department's conclusion that PGE has satisfied this portion of the criterion.

6. ***The analysis must demonstrate that the alternative chosen protects the environment and the health and safety of the public consistent with state and federal statutes, rules and regulations.***

PGE's evaluation demonstrates that the chosen alternative is within the guidelines established by the NRC studies, which were chosen based, in part, on their ability to protect the environment and the health and safety of the public and be consistent with state and federal statutes, rules, and regulations, including but not limited to regulations concerning occupational radiation exposure at 10 CFR 20, regulations concerning public health and safety at 10 CFR 50 and 10 CFR 72, state regulations shown in Appendix B of this report, and regulations concerning radioactive waste transportation as listed in Appendix C of this report. It is the department's conclusion that PGE has satisfied this

portion of the criterion.

VII. DECOMMISSIONING COST ANALYSIS

A. Overview

Section 5 of the plan addresses the issue of decommissioning costs and funding as required by 10 CFR 50.82. It provides an updated cost estimate for decommissioning using the DECON alternative, a comparison of the estimate with funds already set aside, and a plan for assuring the availability of adequate funds to complete decommissioning.

B. PGE's Cost Estimate — Contractor and Methodology

The methodology used for determining the decommissioning cost estimate follows the basic approach originally presented in U.S. DOE Decommissioning Handbook, November 1980, and AIF/NESP-036, Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates, May 1986. AIF/NESP-036 was developed in response to a nuclear industry need for a credible, thorough, and consistently applied method for preparing cost estimates. It was prepared by TLG Engineering, Inc. and reviewed by a task force consisting of representatives from utilities, state regulatory commissioners, architect/engineering firms, nuclear consulting firms, the U.S. Federal Energy Regulatory Commission, the NRC, and the National Association of Regulatory Utility Commissioners.

The method described in these references identifies each work activity to be accomplished during decommissioning and then breaks these activities into basic repetitive events, such as cutting pipe, removing pumps, or demolishing concrete. Each repetitive event is individually cost estimated. The costs include labor, equipment, materials, energy, and services. From this process unit factors are developed in terms of cost per cut, cost per cubic foot demolished, and cost per cubic yard of burial, etc. An inventory of plant equipment and structures is then used in conjunction with the factors to develop a reliable cost estimate.

To prepare the decommissioning cost estimates for Trojan, PGE contracted TLG Services, Inc. They presented the results of their study in May 1994.[98] The unit cost factor methodology used for Trojan in this study incorporates site-specific considerations, including PGE salary and hourly rates for personnel, and equipment and structure data based on plant drawings and inventory documents. The unit cost factors also reflect the latest available information about worker productivity in decommissioning, including the Shippingport Station Decommissioning Project, which was completed in 1989.[99] The TLG study also follows the principles of ALARA, including such items as radiation protection training and the use of respiratory protection and personnel protective clothing.

The department reviewed the basis and assumptions for the TLG Services study and found them reasonable and justifiable. The department further found that the unit cost methodology and the manner in which it was used for the Trojan decommissioning provides a detailed and demonstrable basis for establishing realistic cost estimates.

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98 TLG Services, Inc., Decommissioning Cost Study for the Trojan Nuclear Plant, May 1994

99 ibid., p.4-3

C. Decommissioning Cost Estimate Results and Evaluation

Table 5.1-1 of the plan presents the results of decommissioning cost estimates, which are summarized in the following table.[100] The costs are presented in 1993 dollars.

Large Component Removal Project	18,533,000
DECON Planning/DECON/License Termination	179,218,000
Site Restoration	42,220,000
Spent Fuel Pool Operation/Maintenance	63,538,000
ISFSI Construction and Decommissioning	44,758,000
ISFSI Operation/Maintenance (through 2018)	65,616,000
Financial Assurance	672,000
Decommissioning Loans	10,588,000
TOTAL	**$425,143,000**

The TLG Services' study estimated the total decommissioning costs to be $289,845,000 (in 1993 dollars).[101] The department asked PGE representatives to describe the major differences between the TLG figure and the total of $425,143,000 given in the plan. PGE responded that the TLG figure did not include the costs of the LCRP, dismantling the reactor vessel internals (burial costs were included), an escalation for burial costs, and spent fuel operation and maintenance. The department verified these differences.

D. Decommissioning Funding Plan

Because TNP was shutdown prematurely, the external trust funds originally established to provide the total cost of decommissioning are not sufficient. According to Table 5.3-1 of the plan, the total of trust funds as of December 31, 1993, was $62,994,728. Because the current cost estimate for decommissioning is higher than the original basis for determining the trust fund contribution schedule, the TNP co-owners have increased their respective contribution schedules. PGE proposes to contribute $14,041,000 each year to the external trust fund through the year 2011. After 2011, it is expected that Trojan will have been replaced by other resources, so the generation of ratepayers after 2011 should not

100 Portland General Electric Company, PGE-1061, Trojan Nuclear Plant Decommissioning Plan, January 26, 1995, Table 5.1-1

101 TLG Services, Inc., Decommissioning Cost Study for the Trojan Nuclear Plant, May 1994, p.4-3

share in decommissioning costs.[102] The funding plan expenditures and contributions for PGE, EWEB/BPA, and PP&L are described in Section 5.3.2 of the plan.

Even with increased contributions to the trust funds, however, "bridging" or borrowed funds will be needed to be secured and maintained throughout the DECON period until termination of TNP's Part 50 license. The department recommends that prior to the implementation of the Decommissioning Plan, PGE provide evidence to the Council that they have obtained a Letter of Credit to ensure that bridging funds will be made available to complete decommissioning.

One potential source of confusion in the Decommissioning Plan exists regarding the Decommissioning Trust Fund cash flow for each of the owners of Trojan. The total for trust fund expenditures on Table 5.1-1 of $348,714,000 is less than the sum of the totals of trust fund expenditures for each of the owners of Trojan given on Tables 5.3-2, 5.3-3, and 5.3-4. This is because Table 5.1-1 is given in constant 1993 dollars; the other tables are presented in escalating dollars through the end of the trust fund in 2011.

E. Public Utility Commission Finding

[102] Public Utility Commission of Oregon (PUC) Order No. 95-322, March 29, 1995, p.57

The Oregon PUC staff reviewed both PGE's decommissioning plan and the proposal for funding it. They found that the plan was the least-cost decommissioning option. They further noted that "as the process of decommissioning evolves, PGE will doubtless find it necessary to make changes in its total cost estimate. The plan and its funding mechanism should therefore be subject to regular, ongoing review by the Commission and staff."[103] In conclusion, the PUC staff recommended the plan's approval.

In its Order No. 95-322 of March 29, 1995, the Oregon PUC determined that decommissioning costs are to be considered capital costs, and therefore, may be recovered under ORS 757.140(2).[104] In conclusion, the PUC stated the following:

> "In this order, we also approve funds to decommission Trojan and to pay for the transition to shutdown. Decommissioning costs are the costs of physically dismantling the plant and packaging and storing the radioactive components and spent fuel. Transition costs are the operations and maintenance (O&M) and administrative and general (A&G) costs associated with plant closure.
>
> PGE would incur decommissioning and transition costs regardless of when the plant was taken out of service, and the company has already been paying into a decommissioning fund. Because Trojan was shut down before the end of its license life, however, payments into the fund will have to increase for a time. Even with the increase in annual contribution, PGE will have to borrow to bridge its needs. As currently estimated, however, the cash flows will eventually be sufficient to fund the cost of decommissioning including repayment of the interim financing.
>
> PGE has submitted a decommissioning plan for approval by the Nuclear Regulatory Commission (NRC). We approve PGE's plan subject to our review and monitoring of costs. There are a great many unknowns as regards decommissioning, and we need to retain the flexibility to modify PGE's plan if circumstances change significantly.[105]"

F. Conclusions

The unit cost factor methodology for estimating decommissioning costs is proven and acceptable. The application of this methodology with site-specific considerations provides a detailed and demonstrable basis for establishing reliable cost estimates. In addition, the department reviewed the specifics of the TLG Services study and concluded that the unit cost factors and their application were sufficiently reasonable to provide a solid basis for the decommissioning cost estimate.

OAR 345-26-370(3) requires that "the plan must include an estimate of funding necessary for implementation. The Council shall determine if provisions for funding are adequate to implement the plan." The department determined that the plan does include an estimate of the funding necessary to complete decommissioning and that it appears adequate based on the decommissioning cost estimate. Furthermore, the department recognizes the Oregon PUC's analysis and approval of the funding plan

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103 ibid., p.58
104 ibid., p.55
105 ibid., pp.3-4

presented in the decommissioning plan.

VIII. PUBLIC COMMENTS AT MARCH 29, 1995 MEETING

On March 29, 1995, a public meeting was held at St. Helens High School in St. Helens, Oregon for the purpose of informing the public and receiving public questions and comments on the plan to decommission Trojan. The meeting was sponsored by both the department and the NRC. Representatives of the department, NRC, and PGE made presentations, answered questions, and received comments from the attendees. To date, this has been the only meeting opportunity for public comment on the subject of the decommissioning of Trojan.

The following is a summation of the attendees' questions and comments that pertained to the Trojan decommissioning. These have been rewritten or paraphrased from the meeting transcript to capture the core issues, and to relate to the Council the nature of the public concerns that were expressed at the time. Questions and comments that did not relate to the Trojan decommissioning were not included.

These questions and comments are provided to the Council for information. All of them were responded to at the meeting, those that pertain directly to the decommissioning plan are answered in this report, and some are beyond the scope of this report. For those who are interested, the transcript of the meeting is available through the department.

Radiation Monitoring

- What is the final release criteria for the site?
- After decommissioning, will a residual amount of radiation remain that is more than what was present prior to the plant being built?
- How many sites were sampled for the background radiation survey?
- Will there be continuous radiation monitoring by the State, the NRC, or PGE after decommissioning, or will monitoring end when the site is released for unrestricted access?
- Will members of the public be able to get a copy of the verification survey done by the State to determine whether the final radiation survey was acceptable? Will members of the public be able to download this report from the Internet?
- Will the concept of ALARA be a factor in the clean-up of the site?
- If the federal or state radiation standards change after the Decommissioning Plan has been approved, will PGE be required to meet the newer standards?
- If the radiation standards were made more stringent, would that increase the cost?

Large Component Removal Project

- Why was the LCRP allowed to take place prior to the Decommissioning Plan being approved and without public meetings or hearings in Columbia County?

- Has any other portion of the decommissioning process been started prior to the Decommissioning Plan being approved?

Alternative Methods for Decommissioning

- Is the decision on the method of decommissioning entirely in the hands of PGE?
- In order to use the DECON alternative, isn't it necessary to build an ISFSI?
- If the SAFSTOR option was chosen, wouldn't the ISFSI be unnecessary?
- Doesn't SAFSTOR assume that the spent fuel remains in the spent fuel pool?
- Why have various aspects of decommissioning process been addressed piecemeal? Why haven't the LCRP, ISFSI, and the rest of the decommissioning process been addressed at one meeting?
- Does the 25 year SAFSTOR and the 60 year SAFSTOR include management costs for the spent fuel?
- Which of the SAFSTOR options did you consider: custodial, passive, hardened?
- Why weren't all of the SAFSTOR options examined in making a cost comparison?
- Is the analysis available in which you evaluated the cost of the SAFSTOR options?
- Why is DECON considered the lower cost option? What is the justification?

State's Review and Approval Process for the Decommissioning Plan

- Will the department's report on the Decommissioning Plan make a recommendation on the method and timetable for decommissioning?
- To what degree will cost be a factor in the department's recommendation on the method for decommissioning? Will cost be weighed against the potential safety risks? Will the department perform a cost-benefit analysis on the plan?
- Will worker and public safety issues get the same quality of consideration as the financial consequences of decommissioning?
- Will copies of the Decommissioning Plan be made available to the public?
- Are copies of the department's standards (OARs) used in reviewing the Decommissioning Plan available to the public?
- Where did the period of 30 days for the public review of the department's recommendation on the Decommissioning Plan come from? Will it be possible to extend that period if the public needs more time to review the department's recommendation?

NRC's Review and Approval Process for the Decommissioning Plan

- Will there be an opportunity for the public to address the NRC directly in a public forum on the matter of Trojan's decommissioning?
- Will it be possible to obtain a copy of the "requests for additional information" that are submitted to PGE by the NRC's contractor from Battelle Pacific Northwest Laboratory?
- Is the NRC's review of the Decommissioning Plan coordinated with the EPA, other people, or other organizations?

The Decommissioning Process

- If the spent fuel pool area is used during decommissioning, doesn't that increase the likelihood of an accident?
- Is the NRC contemplating asking PGE to do an alternative analysis on performing decommissioning activities that would not involve using the spent fuel pool area?
- Does the DECON plan involve removing all of the accumulated waste at the site?
- During decommissioning, is it possible or contemplated that PGE might make changes to the decommissioning process from what is in the plan? If so, will these changes be subject to public hearings?

The Cost of Decommissioning

- What is the Decommissioning Trust Fund and how much money is in it?
- What happens if it costs more money to decommission the site than exists in the Decommissioning Trust Fund?
- Ultimately who pays for the decommissioning?

Safety Issues

- What reassurances can you give people who live in the vicinity of Trojan or who drive past it about the long-term storage of radioactive waste and the warning systems that go with it?
- Why have the evacuation plans and warning systems been discontinued?

Independent Spent Fuel Storage Installation (ISFSI)

- Will there be continuous radiation monitoring for the ISFSI after decommissioning has been completed?
- What about the danger from an earthquake or a flood in the area of the ISFSI?
- Will there be an emergency plan for the ISFSI facility? Where can that plan be reviewed by the public?
- Isn't it true that the best dry cask storage method for spent fuel will only last

40 years before it starts to disintegrate?
- What is the history of the use of dry cask storage?
- How will the fuel be put into the casks? What safeguards will be used in establishing the ISFSI?
- Has any analysis been performed to show what the cost of decommissioning would be if the spent fuel and other radioactive waste was not removed by 2018?
- Why take the risk of keeping the spent fuel and high-level waste onsite and possibly contaminating the Columbia River and this area?

Radioactive Waste Disposal

- The proposed federal repository for high-level radioactive waste at Yucca Mountain is not a sure thing. What happens if it doesn't open or if the opening is delayed?
- Why is PGE considering transferring spent fuel from recent core off-loads to another licensee?
- After the radioactive waste is shipped offsite, is PGE still liable for what happens to it? Will PGE have to pay costs in the future if something happens to that waste?
- Is the waste generated at Trojan safer at Yucca Mountain or here?
- Who is responsible for problems that occur in transporting waste?

Other Issues

- The Trojan decommissioning is the largest one so far and will set precedents. The participants need to proceed with caution.
- Could we have an independent commission study the decommissioning and waste disposal process before we move ahead without coordinating all of our nuclear waste policies in the country?

IX. RECOMMENDATIONS

A. Recommendations to the Council

The department concludes that the proposed decommissioning plan complies with the requirements of OAR 345-26-370(2)(a) through (g) and OAR 345-26-370(3). Accordingly, the department recommends Council approval of the plan. The department further recommends that such approval include the following conditions:

1. PGE shall decommission the plant in accordance with all representations made in PGE-1061, Trojan Nuclear Plant Decommissioning Plan, and their responses to our Requests for Additional Information (RAIs).

2. PGE shall submit quarterly reports to the department on the actual versus projected status of the following items for decommissioning.

    (1) Occupational radiation exposures
    (2) Costs, based on the decommissioning cost estimate
    (3) Schedule of activities

    Even though all of this information is available for review at Trojan, the sensitive and significant nature of the material warrants that it be submitted to the department on a regularly scheduled basis so that trends can be detected. (Section VI.F.4)

    In addition to these status reports, OAR 345-26-380 requires a more comprehensive "Annual Decommissioning Report" to the Council that contains the following:

    (a) The report shall include summaries, interpretations, and analyses of trends of the results of the Environmental Monitoring Program and the Radiological Environmental Monitoring Program required by OAR 345-26-320 and 330. It shall also contain the results of analyses of all radiological environmental samples and of all environmental radiation measurements taken during the reporting period.

    (b) The report shall include a financial report which demonstrates the financial qualifications of the owners to perform retirement and decommissioning activities. Changes in the financial plan or status of the financial plan shall be included.

    (c) The report shall include a summary report on site conditions and the status of decommissioning activities.

3. Prior to the commencement of that portion of decommissioning which comes under the Decommissioning Plan, PGE shall provide evidence to the Council that they have obtained a Letter of Credit to ensure that bridging funds will be made available to complete decommissioning. (Section VII.D)

4. PGE has stated that "no formal plans or estimates have been prepared for contingencies if an ISFSI cannot be licensed." Although the risk of the ISFSI not being approved by the NRC appears minimal, the department recommends a

condition that PGE shall take no actions that would preclude going to a wet SAFSTOR condition for decommissioning until the matter is resolved. Furthermore, if an ISFSI is not approved, PGE should submit a plan for continued safe storage of spent fuel in the spent fuel pool and should revise the Decommissioning Plan, as appropriate. (Section VII.F.5, Section V.H.1)

5. PGE representatives indicated that they would perform a final survey on the site of the ISFSI prior to its construction and the transfer of spent fuel. The department recommends a condition that PGE shall provide the schedule and scope of this survey to the department in advance of the fuel transfer, and that PGE provide the survey results to the Council. Furthermore, the spent fuel transfer out of the spent fuel pool should be contingent on a finding by the Council that areas which will not be included in the ISFSI under the NRC 10CFR 72 license and which are potentially affected by spent fuel storage have been adequately surveyed and meet the release criteria of OAR 345-26-370(2)(a) and (b). (Section IV.F.1.d)

6. In response to a request for information about handling radioactive liquid inventories, PGE stated that "administrative controls will be implemented to limit the amount of contaminated liquid being generated to be within the capacity of the storage capacity of these retention facilities." The department recommends that this commitment be a condition for the Council approval of the Decommissioning Plan. (Section V.H.2)

7. The department found that PGE's ability to provide the documents and calculations which formed the basis for a conclusion that federal and state requirements were met was essential in resolving questions which arose during the department's review. Therefore, the department recommends that PGE treat all the records for decommissioning that provide the basis for the selection of the alternative method of decommissioning or that provide the basis for decisions affecting the decommissioning process as quality records. (Section VI.F.2)

8. Similar to the Council's requirements for the LCRP, PGE should submit to the department a comprehensive safety and emergency plan for transporting radwaste during decommissioning. In the event that radwaste shipments must travel on highways in other counties in Oregon, the plan should provide for consultation with those affected counties. This plan should also require coordination between state and federal agencies with emergency responsibilities prior to radwaste shipments. (Section V.F)

9. At or before the Final Radiation survey, PGE shall take additional background and unbiased radiation measurements sufficient to characterize background and residual radiation levels to a 95% confidence level in accordance with OAR 345-01-010(3).

B. <u>Recommendations for the Department's Inspection Program</u>

1. The department inspection program should periodically verify that:
   a. Selected non-quality-related decommissioning work packages are evaluated by Nuclear Oversight Department personnel for, as a minimum, the potential impact the work could have on quality-related systems, structures, or activities.
   b. "Notification points" are put in some nonquality-related work packages as

provided for in administrative procedures.

c. Audits of the department(s) responsible for decommissioning work packages verify the controls for nonquality-related work packages.

The effectiveness of a QA/QC organization can best be measured by their ability to create an atmosphere within the overall organization that fosters good quality practices. Nowhere is the effectiveness of such an atmosphere more evident than in areas that border the so-called “quality-related” or “safety-related” areas. To date, PGE’s quality programs have shown a high degree of commitment to creating just such an atmosphere. The department inspection program should encourage PGE’s continuation of these excellent practices. (Section IV.I.2)

2. The department should verify that a comprehensive program of internal audits and surveillances examines radiation protection practices at least semi-annually. The Radiation Protection program has a designated audit frequency of 24 months. Records and interviews with PGE representatives, however, indicate that in addition to these biennial audits, routine surveillances of work packages and work in progress examine radiation protection measures more frequently. There is no requirement to audit this area more frequently than once every two years; however, it would seem both prudent and a good industry practice for a plant undergoing decommissioning to evaluate radiation protection practices more frequently than biennially. (Section IV.I.1)

3. The department has paid particular attention to the radiation protection and ALARA programs during critical activities of the LCRP, and PGE’s programs in these areas appear to contain effective programmatic controls. However, because of the extreme importance of these programs, the department’s practice of closely monitoring the radiation protection and ALARA programs should continue for other decommissioning activities beyond the LCRP. (Section IV.D.2)

4. Throughout the decommissioning plan, PGE stressed the importance of implementing administrative and engineering controls on all decommissioning activities, particularly to avoid postulated accident scenarios. These controls, particularly the review and approval of procedures and design changes, are essentially the same as when the plant was operating, and the department finds them more than adequate for decommissioning activities. The QA program has been found at this time to provide an adequate system of internal checks on these controls. However, the inspection program should continue to periodically verify adherence to the QA program to ensure that administrative and engineering controls are rigorously adhered to. Such controls are important to the department and the Council because they are the mechanism that PGE management will use to ensure that decommissioning activities will be conducted (1) safely and without significant public radiation exposures or environmental impact; and (2) with the minimum resources—time, manpower, and money—required to do the job while maintaining public health and safety. (Section V.I)

5. PGE representatives indicated that they would perform a final survey on the site of the ISFSI prior to its construction and the transfer of spent fuel. They also indicated that a confirmatory survey would probably be conducted by the NRC. Whether or not the NRC performs a confirmatory survey, the department should reserve the right to perform its own. Such a survey will not only verify the results of the survey conducted by PGE, but it will also allow the final site survey and

dose rate measurements to be taken without interference from ISFSI radiation.

X. REFERENCES

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APPENDIX A - CODE OF FEDERAL REGULATIONS APPLICABLE TO THE TNP DECOMMISSIONING PLAN

10 CFR 50.82 Application for termination of license.

(a) Any licensee may apply to the Commission for authority to surrender a license voluntarily and to decommission its facility. For a facility that permanently ceases operation after July 27, 1988, this application must be made within two years following permanent cessation of operations, and in no case later than one year prior to expiration of the operating license. Each application for termination of license must be accompanied, or preceded, by a proposed decommissioning plan.... For a facility which has permanently ceased operation before the expiration of its operating license, the collection period for any shortfall of funds will be determined, upon application by the licensee, on a case-by-case basis taking into account the specific financial situation of each licensee.

(b) The proposed decommissioning plan must include—

(1) The choice of the alternative for decommissioning with a description of activities involved.

(i) For an electric utility licensee, an alternative is acceptable if it provides for completion of decommissioning within 60 years. Consideration will be given to an alternative which provides for completion of decommissioning beyond 60 years only when necessary to protect the public health and safety. Factors to be considered in evaluation an alternative which provides for completion of decommissioning beyond 60 years are set out in paragraph (b)(1)(iii) of this section.

(ii) (Not applicable)

(iii) Factors to be considered in making the evaluations required paragraphs (b)(1)(i) ... of this section include unavailability of waste disposal capacity and other site specific factors affecting the licensee's capability to carry out decommissioning safely....

(2) A description of controls and limits on procedures and equipment to protect occupational and public health and safety.

(3) A description of the planned final radiation survey.

(4) An updated cost estimate for the chosen alternative for decommissioning, comparison of that estimate with present funds set aside for decommissioning, and plan for assuring the availability of adequate funds for completion of decommissioning.

(5) A description of technical specifications, quality assurance provisions and physical security plan provisions in place during decommissioning.

(c) Decommissioning plans which propose an alternative that delays completion of decommissioning .....

(d) (Not applicable)

(e) If the decommissioning plan demonstrates that the decommissioning will be performed in accordance with the regulations in this chapter and will not be inimical to the common defense and security or to the health and safety of the public, and after notice to interested persons, the Commission will approve the plan subject to such conditions and limitations as it deems appropriate and necessary and issue an order authorizing the decommissioning.

APPENDIX B - OREGON ADMINISTRATIVE RULES APPLICABLE TO THE DECOMMISSIONING PLAN

OAR 345-26-370 specifies the following standards for the Council approval of a decommissioning Plan regarding the content of the plan:

(1)(b) Perform a technical review, and produce a staff report containing the department's technical conclusions, recommendations on specific issues raised in the proposed plan

(2) The Council shall review the proposed decommissioning plan to verify that the proposed activities will not adversely affect the health and safety of the public or the environment. The Council will ensure the following when evaluating acceptability of a proposed decommissioning plan:

(a) The plan contains criteria for the free release of materials and the area as specified in Table 1 below:

TABLE 1

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDE	AVER-AGE	MAXIMUM	REMOV-ABLE
Natural Uranium, U-235, U-238, and associated decay products	5000 dpm alpha	15000 dpm alpha	1000 dpm alpha
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm	300 dpm	20 dpm
Natural Thorium, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm	3000 dpm	200 dpm
Beta-gamma emitters with decay modes other than alpha emission or spontaneous fission except Sr-90 and others noted above	5000 dpm beta/gamma	15000 dpm beta/gamma	1000 dpm beta/gamma

(Refer to OAR 345-26-370 for table notes. This table was excerpted from U.S. Atomic Energy Commission Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors," Table 1, June 1974.)

(b) After decommissioning, the exposure rate at one meter from all surfaces in the facility buildings and outdoor areas shall be 5μR/hr or less above the background radiation level. Background radiation is defined in OAR 345-01-010.

(c) The plan must contain provisions that require removal from the site of all radioactive waste as defined in ORS 469.300 on a schedule acceptable to the Council. Spent nuclear fuel and other radioactive materials that must be disposed of in a federally approved facility may be stored on the site until such a federally approved facility will take the fuel and these radioactive materials.

(d) The plan must contain an acceptable program for monitoring and controlling

effluents to ensure compliance with applicable state and federal limits. This program may be incorporated by reference, if it has previously be approved by the department.

(e) The plan must contain a program for radiological monitoring to ensure the environment is not being adversely affected. This program may be incorporated by reference if it has previously been approved by the department.

(f) The plan must contain provisions for removal or control of hazardous wastes that are consistent with applicable federal and state regulations.

(g) An analysis of decommissioning alternatives shall be provided with the plan, satisfactory to the Council. This analysis will describe the bases for the decommissioning alternative selected, and shall include a comparison of SAFSTOR and DECON as those terms are defined by the U.S. Nuclear Regulatory Commission. The analysis must demonstrate that impacts to public health and safety for the option chosen are bounded by the alternatives analyzed above. The analysis must demonstrate that the alternative chosen protects the environment and the health and safety of the public consistent with state and federal statutes, rules and regulations.

(3) The plan must include an estimate of funding necessary for implementation. The Council shall determine if provisions for funding are adequate to implement the plan.

APPENDIX C - RADWASTE PACKAGING AND TRANSPORT REGULATIONS

AGENCY	REVIEW / APPROVAL
U.S.Nuclear Regulatory Commission	Review and approve component shipping package per 10 CFR 71 Approval of change to Trojan Quality Assurance Program to permit design & fabrication of material packages per 10 CFR 71, Subpart H
U.S.Army Corps of Engineers	Review dredging application and issue Material Removal Permit for dredging barge slip
Oregon Division of State Lands	Review dredging application and issue Material Removal Permit for dredging barge slip
American Bureau of Shipping (ABS)	Certify barge conforms to ABS standards
National Cargo Bureau	Review and approve barge tie-down design
U.S.Coast Guard	Review and approve tiedown & stability calculations Inspect barge and stowage of package prior to departure Review and approve transportation procedure (including contingency plans) prior to shipment Provide barge certification
Washington State Patrol	Inspect transport vehicle and issue Commercial Vehicle Safety Analysis report
State of Washington Department of Health	Inspect shipment for conformance to 10 CFR 71 requirements prior to departure from Trojan and upon arrival at the Port of Benton
U.S.Department of Energy	Issue overweight & oversize permit from DOE for land transport on Hanford Reservation