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Chief, Rules Review and Directives Branch,
Division of Freedom of Information and Publications Services
Mail Stop P-223
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Sir/Madam:

Enclosed are my comments on the draft report entitled "Revised Analyses of Decommissioning for the Reference Pressurized Water Reactor Power Station" (NUREG/CR-5884). Please do not hesitate to contact me if you have any questions or need any additional information.

Sincerely,

William A. Cloutier Jr. for

Thomas S. LaGuardia, P.E.
President

Enclosure



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**TLG SERVICES, INC.**
**REVIEW OF NUREG/CR - 5884, VOL. 1**
**PREPARED BY**
**PACIFI : NORTHWEST LABORATORY**

## SUMMARY

A detailed review and assessment of the technical material presented by PNL is discussed in the TLG review of Volume 2. This review section will address general methodology or assumptions made by PNL for this study.

## DISCUSSION

Specific comments on sections of the Revised Analysis Volume 1 are referenced to the applicable section and page number for convenience.

<u>Executive Summary</u>

Page xvi

PNL has adopted a specific scenario for Entombment whereby all the reactor vessel internals are removed shortly after shutdown, and the remainder of the radioactive wastes relocated into the reactor containment building for long term storage (up to 300 years). This scenario had been proposed by Maine Yankee only a few years ago, and was rejected out-of-hand by the NRC. The reason given was that the Maine Yankee facility had not been designed or licensed as a long term waste disposal facility. The licensee had not performed extensive analyses to determine the long-term effects of building and structure degradation, and the total environmental effects of waste storage. In addition, the NRC did not want to create a series of low-level waste storage sites all across the nation that would increase NRC's difficulty to monitor them. It is not clear whether this PNL proposal represents a shift in NRC policy, or whether it is offered as "new alternative" which must be evaluated under the NRC's LLW storage facility criteria. In either case, PNL has not provided sufficient evidence that such an evaluation was performed and that the results favored the 300 year storage scenario.

Page xxii

The discussion of increasing LLW disposal costs driving the waste volumes down by means of volume reduction and recycling techniques has been evaluated at length in the industry. The burial cost basis depends on the size of the burial facility (capital and operating costs), region of the country (in terms of labor costs), and when in the burial facility life cycle decommissioning wastes are expected to be received. The later in burial facility life that the decommissioning wastes are received, the lower the unit cost for burial as all initial development costs have been borne by operating reactor wastes. Unless, the delay is long enough that a second host burial facility must be constructed, in which case the decommissioned reactor will bear most of the development cost.

As waste volumes decrease the burial facility operators have smaller quantities of volume upon which to cover their fixed and variable operating costs. In return, they must increase the unit costs of waste burial. This may drive volumes down even further, causing an upward spiral of burial rates. The equilibrium burial cost has not been identified at this time. The economic forces at the time of decommissioning will determine these costs.

Page xxv

Present Value calculations are often helpful when evaluating one or more alternatives for capital equipment expenditure, such as the purchase of a new piece of machinery for a manufacturing facility. These Present Value (PV) calculations escalate current costs of a piece of machinery to future dollars using an assumed inflation rate, then discount those dollars back to their present value by assuming an appropriate interest rate. The lower PV of the alternatives is usually selected for purchase of that equipment.

While the PV of future cash expenditures is useful for evaluating alternative actions, PV is used with considerable care by regulated entities for the following reasons:

> Utility regulatory proceedings make use of nominal amounts, not real amounts, for determining electricity prices;
>
> Discount rates used in regulatory proceedings may be based on achieving a settlement amount rather than on historical data;
>
> Utility regulators deal with the impact on customers through evaluating revenue requirements; and
>
> PV's of the revenue requirements generated from cash expenditure alternatives may be significantly different from PV's of the cash expenditures.

This care is particularly important for decommissioning costs, because the patterns of the cash expenditures are very different from the patterns of the revenue requirements the expenditures will cause.

The range of available decommissioning alternatives produces a range of technical, financial and regulatory risks that must be evaluated. The regulatory risk is particularly significant for delayed decommissioning alternatives, because:

decommissioning costs are sensitive to changes to NRC and environmental regulations (such as residual radioactivity release criteria) and to technical requirements;

fund contribution requirements are sensitive to changes to decommissioning costs, inflation rates, fund earnings levels and income tax rates;

delayed decommissioning for up to 300 years presents considerable uncertainties with respect to public utility commission rulings for lower revenue requirements for the external trust fund; and,

under electric utility deregulation, the business focus may change from generation to transmission and distribution, such that license transfers to another utility may occur whereby the new licensee may not be financially equipped to handle the risks of decommissioning.

Therefore, fund contributions (and the resulting revenue requirements) for delayed decommissioning alternatives could change long after a nuclear generating unit has ceased to operate. The risk of future regulators precluding customers from being further charged may keep delayed decommissioning alternatives from being viable, no matter what PV calculations for either cash expenditures or revenue requirements show.

These same comments apply to PNL's use of PV calculations relating the spent fuel storage alternatives of wet versus dry storage, as discussed in Volume 1, Summary, Page xxvi, and in Volume 2, Appendix D, Section D.4.3.

The inclusion of PV calculations in the PNL Revised Analysis based on cash expenditures is misleading at best and is an open invitation for criticism. PV calculations should be left to the readers, who will then be responsible for defending the PV validity.

4.3 <u>Dismantlement - Period 4</u>
(Page 3.12)

PNL has assumed all work will be done on an 8-hour per day basis, two shifts per day. The utility and DOC staff shown in Figure 3.6 for Dismantlement does not indicate how many management personnel are dedicated for second shift operations. It is not reasonable to assume dismantling activities can be performed on second shift with no, or minimal second shift management.

(Page 3.16 - 3.18)

The number of craft personnel does not appear to be reasonable. Based on 35,357 crew hours in the Reactor, Fuel and Auxiliary Buildings for the 80 week period shown in Figure 3.9, the total number of craft personnel is about:

35,357 crew hrs/(80 wks x 5days/wk x 8 hrs/day) = 11 crews

If the average crew size is 5 workers, there are about 55 total workers on day and night shifts, or about 27 workers per shift. This number of workers per shift seems very low. It is not clear how PNL calculated the number of crews to be employed. TLG employed an average of 35 workers for one-shift operations at Shippingport, just to remove piping and components. This was exclusive of vessel and internals, or building structures.

Please refer to comments on Volume 2, which are directed at the detailed estimate assumptions and bases.

TLG SERVICES, INC.
REVIEW OF NUREG/CR-5884, VOL. 2
PREPARED BY
PACIFIC NORTHWEST LABORATORY

SUMMARY

PNL's Revised Analysis of Decommissioning a Reference PWR was reviewed by TLG, following TLG's recent site-specific cost estimate prepared for Portland General Electric Company. The objective of the review was to provide constructive comments and observations for consideration by PNL, and the US NRC. No attempt was made to match TLG's cost estimate to that of PNL's as such comparisons have proven futile in the past. There are several differences in approach that PNL and TLG will probably never resolve. That is not to say that either methodology is wrong, but only that such differences make it difficult to compare on a line-item basis.

A number of important differences and observations were noted in this review which are summarized herein. The discussion contains more detailed evaluations of each section of the PNL report. The key issues for PNL review are as follows:

1. With respect to on-site spent fuel storage, PNL assumes an ISFSI is constructed on site so that decommissioning can proceed with "minimum impact," but no costs are included for the ISFSI or its operation and maintenance. PNL assumes these costs are assumed to be operating costs.

   Current ISFSI designs cannot accommodate fuel cooled less than five years (the last core discharge). Accordingly, PNL should include the wet storage costs as part of the decommissioning cost.

2. The utility staff overhead rate assumed at 42% seems very low. In general, employee fringe benefits (vacation and holidays), insurance (life, health and accidental death and dismemberment, and worker's compensation) and taxes (FICA, FUTA and SUTA) are a minimum of 32 to 35%. Comprehensive general liability insurance, building overhead (rent or capital depreciation), utilities, furniture and fixtures, and consumables add a substantial cost to the utility burden. TLG has typically seen values in the range of 80 to 90%.

   Similarly, the DOC staff overhead rate varies for "home office staff" assigned to the site temporarily, and permanently assigned site management personnel. TLG has seen values ranging from 110 to 150%. It is presumed that the DOC overhead rates include per diem and travel expenses.

   PNL should consider separating the overhead costs into fixed and variable portions, to account for the changes in staffing levels throughout the different phases of the project.

3. In addition to the Reactor Coolant System, PNL has listed only eleven contaminated systems. Portland General Electric Company identified at least eighteen systems that are completely or partially contaminated at the Trojan plant. The PNL inventory is approximately 50% to 60% of the TLG inventory. This represents a considerable difference in removal and waste disposal costs.

PNL has not included any contaminated electrical systems, nor conduit or cable tray. These electrical systems and components in the Radiological Controlled Areas of the Reactor Building, Fuel Building, Auxiliary Building and the Radwaste Facilities represent a large portion of the contaminated equipment inventory. The Attachments to these TLG review comments include the Trojan contaminated electrical inventory developed by TLG with Portland General Electric Company.

4. PNL has not included the use of waste recycling vendors to volume reduce wastes prior to burial. These vendors can achieve 80 to 90 percent volume reduction for metallic components.

5. PNL assumes 8-hour shifts, two 15-minute breaks per shift and multiple shifts (two for most activities). Two shift operations may not be realistic for an extended, multi-year project. Second shift work in construction or decommissioning is generally used to correct for schedule slippages over a short period of time. Two shift operation will undoubtedly shorten the overall schedule, and will appear to reduce overall costs substantially unless second-shift management costs and equipment rental surcharges are included (see below).

   The estimate should address how multiple shift operations will provide for one-of-a-kind tool breakdown and repair. Adequate replacement parts and backup equipment must be provided such that second shift productivity is not affected. Vendor and supplier support is not available on second shifts. If the damaged equipment is a key to critical path activities, first shift operations will also be affected.

6. PNL has assumed all work will be performed on multiple shifts. Yet Table B.1 lists only a single utility and DOC staff with no mention of second-shift management coverage. Clearly, if the first shift requires a management organization, the second shift also requires management coverage (even if somewhat reduced in staff). From TLG's experience, the same problems that can occur on first shift will also occur on second shift and adequate coverage is required. If PNL has shortened the overall schedule taking credit for two shift operations without adjusting the management staff size, the overall costs will be low.

   In general, rental equipment suppliers charge a surcharge of approximately 50% of the daily rate for equipment is used more than eight hours per day. This charge covers the cost of wear and tear on the equipment and replacement.

7. Development of the overall project schedule is a difficult process. Determination of the critical path of major activities is often used as a starting

point. PNL has not provided any detail on this very important part of the Revised Analysis cost estimate.

INTRODUCTION

The report, "Revised Analysis of Decommissioning for the Reference Pressurized Water Reactor Power Station," NUREG/CR-5884 prepared by Battelle Pacific Northwest Laboratory (PNL) represents a much more detailed analysis of decommissioning activities for the Reference PWR than its predecessor report NUREG/CR-0130. PNL has adopted the unit cost factor (UCF) approach to estimating which provides greater insight into the estimating bases and permits an in depth evaluation of the reasonableness of the cost estimates. Recent experience in steam generator changeout has been analyzed for the activities common to decommissioning and have been incorporated in this Revised Analysis. It appears that PNL reassessed the Reference PWR inventory of piping, components and structures for this Revised Analysis, although no comparison to the previous NUREG/CR-0130 is provided. In addition, PNL has significantly increased the size of the management staff for the decommissioning project and has adopted the utility plus Decommissioning Operations Contractor (DOC) concept of project management.

TLG Services, Inc. (TLG), recently completed an independent cost estimate for the Trojan Nuclear Plant in preparation for its decommissioning. Accordingly, this review provides a timely analysis and comparison to the PNL results. The TLG comments included in this review are intended to be constructive identification of differences in the cost bases, or of areas where additional information or documentation support would be helpful to establishing the credibility of the analysis. Where omissions in documentation are identified, suggested sources are provided or referenced.

No attempt is made in this review to provide concurrence on issues where TLG and PNL are in general agreement. Rather, only those areas are identified where constructive comments can be offered. By no means should this approach be interpreted as being highly critical, nor an endorsement of the PNL revised analysis. In some cases the differences are too small to be of any cost significance. The PNL Revised Analysis and its accompanying computer program are intended to be used by NRC as a proxy for the more detailed site-specific studies necessary to adequately fund decommissioning trusts. As stated in the Abstract of Volume 2, Page iii, "The NRC staff is in need of bases documentation that will assist them in assessing the adequacy of the licensee submittals, from the viewpoint of both the planned actions, including occupational radiation exposure, and the probable costs. The purpose of this reevaluation study is to provide some of the needed bases documentation."

DISCUSSION

Specific comments on sections of the Revised Analysis Volume 2 Appendices are referenced to the applicable section number for convenience.

## APPENDIX B - COST ESTIMATING BASES

### B.1 Bases and Assumptions

PNL states an ISFSI is constructed on site so that decommissioning can proceed with "minimum impact," but no costs are included for the ISFSI, or its operation and maintenance. PNL assumes these costs are assumed to be operating costs. While it was planned that a federal repository would be available to accept this spent fuel on a timely basis during plant operations, such is not the case. No cost provision has been made to store this spent fuel until the US DOE is ready to accept shipments. DOE's fuel receipt queue now extends well into the next century, and the cost for wet or dry storage on site needs to be included.

Recent examples of the effect of spent fuel storage on decommissioning include Rancho Seco, Yankee Rowe, Trojan and Fort St. Vrain. These plants are required to delay total decommissioning until fuel can be removed from the site.

The monies to store and maintain spent fuel on site should be an identified and allowable cost of decommissioning, since decommissioning can not be completed (license termination) until the fuel is removed from the site. Also, PNL has not included any costs for decommissioning of the ISFSI storage containers, as these containers will become activated from the fuel stored within them. It is not clear whether NRC or the public utility commissions will allow utilities to fund spent fuel storage after final shutdown unless it is considered a decommissioning expense.

### B.2 Manpower Costs

The utility and DOC staff cost represent the largest single element of cost of the PNL estimate. Based on Volume 1, Tables 3.2 and 3.3, the total cost of the Utility staff for Periods 1 through 4 is $30,628,745 (including Pool operations during Period 3 and ISFSI operations during Period 4) . This $30.6 million is before the author's 90% allocation of such costs to spent nuclear fuel storage costs, charged to plant operations. There is no justification provided by PNL for this 90%/10% allocation (or 88%/12% for security allocation). Applying these percentages for Periods 1 through 4 of the PNL estimate gives $13.1 million for decommissioning and $17.5 million for spent fuel storage. The specific responsibilities for the personnel identified as part of the spent fuel storage costs should be explained. Any arbitrary assignment of these percentages can result in many millions of dollars difference in the total decommissioning cost.

The DOC portion of the decommissioning cost for Periods 1 through 4 is $16,440,363. With the $13.1 million utility staff for these periods, the total cost is $29.5 million. This represents 24% of the PNL total decommissioning cost. This large portion of the cost should be reviewed in considerable detail by PNL, and supporting documentation provided to substantiate all estimates.

The utility staff overhead rate assumed at 42% seems very low. In general, employee fringe benefits (vacation and holidays), insurance (life, health and accidental death and dismemberment, and worker's compensation) and taxes (FICA, FUTA and SUTA) are a minimum of 32 to 35%. Comprehensive general liability insurance, building overhead (rent or capital depreciation), furniture and fixtures, computers, copiers, telephone systems, postage, memberships and dues, contract lawn/landscaping services, and consumables add a substantial cost to the utility burden. TLG has typically seen values in the range of 80 to 90%.

Similarly, the DOC staff overhead rate varies for "home office staff" assigned to the site temporarily, and permanently assigned site management personnel. TLG has seen values ranging from 110 to 150%. It is presumed that the DOC overhead rates include per diem and travel expenses.

The PNL list of utility and DOC staff management personnel shows few engineering positions (licensing, QA, planning/scheduling, training and plant engineers). Experience at Shippingport, Shoreham, Ft. St. Vrain and Yankee indicate more engineers should be included (mechanical, electrical, nuclear, and civil/structural). The number of administrative personnel, clerks, secretaries and warehousemen/tool crib persons seems low. The total utility and DOC staff at Shoreham was in excess of 650 persons for decommissioning.

The DOC staff shows few field supervision personnel and no waste processing personnel, e.g., field superintendents (one or more for each building), radwaste processing crews, waste packaging and handling crews, etc. These crews cannot work under the minimal direction of a foreman. Experienced decommissioning supervisory personnel must oversee all field work.

It would be helpful if Table B.1 indicated the number of personnel in each job function. Since staff costs are one of the major cost components of decommissioning, the number and salaries for these personnel would be a valuable aid to establishing the credibility of the estimate.

B.3 Mobilization and Demobilization Costs

The DOC mobilization and demobilization costs previously estimated in NUREG/CR 0130 were based on a substantially smaller DOC staff size. Applying an escalation factor to this older basis may not be justified. Accordingly, PNL should re-estimate these costs for the larger staff size used in the Revised Analysis.

B.6 Transportation Costs

It is not clear whether "front-end" cost and "dead-end" costs are zeroed out for multiple cask shipments. Usually, cask shipping campaigns are performed on a continuous basis and there is only one front-end and dead-end cost per cask. The PNL approach may result in duplication of cask costs.

If the transportation scenario is specific to the Trojan Reference plant, are there other credible transportation scenarios included in the PNL computer code to handle heavy components by rail, multi-modal transport, special routing for bridges, overpasses, etc.?

B.8 Costs of Services, Supplies and Special Equipment

The special tools needed for decommissioning are identified in Table B.6. Appendix E discusses removal of over 3,200 bolts under water to disassemble the vessel internals for further sectioning by the plasma arc torch. Such a tool would be a highly specialized, costly tool to perform its functions remotely under water at depths of 20 to 30 ft. No mention is made of this tool in Table B.6.

The small tool allowance cost of 2% of the direct labor cost is consistent with the R. S. Means recommendation.

However, PNL's example of $10 million for direct labor costs may be misleading. For example, for the $124 million total cost (Hanford burial site) Table C.1 on Page c.17 shows the labor and materials cost to be $86 million. Assuming half of this is labor cost (conservative assumption), the labor cost would be $43 million. This would mean a small tool cost of $860,000. At $1,100 per tool, this would require 782 small tools. If there are only 27 workers per shift based on TLG's review of Volume 1 of the Revised Assessment (Page 3.16 - 3.18), this means each worker will have 29 hand tools to use. This sounds high, and warrants a closer look.

B.9 Property Taxation

PNL assumes local property taxes will be assessed only on the land value at the time of plant shutdown, not the value of the capital equipment installed at the site. While fully depreciated assets have no book value, local tax assessors don't always treat the assets this way. In most localities, taxes are assessed on the full value of the land, and a declining value of capital equipment at the site as the equipment is removed for disposal. This approach provides for a graded phaseout of the tax base without adversely affecting the local community. PNL should provide the land and real estate property tax assessments for the reader to evaluate the potential impact for another site.

Also, PNL assumes all the land is available for use, except the exclusion area (about 34 acres). From a local community's standpoint, the land inside the exclusion area has value to the utility (for decommissioning purposes) and would be included in the tax base.

B.10 Nuclear Insurance Costs

PNL has assumed that the spent nuclear fuel storage insurance costs are not charged to decommissioning. This would be a reasonable assumption if the US DOE had provided a federal repository to dispose of the spent fuel. However, since the fuel must remain on site until a repository is available, and the 10 CFR Part 901 contract requires fuel to remain on site for at least five years, this cost should be considered a decommissioning cost.

B.11 License Termination Survey Costs

PNL's postulated crew size and duration appears low. The Shoreham Nuclear Power Station used a team of approximately 35 workers to perform the characterization work in a period of about four months (exclusive of the NRC independent verification contractor for the final termination survey work). PNL should consider doubling the survey crew size and lengthening the survey duration.

B.12 Cascading Costs

PNL has apparently and rightly included cascading costs in its Revised Analysis, but no guidance as to the methodology used is included. As this is a relatively new approach for PNL, it would be instructive to evaluate how such costs are calculated by PNL.

B.13 Regulatory Costs

PNL has assumed that 10 CFR Part 171 fees are not applicable for decommissioning. It would be helpful if an NRC citation or reference were provided.

B.14 Contingency

PNL has retained the 25% overall contingency percentage for use in this Revised Analysis. They acknowledge that a single contingency value is not appropriate for all situations. It would be helpful for PNL to show the varying levels of contingency and their application to decommissioning activities. The AIF Guidelines (AIF/NESP - 036) provides several examples of varying contingency percentages for the various aspects of a decommissioning process. The contingency values used should reflect the utility licensee's confidence in various elements of cost.

## APPENDIX C - COST ESTIMATING COMPUTER PROGRAM

C.1 Inventory

In the following inventory and removal cost estimates, PNL has not identified the use of recycling centers to volume reduce the waste prior to burial. This volume reduction can account for up to 80 to 90 percent reduction of metallic components (valves, pipe, small heat exchangers, etc.), at considerable reduction in burial cost.

PNL assumes valves 3 in. and smaller are removed with the piping to which they are attached. TLG assumes valves 2 in. and smaller are removed with the pipe.

PNL does not include pipe hangers in its estimates because they "are sufficiently small that they can be placed in the piping containers without further consideration." This is not so. Pipe hangers, seismic supports and pipe whip restraints for large piping and valves weigh thousands of pounds and will require their own containers for disposal. There are literally thousands of them in the radioactive portions of the plant.

PNL does not break down piping by system. The assumption is made that all stainless steel piping is contaminated and will be removed. Any carbon steel piping connected to the main steam system in the reactor building is contaminated and removed. The remaining piping remains in place for a "demolition contractor" to remove. No allowance is made for the difficulty in performing final site license termination surveys with all that pipe in place.

In addition to the Reactor Coolant System, PNL assumed there are only eleven systems listed as contaminated. Portland General Electric Company identified at least eighteen systems that are completely or partially contaminated.

PNL has not included any contaminated electrical systems, nor conduit or cable tray. TLG has included the applicable portions of these systems and components.

TLG reviewed the radioactive inventory of system components identified by PNL in Section C, and compared the inventory to the TLG site- specific inventory prepared for Trojan. Attachment I shows all of the systems PNL listed as contaminated, and provides a comparison to the TLG listed inventory for each system. Excluding the piping and pipe hanger inventory for the moment, it appears the TLG quantities are considerably larger than the PNL estimate. TLG has identified 4,328 large and small pipe hangers at the Trojan plant; not an insignificant amount. By inspection, for the components identified as contaminated by PNL, the PNL inventory is about 50% of the TLG inventory. However, as noted earlier PNL identified only eleven contaminated systems. Portland General Electric Company identified eighteen contaminated systems.

TLG also reviewed the PNL inventory of contaminated pipe and compared it to the TLG estimate. This comparison is shown in Attachment II. For the PNL list of contaminated piping shown on Pages C.30 and C.40, the TLG inventory lists 54,732 feet and PNL lists 477,835 feet. If the additional systems are included the totals are 79,762 for TLG, and 47,835 for PNL. This is about 60 % of the TLG inventory estimate.

Attachment III shows the additional contaminated mechanical and electrical systems inventory identified by Portland General Electric Company.

It should be noted that total removal of all components, piping and electrical equipment will be necessary to support 100% verification surveys of pipe penetrations, equipment support pads, floor drains and internal surfaces of the buildings in the radiologically controlled areas.

## C.2 Unit Cost Factors and Work Difficulty Factors

PNL assumes 8-hour shifts, two 15-minute breaks per shift and multiple shifts (two for most activities).

The Work Difficulty Factors (WDFs) for a 480 min shift break down as follows:

| WDF | Percent |
|---|---|
| Work breaks | 10.00 |
| Anti-C suit up | 40.00 |
| ALARA activities | 08.00 |
| Respiratory protection | 20.00 |
| Scaffolding/access | 10.00 |

The time lost for each 480 min shift is:

30 + 120 + 25 = 175 min

That leaves 480 - 175 = 305 minutes for productive work.

{1 + (30/305) + (120/305) (25/305)} x 305 = 480

{1 + 0.098 + 0.393 + 0.082} x 305 = 480

The non-productive time adjustment factor is:

480/305 = 1.574

The respiratory protection factor is 100/83 = 1.2

The scaffolding/access factor is 100/93 = 1.1

The total work difficulty factor is:

1.574 x (1.2 x 1.1) = 2.046 times the estimated work duration

This appears to be PNL's worst case for work difficulty factor.

It is not clear where or how PNL takes into account the following:

a. Initial rad worker training and respirator fit testing
   40 hrs/worker/year

b. OSHA training
   24 hrs minimum, 40 hrs maximum

c. Tool box briefings - daily worker safety training 10 - 20 minutes daily, 1 hr nominally per week

d. Replacement worker training due to attrition, changeout for exposure, termination for cause

e. High dose worker training, mockups, dry-runs

f. Multiple shift briefings and debriefings. The 8% ALARA factor may be too low for this interface activity.

In general, utilities indicate that worker productivity is about 33% for work in radioactive work area.

TLG's worst case is a WDF of 2.96 for the following factors:

| WDF | Percent |
|---|---|
| Work breaks | 8.33 |
| Anti-C suit up | 30.00 |
| ALARA activities | 40.00 |
| Respiratory protection | 50.00 |
| Scaffolding/access | 20.00 |

Thus, the scaffolding factor, respiratory protection factor and ALARA factor are all multiplied by the estimated work duration.

$$(1 + 0.2 + 0.5 + 0.4) \times AWD = 2.10 \times AWD$$

The Anti-C suit up factor is multiplied by the above actual work duration, and the work break factor multiplied by the productive work duration.

$$(2.10 \times AWD) \times 1.3 = 2.73 \times AWD$$

$$(2.73 \times AWD) \times 1.0833 = 2.96 \times AWD$$

TLG compared these results against three work difficulty references as follows:

"Labor Productivity Adjustment Factors," B.J. Riordan, Mathtech, Inc., NUREG/CR - 4546, January, 1986

"Validation of Generic Cost Estimates for Construction-Related Activities at Nuclear Power Plants," G. Simion, et. al., Science and Engineering Associates, Inc., NUREG/CR - 5138, May, 1988

"Radiation-Related Impacts for Nuclear Plant Physical Modifications," F. Sciacca, et. al., Science and Engineering Associates, Inc., NUREG/CR - 5236, October 1989

These references refer to work difficulty factors for similar activities that are approximately 3.13 x AWD, slightly greater than the 2.96 factor used by TLG for large PWRs that have operated for their full license life.

PNL may wish to review these references for further information.

C.2.2 Labor and Materials Costs per Crew Hour

The source document for materials references is not provided. PNL includes 110% overhead and 15% DOC profit, and a 10% shift differential for second shift on this (and all subsequent) unit cost factors. No basis is provided for these percentages.

Furthermore, it appears PNL has assumed all work will be performed on multiple shifts. Yet Table B.1 lists only a single utility and DOC staff with no mention of second-shift management coverage. Clearly, if the first shift requires a management organization, the second shift also requires management (even if somewhat reduced in staff). From TLG's experience, the same problems that can occur on first shift will also occur on second shift and adequate coverage is required. If PNL has shortened the overall schedule taking credit for two shift operations without adjusting the management staff size, the overall costs will be low.

With respect to materials costs (including equipment rental costs), all rental companies charge a 50% premium for equipment usage time in excess of eight hours per day (as recorded on engine operating meters). This charge covers the cost of wear and tear on the equipment and replacement. PNL has not included this cost in its materials costs or markup.

The estimate should address how multiple shift operations will provide for one-of-a-kind tool breakdown and repair. Adequate replacement parts and backup equipment must be provided such that second shift productivity is not affected. Vendor and supplier support is not available on second shifts. If the damaged equipment is a key to critical path activities, first shift operations will also be affected.

C.2.10 Removal and Packaging of the Pressurizer

PNL assumes the pressurizer will be shipped as its own container without grouting the interior. Current practice in the industry, and endorsed by NRC is to fill the pressurizer with a lightweight grout to prevent its radioactive contents from being released in the event of an accident. This effort would add to the cost of handling and disposal.

C.2.12 High-Pressure Water Wash/Vacuuming of Surfaces

PNL states high pressure jet pressure is 250 psi. This may be a typo, as 250 psi is less than used in a car wash. A minimum pressure of 2500 psi is more realistic. PNL claims a cleansing rate of 8 sq ft per min. It is not clear what is meant by "cleansing rate." If it is intended to mean decon to free releasable condition, it is doubtful an 8 sq ft per min rate will accomplish that objective. It would be helpful if PNL were to state the reference material or plant experience relied upon for such performance rates. PNL adds 20% to labor for overhead surfaces and 5% for stairs. Again, experience citations would be helpful. PNL assumes only one gal per min for water generation. This appears very low, even for only 250 psig.

It should be noted that high pressure washing of overhead surfaces is not practical without water containment and collection systems. Additional setup and operating time should be included for this activity.

C.2.13 Cutting Uncontaminated Concrete Walls and Floors

PNL assumes uncontaminated concrete is part of the "cascading costs." These are costs to remove clean concrete or structures to gain access to radioactive materials. However, PNL applies the same Radiation/ALARA factor (8.2%) as for contaminated systems and structures. There may be some inconsistency here which may warrant additional study. The suit-up factor and respiratory factor is probably appropriate as this work generates a dust-filled work environment.

C.2.14 Removal of Contaminated Concrete Surfaces

Based on data collected at six nuclear power plants by Robertson at PNL, concrete contamination rarely penetrated more than one centimeter depth into concrete. Accordingly, a one inch depth is probably an overestimate.

PNL assumes the total surface to be scarified is 21,600 sq ft. Figure C.5d, (page C.12) lists only 6,570 sq ft of concrete to be removed. No other building concrete is shown. Some explanation of this difference would be helpful.

PNL assumes a five-year lifetime for amortization of this equipment. this appears optimistic, as most percussion equipment takes a terrific beating in use. Perhaps a two-year life would be more realistic.

PNL assumes walls would be four times the horizontal cost, based on the lower removal rates of the wall equipment. However, accessibility and operator fatigue are probably greater factors and might increase costs even more.

C.2.15 Removal of Activated/Contaminated Concrete by Blasting

PNL assumes four B-25 containers (4ft x 4ft x 6ft) will be placed in the biological shield pit to catch falling rubble. Even with chutes to guide the rubble, the rubble will undoubtedly demolish or seriously damage the containers to make them unusable for shipping. PNL should consider using 3/4 in. thick steel containers in the pit to catch the rubble, and removing them after each blast to transfer the contents to B-25 containers. The labor cost is greater, but there will be no damage to the containers.

The labor activity listing does not specifically list installation or removal of the wooden chutes to guide the rubble into the containers.

C.2.18 Removal of Steel Floor Grating

PNL estimates 11,265 sq ft of floor grating to be removed. However, it is not clear how this quantity is estimated. Some additional supporting data would be helpful.

C.3 Transportation Costs

PNL appears to have provided an comprehensive evaluation of transportation costs for the Reference plant. Has PNL prepared similar detail for other localities and modes of transport.

APPENDIX D - EFFECTS OF THE SPENT FUEL INVENTORY ON DECOM. ALTERNATIVES

PNL estimates the minimum spent fuel pool operating time prior to dismantlement is 7 years. In fact, most spent fuel dry cask suppliers are basing their designs on 5 years cooling. Rancho Seco is currently participating in a joint EPRI and DOE demonstration project to construct dry cask storage facilities to accept fuel after five years cooling.

As noted in the footnote to Table D.4 (page D.18), PNL allocates 90% of fuel pool operating and maintenance cost to pool operations (non-decommissioning), and 10% to safe storage (decommissioning). This allocation is neither discussed in the text nor justified by NRC regulatory policy or guidance. If DOE had met its commitment to provide a spent fuel repository by 1998, spent fuel pool storage periods (and costs) would have been much shorter (no more than the 10 CFR 970 fuel contract with DOE to store fuel on site for a minimum of five years). These costs would have been borne by the utilities as operating costs. However, because of the recognized delay 100% of these costs should be considered as decommissioning costs.

Please refer to the discussion in TLG's comments to Volume 1, Summary, Page xxvi, regarding the use of Present Value (PV) calculations for alternative evaluations for a utility licensee regulated by public utility commissions (PUCs). Such PV calculations are risky if they are based on expected expenditures rather than on PUC allowed revenue requirements.

## APPENDIX E. REACTOR PRESSURE VESSEL AND INTERNALS DISMANTLEMENT

### E.1 Basic Disassembly Plan

PNL assumes the reactor pressure vessel (RPV) can be cut with an oxyacetylene torch from the outside of the RPV in the annular space between the RPV and the bioshield. This is nearly impossible, as there is only 8-1/2 inches radial clearance after the insulation is removed. While it is true cutting through the carbon steel shell wall will also cut through the stainless steel cladding, the practicality of cutting in such a limited access space should be re-examined by PNL. There is also limited access because of nozzles and vessel support structures.

### E.2.1 CRD Guides

PNL recommends unbolting or breaking the 244 bolts which attach the CRD guide collars to the top of the upper core support assembly. Neither method of removal is practical when performed underwater at a distance with long-handled tools. These collars should be cut with a torch or saw device. Table E.2 (page E.20) does not include a time or cost analysis for removing these 244 bolts.

### E.2.2 Top Plate

Similarly, PNL assumes 48 nuts are removed from the top ends of the support columns and mixer columns to free the top plate. These should be cut off, not unbolted. Table E.2 does not include a time or cost to remove these 48 nuts.

### E.2.3 Posts and Columns

PNL assumes 316 bolts attach the 79 support posts and mixing columns, and will be removed. Table E.2 does not include a time or cost to remove these 316 nuts.

### E.2.4 Upper Grid Plate

PNL cuts the upper grid plate into 8-1/2 inch wide strips to fit in the GTCC canisters. TLG performed a detailed activation analysis using Trojan plant operating histograms, flux data, the ORIGEN code, etc., to determine the vessel and internals activation levels. TLG's calculations indicate this section of the internals is Class C waste, not GTCC waste. PNL assumes the packing factor will be 41% (59% voids). Recent experience at Yankee Rowe cutting vessel internals with the plasma arc torch indicates Yankee is having trouble achieving 25% packing factors (75% voids). The slag accumulation on the back face of the cut tends to interfere with the tight loading arrangement in the liners. PNL should reassess these assumptions.

Currently, the GTCC wastes are a decommissioning "orphan waste." The new regional compacts are not designing their facilities to bury GTCC wastes, and the US DOE has not published estimated costs to send it to the federal repository when it becomes operational. Prudent conservatism (high estimated cost) would be appropriate for this waste classification.

E.3 Lower Core Assembly

E.3.2 Thermal Shields

PNL removes the 156 bolts that hold the shields to the barrel, and section them into 8-1/2 inch strips for the GTCC canisters. TLG's calculations indicate these sections are Class C waste, not GTCC. Table E.2 does not include a time or cost to remove these 156 bolts. PNL assumes a packing factor of 81% (see above).

E.3.3 Core Shroud Plates

PNL removes the 900 bolts holding the plates to the shroud former plates. PNL cuts them into 8-1/2 inch strips for the GTCC canisters. TLG's calculations indicate these are GTCC waste. Table E.2 does not include a time or cost to remove these 900 bolts.

E.3.4 Shroud Former Plates

PNL removes the 700 bolts holding the former plates to the core barrel. PNL (and) TLG calculates these to be GTCC wastes. PNL assumes an 84% packing factor. Table E.2 does not include a time or cost to remove these 700 bolts.

E.3.5 Lower Grid Plate

PNL removes the 384 bolts attaching the lower grid plate to the core support posts, and 60 bolts are removed from the lower grid plate to the lower core barrel. PNL (and TLG) calculate these to be GTCC. PNL assumes a 70% packing factor. Table E.2 does not include a time or cost to remove these 444 bolts.

E.3.6 Lower Core Barrel

PNL calculates the lower core barrel as GTCC waste. TLG calculates it as Class A, B, and C wastes (at various locations above and below the core centerline). PNL assumes a packing factor of 76%.

E.3.7 Lower Core Support Structure

PNL assumes the 96 support posts and 25 instrument tubes will be cut off with a plasma arc torch. However, a plasma arc torch can not cut through multiple thicknesses of metal such as a tube, as the torch loses its arc to the rear side of the tube. PNL calculates these posts and guides are GTCC. TLG's calculations show them as Class C. PNL removes the 236 bolts on each side (total of 472 bolts) of the forging to remove the posts and guides. PNL assumes the forging which is 20 inches thick, can be cut up with a plasma arc torch. Sections of the forging are at least 10 inches thick. The cutting depth limit of a plasma arc torch on stainless steel under water is about six inches. Table E.2 does not include a time or cost to remove these 472 bolts which must be removed underwater with long-handled tools.

For these internals, PNL lists 35,287 inches of cut (not including the insulation), which at 5 inches per minute plasma cutting speed (E.5.2, page E.18) amounts to 35,287 x 5 = 176,435 minutes, or 2,941 crew hours. At an average crew cost of $324.89 per hour, this cost should be $955,501. If the average cutting speed is as high as 10 inches per minute, the cost would be $477,750.

In addition, PNL has removed 3,232 bolts in the disassembly process. At 3 minutes a bolt (highly optimistic), this will take approximately 162 crew hours. With the 162 hours to remove bolts, this adds 162 hours x $324.89 = $52,632, for a total cost of $530,382.

Table E.2 shows the cutting cost without insulation to be $385,772. PNL should review the cutting and unbolting assumptions and costs for the RPV internals.

Note that in Table E.2, the cutting time for the Lower Barrel should be 1,753 minutes instead of 1,596 minutes.

E.5.1 Cutting Team Compositions

PNL assumes the nine man team shown in Table E.1 is used to cut the vessel and internals on a two shift per day operation. In addition, PNL assumes a second six man crew handles the packaged materials on the third shift. This second crew is provided by the utility at a daily cost of $1,546.40 (about $193 per crew hour), but is charged off to the non-dedicated crew costs. PNL further assumes the DOC provides this same crew composition during cutting and packaging of the RPV at a daily cost of $2,500.48 (about $312 per crew hour), and is also charged off to non-dedicated crew costs.

It is not clear why the utility crew and DOC crew are considered non-dedicated when they clearly are performing dedicated activities related to the

RPV and internals removal. It is not possible to identify the specific costs for this work in the non-dedicated cost category, so that it is not clear that this cost has been properly addressed. Also, why does the utility provide these crews when this work is stated as the type of work performed by the DOC? Why does PNL assume a different crew cost per hour for these crews than for the cutting crews? This type of reassignment of crew costs distorts the ability to track RPV and internals cutting and removal labor costs.

APPENDIX F - Steam Generators Dismantlement and Disposal Activities

PNL does not discuss grouting of the steam generators, which has become an NRC requirement prior to shipment for burial. This activity adds about three to four days to each steam generator and several thousands of dollars of material each.

PNL estimates the total manhours for Phases II (Preparatory) and III (Removal) to be 86,557 manhours (without grouting). TLG estimated in the AIF Guidelines (NESP-036) a total of 92,170 manhours (without grouting). This represents reasonable agreement on the costs of this activity for steam generators of the Surry design.

However, does PNL have a procedure to adjust for fewer number of steam generators? Is there a factor for removal of larger diameter generators of another NSSS vendor?

ATTACHMENT I
COMPARISON OF TLG AND PNL INVENTORY
LIST OF THE PNL CONTAMINATED SYSTEMS

(REFER TO COMMENTS PAGE 7)

Plant Name: Trojan Nuclear Plant Date: 7-Feb-94 2:12 PM
PNL -VS- TLG Inventory

System: Chemical and Volume Control

| Index | Component | TLG Amount | PNL Amount |
|---|---|---|---|
| 2 | Piping .25 to 2 inches diameter, linear foot | 6,101 | 0 |
| 3 | Piping >2 to 4 inches diameter, linear foot | 8,384 | 0 |
| 4 | Piping >4 to 8 inches diameter, linear foot | 426 | 0 |
| 10 | Valves >2 to 4 inches diameter, each | 118 | 84 |
| 11 | Valves >4 to 8 inches diameter, each | 6 | 2 |
| | Valves 2 or less, each | * | 292 |
| 24 | Pipe hangers for small bore pipe, each | 847 | 0 |
| 26 | Pumps, < 300 pounds, each | 6 | 7 |
| 27 | Pumps, 300 - 1,000 pounds, each | . | 3 |
| 32 | Pumps motors, 300 - 1,000 pounds, each | 6 | 0 |
| 39 | Heat Exchangers < 3,000 pounds, each | 14 | 3 |
| 40 | Heat Exchangers > 3,000 pounds, each | 0 | 3 |
| 51 | Tanks, <300 gallons, Filters, and ion exchangers, each | 21 | 25 |
| 53 | Tanks, >3,000 gallons, square foot surface area | 12,737 | 5,959 |
| 54 | Electrical equipment, <300 pounds, each | 31 | 0 |
| 69 | Mechanical equipment, <300 pounds, each | 3 | 0 |
| 71 | Mechanical equipment, 1,000 to 10,000 pounds, each | 4 | 0 |

Plant Name: Trojan Nuclear Plant Date: 7-Feb-94 2:12 PM
PNL -VS- TLG Inventory

System: Clean Radwaste

| Index | Component | TLG Amount | PNL Amount |
|---|---|---|---|
| 2 | Piping .25 to 2 inches diameter, linear foot | 3,142 | 0 |
| 3 | Piping >2 to 4 inches diameter, linear foot | 4,213 | 0 |
| 4 | Piping >4 to 8 inches diameter, linear foot | 324 | 0 |
| 10 | Valves >2 to 4 inches diameter, each | 39 | 19 |
| 11 | Valves >4 to 8 inches diameter, each | 3 | 0 |
| | Valves 2 or less, each | * | 64 |
| 17 | Pipe fittings >2 to 4 inches diameter, each | 13 | 0 |
| 24 | Pipe hangers for small bore pipe, each | 436 | 0 |
| 26 | Pumps, < 300 pounds, each | 12 | 5 |
| 27 | Pumps, 300 - 1,000 pounds, each | 2 | 6 |
| 29 | Pumps,>10,000 pounds, each | 1 | 0 |
| 32 | Pumps motors, 300 - 1,000 pounds, each | 2 | 0 |
| 34 | Pumps motors, > 10,000 pounds, each | 1 | 0 |
| 39 | Heat Exchangers < 3,000 pounds, each | 4 | 0 |
| 40 | Heat Exchangers > 3,000 pounds, each | 0 | 2 |
| 51 | Tanks, <300 gallons, Filters, and ion exchangers, each | 4 | 2 |
| 53 | Tanks, >3,000 gallons, square foot surface area | 5,767 | 3,701 |
| 54 | Electrical equipment, <300 pounds, each | 1 | 0 |
| 71 | Mechanical equipment, 1,000 to 10,000 pounds, each | 2 | 0 |

* Indicates that TLG valves less than 2 inches in diameter are removed with the pipe.

ATTACHMENT I

Plant Name: Trojan Nuclear Plant    Date:    7-Feb-94    2:14 PM

PNL -VS- TLG Inventory

System: Component Cooling Water (Clean)

| Index | Component | TLG Amount | PNL Amount |
|---|---|---|---|
| 2 | Piping .25 to 2 inches diameter, linear foot | 2,049 | 0 |
| 3 | Piping >2 to 4 inches diameter, linear foot | 2,031 | 0 |
| 4 | Piping >4 to 8 inches diameter, linear foot | 508 | 0 |
| 5 | Piping >8 to 14 inches diameter, linear foot | 35 | 0 |
| 6 | Piping >14 to 20 inches diameter, linear foot | 70 | 0 |
| 7 | Piping >20 to 36 inches diameter, linear foot | 315 | 0 |
| 10 | Valves >2 to 4 inches diameter, each | 116 | 0 |
| 11 | Valves >4 to 8 inches diameter, each | 21 | 0 |
| 12 | Valves >8 to 14 inches diameter, each | 10 | 0 |
| 13 | Valves >14 to 20 inches diameter, each | 4 | 0 |
| 14 | Valves >20 to 36 inches diameter, each | 18 | 0 |
| 21 | Pipe fittings >20 to 36 inches diameter, each | 7 | 0 |
| 24 | Pipe hangers for small bore pipe, each | 244 | 0 |
| 25 | Pipe hangers for large bore pipe, each | 124 | 0 |
| 26 | Pumps, < 300 pounds, each | 2 | 0 |
| 29 | Pumps, >10,000 pounds, each | 3 | 0 |
| 34 | Pumps motors, > 10,000 pounds, each | 3 | 2 |
| 40 | Heat Exchangers > 3,000 pounds, each | 2 | 0 |
| 51 | Tanks, <300 gallons, Filters, and ion exchangers, each | 2 | 2 |
| 52 | Tanks, 300 to 3,000 gallons (clean Only !!), each | 2 | 1 |
| 54 | Electrical equipment, <300 pounds, each | 33 | 2 |
| 69 | Mechanical equipment, < 300 pounds, each | 2 | 0 |
| 76 | HVAC equipment, < 300 pounds, each | 18 | 0 |

Plant Name: Trojan Nuclear Plant    Date:    7-Feb-94    2:14 PM

PNL -VS- TLG Inventory

System: Component Cooling Water (Contaminated)

| Index | Component | TLG Amount | PNL Amount |
|---|---|---|---|
| 2 | Piping .25 to 2 inches diameter, linear foot | 633 | 0 |
| 3 | Piping >2 to 4 inches diameter, linear foot | 589 | 0 |
| 4 | Piping >4 to 8 inches diameter, linear foot | 74 | 0 |
| 5 | Piping >8 to 14 inches diameter, linear foot | 295 | 0 |
| 10 | Valves >2 to 4 inches diameter, each | 16 | 16 |
| 11 | Valves >4 to 8 inches diameter, each | 10 | 49 |
| | Valves 2 or less, each | * | 72 |
| | Valves > 8 inches, each | N/A | 32 |
| 24 | Pipe hangers for small bore pipe, each | 64 | 0 |
| 25 | Pipe hangers for large bore pipe, each | 89 | 0 |
| 40 | Heat Exchangers > 3,000 pounds, each | 0 | 9 |

* Indicates that TLG valves less than 2 inches in diameter are removed with the pipe.

Plant Name: Trojan Nuclear Plant Date: 7-Feb-94 2:15 PM
PNL -VS- TLG Inventory

System: Containment Spray

| Index | Component | TLG Amount | PNL Amount |
|---|---|---|---|
| 2 | Piping .25 to 2 inches diameter, linear foot | 1,815 | 0 |
| 3 | Piping >2 to 4 inches diameter, linear foot | 798 | 0 |
| 5 | Piping >8 to 14 inches diameter, linear foot | 1,823 | 0 |
| 10 | Valves >2 to 4 inches diameter, each | 7 | 3 |
| 12 | Valves >8 to 14 inches diameter, each | 16 | 20 |
| | Valves 2 or less, each | * | 24 |
| 17 | Pipe fittings >2 to 4 inches diameter, each | 2 | 0 |
| 24 | Pipe hangers for small bore pipe, each | 77 | 0 |
| 25 | Pipe hangers for large bore pipe, each | 537 | 0 |
| 26 | Pumps, <300 pounds, each | 0 | 2 |
| | Pumps < 10,000 pounds, each | 0 | 2 |
| 29 | Pumps, >10,000 pounds, each | 2 | 0 |
| 34 | Pumps motors, > 10,000 pounds, each | 2 | 0 |
| 53 | Tanks, >3,000 gallons, square foot surface area | 383 | 410 |
| 54 | Electrical equipment, <300 pounds, each | 12 | 0 |

Plant Name: Trojan Nuclear Plant Date: 7-Feb-94 2:15 PM
PNL -VS- TLG Inventory

System: Control Rod Drive

| Index | Component | TLG Amount | PNL Amount |
|---|---|---|---|
| 54 | Electrical equipment, <300 pounds, each | 8 | 0 |
| 69 | Mechanical equipment, < 300 pounds, each | 1 | 0 |

* Indicates that TLG valves less than 2 inches in diameter are removed with the pipe.

Plant Name: Trojan Nuclear Plant Date: 7-Feb-94 2:16 PM
PNL -VS- TLG Inventory

System: Dirty Radwaste

| Index | Component | TLG Amount | PNL Amount |
|---|---|---|---|
| 2 | Piping .25 to 2 inches diameter, linear foot | 856 | 0 |
| 3 | Piping >2 to 4 inches diameter, linear foot | 1,154 | 0 |
| 5 | Piping >8 to 14 inches diameter, linear foot | 82 | 0 |
| 10 | Valves >2 to 4 inches diameter, each | 28 | 14 |
| 12 | Valves >8 to 14 inches diameter, each | 2 | 0 |
| | Valves 2 or less, each | * | 32 |
| 17 | Pipe fittings >2 to 4 inches diameter, each | 4 | 0 |
| 24 | Pipe hangers for small bore pipe, each | 111 | 0 |
| 25 | Pipe hangers for large bore pipe, each | 24 | 0 |
| 26 | Pumps, < 300 pounds, each | 10 | 3 |
| | Pumps, > 300 pounds, each | 0 | 4 |
| 53 | Tanks, >3,000 gallons, square foot surface area | 1,044 | 1,099 |
| 54 | Electrical equipment, <300 pounds, each | 3 | 0 |

Plant Name: Trojan Nuclear Plant Date: 7-Feb-94 2:16 PM
PNL -VS- TLG Inventory

System: Fuel Pool Cooling & Demin

| Index | Component | TLG Amount | PNL Amount |
|---|---|---|---|
| 2 | Piping .25 to 2 inches diameter, linear foot | 1,031 | 0 |
| 3 | Piping >2 to 4 inches diameter, linear foot | 882 | 0 |
| 4 | Piping >4 to 8 inches diameter, linear foot | 358 | 0 |
| 5 | Piping >8 to 14 inches diameter, linear foot | 221 | 0 |
| 6 | Piping >14 to 20 inches diameter, linear foot | 28 | 0 |
| 10 | Valves >2 to 4 inches diameter, each | 32 | 25 |
| 11 | Valves >4 to 8 inches diameter, each | 13 | 13 |
| 12 | Valves >8 to 14 inches diameter, each | 8 | 8 |
| 13 | Valves >14 to 20 inches diameter, each | 1 | 0 |
| | Valves 2 or less, each | * | 17 |
| 24 | Pipe hangers for small bore pipe, each | 119 | 0 |
| 25 | Pipe hangers for large bore pipe, each | 73 | 0 |
| 26 | Pumps, < 300 pounds, each | 2 | 0 |
| 28 | Pumps, 1,000 - 10,000 pounds, each | 2 | 4 |
| 33 | Pumps motors, 1,000 - 10,000 pounds, each | 2 | 0 |
| 40 | Heat Exchangers > 3,000 pounds, each | 2 | 0 |
| 51 | Tanks, <300 gallons, Filters, and ion exchangers, each | 2 | 3 |
| 53 | Tanks, >3,000 gallons, square foot surface area | 115 | 120 |

* Indicates that TLG valves less than 2 inches in diameter are removed with the pipe.

Plant Name: Trojan Nuclear Plant    Date: 7-Feb-94 2:16 PM
PNL -VS- TLG Inventory

System: Gaseous Radwaste

| Index | Component | TLG Amount | PNL Amount |
|---|---|---|---|
| 2 | Piping .25 to 2 inches diameter, linear foot | 1,856 | 0 |
| 3 | Piping >2 to 4 inches diameter, linear foot | 2,144 | 0 |
| 4 | Piping >4 to 8 inches diameter, linear foot | 536 | 0 |
| 10 | Valves >2 to 4 inches diameter, each | 4 | 4 |
| 11 | Valves >4 to 8 inches diameter, each | 1 | 0 |
| | Valves 2 or less, each | * | 79 |
| 24 | Pipe hangers for small bore pipe, each | 257 | 0 |
| 39 | Heat Exchangers < 3,000 pounds, each | 2 | 2 |
| 51 | Tanks, <300 gallons, Filters, and ion exchangers, each | 5 | 4 |
| 53 | Tanks, >3,000 gallons, square foot surface area | 1,696 | 731 |
| 54 | Electrical equipment, <300 pounds, each | 4 | 1 |
| 71 | Mechanical equipment, 1,000 to 10,000 pounds, each | 2 | 0 |
| 76 | HVAC equipment, < 300 pounds, each | 1 | 0 |

Plant Name: Trojan Nuclear Plant    Date: 7-Feb-94 2:16 PM
PNL -VS- TLG Inventory

System: Main Steam (Contaminated)

| Index | Component | TLG Amount | PNL Amount |
|---|---|---|---|
| 3 | Piping >2 to 4 inches diameter, linear foot | 0 | 500 |
| 5 | Piping >8 to 14 inches diameter, linear foot | 0 | 420 |
| 7 | Piping >20 to 36 inches diameter, linear foot | 1,188 | 590 |
| 25 | Pipe hangers for large bore pipe, each | 350 | 0 |

* Indicates that TLG valves less than 2 inches in diameter are removed with the pipe.

Plant Name: Trojan Nuclear Plant    Date: 7-Feb-94 2:17 PM
PNL -VS- TLG Inventory

System: Residual Heat Removal

| Index | Component | TLG Amount | PNL Amount |
|---|---|---|---|
| 2 | Piping .25 to 2 inches diameter, linear foot | 1,203 | 0 |
| 3 | Piping >2 to 4 inches diameter, linear foot | 290 | 0 |
| 4 | Piping >4 to 8 inches diameter, linear foot | 933 | 0 |
| 5 | Piping >8 to 14 inches diameter, linear foot | 372 | 0 |
| 6 | Piping >14 to 20 inches diameter, linear foot | 83 | 0 |
| 10 | Valves >2 to 4 inches diameter, each | 7 | 0 |
| 11 | Valves >4 to 8 inches diameter, each | 24 | 18 |
| 12 | Valves >8 to 14 inches diameter, each | 9 | 12 |
| 13 | Valves >14 to 20 inches diameter, each | 2 | 0 |
| | Valves 2 or less, each | * | 12 |
| 20 | Pipe fittings >14 to 20 inches diameter, each | 2 | 0 |
| 24 | Pipe hangers for small bore pipe, each | 123 | 0 |
| 25 | Pipe hangers for large bore pipe, each | 134 | 0 |
| 29 | Pumps, >10,000 pounds, each | 2 | 2 |
| 34 | Pump motors, > 10,000 pounds, each | 2 | 0 |
| 40 | Heat Exchangers > 3,000 pounds, each | 2 | 2 |
| 51 | Tanks, <300 gallons, Filters, and ion exchangers, each | 2 | 0 |
| 54 | Electrical equipment, <300 pounds, each | 23 | 0 |
| 69 | Mechanical equipment, < 300 pounds, each | 1 | 0 |

Plant Name: Trojan Nuclear Plant    Date: 7-Feb-94 2:17 PM
PNL -VS- TLG Inventory

System: Safety Injection

| Index | Component | TLG Amount | PNL Amount |
|---|---|---|---|
| 2 | Piping .25 to 2 inches diameter, linear foot | 2,335 | 0 |
| 3 | Piping >2 to 4 inches diameter, linear foot | 2,023 | 0 |
| 4 | Piping >4 to 8 inches diameter, linear foot | 450 | 0 |
| 5 | Piping >8 to 14 inches diameter, linear foot | 899 | 0 |
| 10 | Valves >2 to 4 inches diameter, each | 18 | 13 |
| 11 | Valves >4 to 8 inches diameter, each | 4 | 18 |
| 12 | Valves >8 to 14 inches diameter, each | 8 | 0 |
| | Valves 2 or less, each | * | 58 |
| 24 | Pipe hangers for small bore pipe, each | 238 | 0 |
| 25 | Pipe hangers for large bore pipe, each | 265 | 0 |
| 28 | Pumps, 1,000 - 10,000 pounds, each | 2 | 2 |
| 33 | Pumps motors, 1,000 - 10,000 pounds, each | 2 | 0 |
| 53 | Tanks, >3,000 gallons, square foot surface area | 2,980 | 1,180 |
| 54 | Electrical equipment, <300 pounds, each | 20 | 0 |
| 69 | Mechanical equipment, < 300 pounds, each | 1 | 0 |

* indicates that TLG valves less than 2 inches in diameter are removed with the pipe.

Plant Name: Trojan Nuclear Plant    Date: 7-Feb-94 2:17 PM
PNL -VS- TLG Inventory

System: Steam Generator

| Index | Component | TLG Amount | PNL Amount |
|---|---|---|---|
| 2 | Piping .25 to 2 inches diameter, linear foot | 1,379 | 0 |
| 3 | Piping >2 to 4 inches diameter, linear foot | [illegible],563 | 0 |
| 4 | Piping >4 to 8 inches diameter, linear foot | 306 | 0 |
| 5 | P[illegible]ng >8 to 14 inches diameter, linear foot | 123 | 0 |
| 10 | [illegible] >2 to 4 inches diameter, each | 51 | 0 |
| 11 | [illegible] >4 to 8 inches diameter, each | 10 | 0 |
| 12 | Valves >8 to 14 inches diameter, each | 4 | 0 |
| 24 | Pipe hangers for small bore pipe, each | 180 | 0 |
| 25 | Pipe hangers for large bore pipe, each | 36 | 0 |
| 26 | Pumps, < 300 pounds, each | 2 | 0 |
| 27 | Pumps, 300 - 1[illegible]0 pounds, each | 1 | 0 |
| 32 | Pumps motors, [illegible] 1,000 pounds, each | 1 | 0 |
| 40 | Heat Exchang[illegible],000 pounds, each | 1 | 0 |
| 51 | Tanks, <300 gallons, Filters, and ion exchangers, each | 2 | 0 |
| 53 | Tanks, >3,000 gallons, square foot surface area | 520 | 0 |
| 55 | Electrical equipment, 300 to 1,000 pounds, each | 1 | 0 |
| 57 | Electrical equipment, >10,000 pounds, each | 1 | 0 |
| 76 | HVAC equipment, < 300 pounds, each | 1 | 0 |

* Indicates that TLG valves less than 2 inches in diameter are removed with the pipe.

ATTACHMENT II
COMPARISON OF TLG AND PNL PIPING LENGTHS

LIST OF PNL CONTAMINATED SYSTEMS

LIST OF TLG ADDITIONAL CONTAMINATED SYSTEMS

(REFER TO COMMENTS PAGE 7)

ATTACHMENT II

Plant Name: Trojan Nuclear Plant Date: 7-Feb-94 2:18 PM
PNL -VS- TLG Inventory

System: Piping

| Index | Component | TLG Amount | PNL Amount |
|---|---|---|---|
| 2 | Piping .25 to 2 inches diameter, linear foot | 22,400 | 23,895 |
| 3 | Piping >2 to 4 inches diameter, linear foot | 24,071 | 14,660 |
| 4 | Piping >4 to 8 inches diameter, linear foot | 3,915 | 4,640 |
| 5 | Piping >8 to 14 inches diameter, linear foot | 3,850 | 4,140 |
| 6 | Piping >14 to 20 inches diameter, linear foot | 181 | 330 |
| 7 | Piping >20 to 36 inches diameter, linear foot | 315 | 170 |
| | TOTAl | 54,732 | 47,835 |

Plant Name: Trojan Nuclear Plant Date: 7-Feb-94 2:18 PM
PNL -VS- TLG Inventory

System: Other Contaminated Pipe

| Index | Component | TLG Amount | PNL Amount |
|---|---|---|---|
| 1 | Instrument and sampling tubing, linear foot | 9,811 | 0 |
| 2 | Piping .25 to 2 inches diameter, linear foot | 11,314 | 0 |
| 3 | Piping >2 to 4 inches diameter, linear foot | 9,223 | 0 |
| 4 | Piping >4 to 8 inches diameter, linear foot | 3,077 | 0 |
| 5 | Piping >8 to 14 inches diameter, linear foot | 638 | 0 |
| 6 | Piping >14 to 20 inches diameter, linear foot | 510 | 0 |
| 7 | Piping >20 to 36 inches diameter, linear foot | 0 | 0 |
| 8 | Piping >36 inches diameter, linear foot | 695 | 0 |
| | TOTAl | 24,762 | 0 |
| | COMBINED TOTAL | 79,494 | 47,835 |

ATTACHMENT III

LIST OF TLG ADDITIONAL CONTAMINATED SYSTEMS

(REFER TO COMMENTS PAGE 7)

## ATTACHMENT III

The following Trojan Nuclear Plant systems are ones that Trojan personnel identified to TLG to be contaminated. These systems are believed to not be considered in the PNL study.

# ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE: Thursday, February 3, 1994 at 16:51:24

SYSTEM: 125 Volt DC Power (Contaminated)

| Index | Component | Amount |
|---|---|---|
| 54 | Electrical equipment, <300 pound | 2.000 |
| 55 | Electrical equipment, 300-1000 pound | 2.000 |
| 56 | Electrical equipment, 1000-10,000 pound | 1.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 1.000 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE: Thursday, February 3, 1994 at 16:51:24

SYSTEM: 4.16 KV AC & Auxiliary Power (Contam)

| Index | Component | Amount |
|---|---|---|
| 55 | Electrical equipment, 300-1000 pound | 1.000 |
| 57 | Electrical equipment, >10,000 pound | 1.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 1.000 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE: Thursday, February 3, 1994 at 16:51:24

SYSTEM: 480 Volt AC Auxiliary Load Centr (Cont)

| Index | Component | Amount |
|---|---|---|
| 55 | Electrical equipment, 300-1000 pound | 7.000 |
| 57 | Electrical equipment, >10,000 pound | 7.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 1.000 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE: Thursday, February 3, 1994 at 16:51:24

SYSTEM: 480 Volt AC MCC (Contaminated)

| Index | Component | Amount |
|---|---|---|
| 55 | Electrical equipment, 300-1000 pound | 1.000 |
| 57 | Electrical equipment, >10,000 pound | 12.00 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 1.000 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE: Thursday, February 3, 1994 at 16:51:24

SYSTEM: Annunciators

| Index | Component | Amount |
|---|---|---|
| 69 | Mechanical equipment, <300 pound | 22.00 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 105 | Cascading costs clean fraction, % | 100.00 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 118 | Decontamination requirements <0/1/2/3> | 1.000 |

This system will be externally decontaminated.

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE: Thursday, February 3, 1994 at 16:51:24

SYSTEM: Communication System

| Index | Component | Amount |
|---|---|---|
| 54 | Electrical equipment, <300 pound | 2.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 1.000 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 118 | Decontamination requirements <0/1/2/3> | 1.000 |

This system will be externally decontaminated.

ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE: Thursday, February 3, 1994 at 16:51:24

SYSTEM: Containment Building Penetrations

| Index | Component | Amount |
|---|---|---|
| 17 | Pipe fittings >2 to 4 inches | 19.00 |
| 19 | Pipe fittings >8 to 14 inches | 11.00 |
| 20 | Pipe fittings >14 to 20 inches | 2.000 |
| 69 | Mechanical equipment, <300 pound | 29.00 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE: Thursday, February 3, 1994 at 16:51:24

SYSTEM: Electric Heat Tracing Power

| Index | Component | Amount |
|---|---|---|
| 54 | Electrical equipment, <300 pound | 16.00 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Electrical (Contaminated)

| Index | Component | Amount |
|---|---|---|
| 54 | Electrical equipment, <300 pound | 333.00 |
| 55 | Electrical equipment, 300-1000 pound | 10.00 |
| 57 | Electrical equipment, >10,000 pound | 4.000 |
| 66 | Electrical cable tray, linear foot | 34,522 |
| 67 | Electrical conduit, linear foot | 89,703 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Electrical (Decontaminated)

| Index | Component | Amount |
|---|---|---|
| 66 | Electrical cable tray, linear foot | 9,864 |
| 67 | Electrical conduit, linear foot | 25,629 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 105 | Cascading costs clean fraction, % | 100.00 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 118 | Decontamination requirements <0/1/2/3> | 1.000 |

This system will be externally decontaminated.

ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Feedwater (Contaminated)

| Index | Component | Amount |
|---|---|---|
| 5 | Piping >8 to 14 inches diameter linear foot | 422.00 |
| 25 | Pipe hangers for large bore piping, each | 124.00 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 105 | Cascading costs clean fraction, % | 100.00 |
| 116 | Systemwide average dose rate, mrem per hour | 5.000 |
| 118 | Decontamination requirements <0/1/2/3> | 1.000 |

This system will be externally decontaminated.

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Fire Protection (Contaminated)

| Index | Component | Amount |
|---|---|---|
| 2 | Piping 0.25 to 2 inches diameter linear foot | 601.00 |
| 3 | Piping >2 to 4 inches diameter linear foot | 434.00 |
| 4 | Piping >4 to 8 inches diameter linear foot | 329.00 |
| 5 | Piping >8 to 14 inches diameter linear foot | 105.00 |
| 10 | Valves >2 to 4 inches | 28.00 |
| 11 | Valves >4 to 8 inches | 21.00 |
| 12 | Valves >8 to 14 inches | 7.000 |
| 24 | Pipe hangers for small bore piping, each | 73.00 |
| 25 | Pipe hangers for large bore piping, each | 31.00 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 105 | Cascading costs clean fraction, % | 100.00 |
| 116 | Systemwide average dose rate, mrem per hour | 5.000 |
| 118 | Decontamination requirements <0/1/2/3> | 1.000 |

This system will be externally decontaminated.

ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE: Thursday, February 3, 1994 at 16:51:24

SYSTEM: Fuel Handling System

| Index | Component | Amount |
|---|---|---|
| 2 | Piping 0.25 to 2 inches diameter linear foot | 35.00 |
| 3 | Piping >2 to 4 inches diameter linear foot | 28.00 |
| 4 | Piping >4 to 8 inches diameter linear foot | 13.00 |
| 5 | Piping >8 to 14 inches diameter linear foot | 11.00 |
| 24 | Pipe hangers for small bore piping, each | 4.000 |
| 25 | Pipe hangers for large bore piping, each | 3.000 |
| 54 | Electrical equipment, <300 pound | 2.000 |
| 70 | Mechanical equipment, 300-1000 pound | 16.00 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 5.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE: Thursday, February 3, 1994 at 16:51:24

SYSTEM: Fuel-Reactor Aux Heating-Vent

| Index | Component | Amount |
|---|---|---|
| 2 | Piping 0.25 to 2 inches diameter linear foot | 1,166 |
| 3 | Piping >2 to 4 inches diameter linear foot | 1,685 |
| 10 | Valves >2 to 4 inches | 17.00 |
| 18 | Pipe fittings >4 to 8 inches | 12.00 |
| 24 | Pipe hangers for small bore piping, each1 | 62.00 |
| 26 | Pumps, <300 pound | 1.000 |
| 27 | Pumps, 300-1000 pound | 2.000 |
| 32 | Pump motors, 300-1000 pound | 2.000 |
| 54 | Electrical equipment, <300 pound | 33.00 |
| 76 | HVAC equipment, <300 pound | 132.00 |
| 77 | HVAC equipment, 300-1000 pound | 9.000 |
| 78 | HVAC equipment, 1000-10,000 pound | 4.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 10.00 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: HVAC (Contaminated)

| Index | Component | Amount |
|---|---|---|
| 76 | HVAC equipment, <300 pound | 68.00 |
| 77 | HVAC equipment, 300-1000 pound | 5.000 |
| 82 | HVAC ductwork, pound 339,046 | |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 5.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Hydrogen Recombiners

| Index | Component | Amount |
|---|---|---|
| 72 | Mechanical equipment, >10,000 pound | 2.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: ILRT Instrument Line

| Index | Component | Amount |
|---|---|---|
| 2 | Piping 0.25 to 2 inches diameter linear foot | 12.00 |
| 51 | Tanks, <300 gallons, filters, and ion exchangers | 1.000 |
| 69 | Mechanical equipment, <300 pound | 1.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Instrument & Service Air (Contaminated)

| Index | Component | Amount |
|---|---|---|
| 1 | Instrument and sampling tubing, linear foot | 4,175 |
| 2 | Piping 0.25 to 2 inches diameter linear foot | 2,072 |
| 3 | Piping >2 to 4 inches diameter linear foot | 2,992 |
| 10 | Valves >2 to 4 inches | 12.00 |
| 24 | Pipe hangers for small bore piping, each | 287.00 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 5.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Lighting Panel Power Supply (Contam)

| Index | Component | Amount |
|---|---|---|
| 54 | Electrical equipment, <300 pound | 2.000 |
| 55 | Electrical equipment, 300-1000 pound | 38.00 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 1.000 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Misc Components (Contaminated)

| Index | Component | Amount |
|---|---|---|
| 10 | Valves >2 to 4 inches | 7.000 |
| 11 | Valves >4 to 8 inches | 5.000 |
| 22 | Pipe fittings >36 inches | 1.000 |
| 26 | Pumps, <300 pound | 10.00 |
| 39 | Heat exchanger <3000 pound | 6.000 |
| 51 | Tanks, <300 gallons, filters, and ion exchangers | 7.000 |
| 69 | Mechanical equipment, <300 pound | 29.00 |
| 70 | Mechanical equipment, 300-1000 pound | 1.000 |
| 72 | Mechanical equipment, >10,000 pound | 1.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Misc. Reactor Coolant

| Index | Component | Amount |
|---|---|---|
| 24 | Pipe hangers for small bore piping, each | 97.00 |
| 25 | Pipe hangers for large bore piping, each | 145.00 |
| 26 | Pumps, <300 pound | 3.000 |
| 39 | Heat exchanger <3000 pound | 8.000 |
| 51 | Tanks, <300 gallons, filters, and ion exchangers | 6.000 |
| 53 | Tanks, >3000 gallons, square foot surface | 861.00 |
| 54 | Electrical equipment, <300 pound | 7.000 |
| 69 | Mechanical equipment, <300 pound | 6.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 50.00 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Nuclear Instrumentation

| Index | Component | Amount |
|---|---|---|
| 54 | Electrical equipment, <300 pound | 18.00 |
| 69 | Mechanical equipment, <300 pound | 3.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 10.00 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Oily Waste & Storm Drains (Contaminated)

| Index | Component | Amount |
|---|---|---|
| 6 | Piping >14 to 20 inches diameter linear foot | 510.00 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 1.000 |
| 116 | Systemwide average dose rate, mrem per hour | 2.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Primary Containment Heating & Vent

| Index | Component | Amount |
|---|---|---|
| 2 | Piping 0.25 to 2 inches diameter linear foot | 3,130 |
| 3 | Piping >2 to 4 inches diameter linear foot | 1,564 |
| 4 | Piping >4 to 8 inches diameter linear foot | 2,260 |
| 8 | Piping >36 inches diameter linear foot | 695.00 |
| 10 | Valves >2 to 4 inches | 9.000 |
| 11 | Valves >4 to 8 inches | 13.00 |
| 15 | Valves >36 inches | 4.000 |
| 24 | Pipe hangers for small bore piping, each | 367.00 |
| 25 | Pipe hangers for large bore piping, each | 205.00 |
| 26 | Pumps, <300 pound | 2.000 |
| 54 | Electrical equipment, <300 pound | 36.00 |
| 69 | Mechanical equipment, <300 pound | 3.000 |
| 70 | Mechanical equipment, 300-1000 pound | 2.000 |
| 71 | Mechanical equipment, 1000-10,000 pound | 2.000 |
| 72 | Mechanical equipment, >10,000 pound | 2.000 |
| 76 | HVAC equipment, <300 pound | 41.00 |
| 77 | HVAC equipment, 300-1000 pound | 27.00 |
| 78 | HVAC equipment, 1000-10,000 pound | 8.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 10.00 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE: Thursday, February 3, 1994 at 16:51:24

SYSTEM: Primary Make-up Water

| Index | Component | Amount |
|---|---|---|
| 2 | Piping 0.25 to 2 inches diameter linear foot | 1,681 |
| 3 | Piping >2 to 4 inches diameter linear foot | 2,080 |
| 4 | Piping >4 to 8 inches diameter linear foot | 347.00 |
| 10 | Valves >2 to 4 inches | 18.00 |
| 11 | Valves >4 to 8 inches | 3.000 |
| 24 | Pipe hangers for small bore piping, each | 233.00 |
| 27 | Pumps, 300-1000 pound | 4.000 |
| 32 | Pump motors, 300-1000 pound | 4.000 |
| 39 | Heat exchanger <3000 pound | 1.000 |
| 53 | Tanks, >3000 gallons, square foot surface | 14,140 |
| 54 | Electrical equipment, <300 pound | 10.00 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 1.000 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE: Thursday, February 3, 1994 at 16:51:24

SYSTEM: Process Sampling (Contaminated)

| Index | Component | Amount |
|---|---|---|
| 1 | Instrument and sampling tubing, linear foot | 5,636 |
| 2 | Piping 0.25 to 2 inches diameter linear foot | 1,360 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 15.00 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE: Thursday, February 3, 1994 at 16:51:24

SYSTEM: Radiation Monitoring

| Index | Component | Amount |
|---|---|---|
| 26 | Pumps, <300 pound | 6.000 |
| 54 | Electrical equipment, <300 pound | 7.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE: Thursday, February 3, 1994 at 16:51:24

SYSTEM: Reactor Non-Nuclear Instrumentation

| Index | Component | Amount |
|---|---|---|
| 2 | Piping 0.25 to 2 inches diameter linear foot | 624.00 |
| 54 | Electrical equipment, <300 pound | 14.00 |
| 55 | Electrical equipment, 300-1000 pound | 2.000 |
| 69 | Mechanical equipment, <300 pound | 4.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 3.000 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

# ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Reactor Vessel System

| Index | Component | Amount |
|---|---|---|
| 2 | Piping 0.25 to 2 inches diameter linear foot | 66.00 |
| 70 | Mechanical equipment, 300-1000 pound | 7.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 25.00 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Solid Radwaste

| Index | Component | Amount |
|---|---|---|
| 2 | Piping 0.25 to 2 inches diameter linear foot | 115.00 |
| 3 | Piping >2 to 4 inches diameter linear foot | 166.00 |
| 10 | Valves >2 to 4 inches | 6.000 |
| 24 | Pipe hangers for small bore piping, each | 16.00 |
| 26 | Pumps, <300 pound | 5.000 |
| 27 | Pumps, 300-1000 pound | 1.000 |
| 32 | Pump motors, 300-1000 pound | 1.000 |
| 53 | Tanks, >3000 gallons, square foot surface | 281.00 |
| 54 | Electrical equipment, <300 pound | 1.000 |
| 69 | Mechanical equipment, <300 pound | 6.000 |
| 71 | Mechanical equipment, 1000-10,000 pound | 1.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 35.00 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |
| 118 | Decontamination requirements <0/1/2/3> | 2.000 |

This system will be internally decontaminated.

ATTACHMENT III

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Spent Fuel Pool

| Index | Component | Amount |
|---|---|---|
| 2 | Piping 0.25 to 2 inches diameter linear foot | 342.00 |
| 3 | Piping >2 to 4 inches diameter linear foot | 274.00 |
| 4 | Piping >4 to 8 inches diameter linear foot | 128.00 |
| 5 | Piping >8 to 14 inches diameter linear foot | 111.00 |
| 24 | Pipe hangers for small bore piping, each | 39.00 |
| 25 | Pipe hangers for large bore piping, each | 33.00 |
| 51 | Tanks, <300 gallons, filters, and ion exchangers | 1.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 2.000 |
| 116 | Systemwide average dose rate, mrem per hour | 15.00 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |

PLANT NAME: Trojan Nuclear Plant
UTILITY NAME: Portland General Electric
DATE:Thursday, February 3, 1994 at 16:51:24

SYSTEM: Turbine Bldg Sump Pumps & Miscellaneous

| Index | Component | Amount |
|---|---|---|
| 2 | Piping 0.25 to 2 inches diameter linear foot | 110.00 |
| 26 | Pumps, <300 pound | 5.000 |
| 39 | Heat exchanger <3000 pound | 2.000 |
| 51 | Tanks, <300 gallons, filters, and ion exchangers | 1.000 |
| 54 | Electrical equipment, <300 pound | 19.00 |
| 55 | Electrical equipment, 300-1000 pound | 2.000 |
| 77 | HVAC equipment, 300-1000 pound | 1.000 |
| 102 | Unit cost factor group <1/2/3/4/5/6> | 1 000 |
| 116 | Systemwide average dose rate, mrem per hour | 10.00 |
| 117 | System disposition status <0/1> (only 0 or 1) | 1.000 |