Enclosure 7

REVIEW OF COST ANALYSIS* CONTAINED IN VALUE IMPACT ANALYSIS FOR REVISION 2 OF REGULATORY GUIDE 1.99

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* See next page!

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ADDENDUM TO ENCLOSURE 7:

"REVIEW OF COST ANALYSIS CONTAINED IN
VALUE IMPACT ANALYSIS FOR
REVISION 2 OF REGULATORY GUIDE 1.99"

This review provides comments on the September 1984 draft version of PNL's "Proposed Revision 2 of Regulatory Guide 1.99 Value Impact Analysis." The reader should be alerted that subsequent revisions, as reflected in PNL's current version of the value impact analysis (Enclosure 6 of this regulatory package), have negated a number of the specific comments contained in this report.

However, issues we view as still being relevant are:

1. PNL's failure to use reactor specific replacement energy costs, and

2. PNL's failure to include savings in replacement energy costs from those plants having start-up and shut-down times which will be positively impacted.

REGULATORY GUIDE 1.99 REVISION 2

Purpose:

This report is in response to a request from the Materials Engineering Branch, Division of Engineering Technology, RES to review the cost analysis contained in Regulatory Guide 1.99 Revision 2 Value Impact Analysis prepared by the Battelle-Pacific Northwest Laboratory (PNL).

Background:

PNL's analysis concludes that the costs associated with adopting revision 2 of Regulatory guide 1.99 far outweigh the benefits, and that the proposed revision should not be implemented. This value impact analysis is dominated by an estimate of industry operating costs which attempts to capture the replacement energy cost penalty resulting from incremental reactor downtime due to the requirements of revision 2. Because other impacts are basically at the "noise" level relative to this consideration, our review focuses predominately on this cost estimate. Additional comments, of a more minor nature, are also provided on several of the other costs estimates presented in the PNL analysis.

Industry Operating Costs:

Industry operating costs dominate the overall value impact analysis. The contractor derives a cost of about $180 million by assuming that 86 reactors will experience incremental downtime of between 1 to 2 hours during each reactor's startup. This estimate is based on an average daily replacement energy cost penalty of $300,000 per reactor, an average of 6 startups per reactor per year, and an average remaining lifetime for reactors of 25 years. Our review indicates that the resulting cost estimate is flawed in two respects. In addition, a procedure is readily available that could significantly refine the estimate; a procedure we believe to be warranted given its dominance on the overall value impact equation.

A - The current estimate captures costs that will occur over the next 25 years, and for a large subset of impacted reactors (45) where construction is still on-going, impacts will be experienced well beyond

the 25 year timeframe. In either case, the cost is clearly future oriented yet no discounting has been performed. Use of a 10% real discount rate, as is applied to other dollar costs included in the value impact analysis, would effectively reduce the industry operating cost of $180 million by approximately a factor of three.

B - The CAG notes that if revision 2 is adopted, 10 operating reactors would benefit (See Table 1, page 1.1 of Value Impact Analysis). This benefit is manifested in a decrease in P-T limits down the temperature scale. If this in turn results in a reduction in startup time without any incremental risk of vessel fracture then a quantified benefit is realized, i.e., part of the replacement energy currently required during startup for these ten reactors could be effectively reduced. This savings should be deducted from the cost attributed to the 86 ratcheted plants to produce a net industry operating cost that is somewhat less than the current estimate.

C - Although $300,000 per day is probably a reasonable representation of a daily replacement energy cost, it must be noted that significant variation exists between reactors. For example, a recent study completed for the CAG (Replacement Energy Costs for Nuclear Electricity-Generating Units in The United States -- NUREG/CR-4012) estimates replacement energy costs varying by reactor from less than $10,000 per day to in excess of $900,000 per day. Depending on the actual reactors impacted by this regulatory change, a significant difference in the bottom line estimate could result. Given the importance of this cost on the overall value impact analysis, a more in depth, case specific, analysis of this cost may be warranted. For example if you could identify the impacted reactors, the CAG could provide you with a more precise measurement of the replacement energy cost penalty based on reactor specific cost estimates. In addition, we could provide this in a present worth context to make it consistent with the 10% discount rate used in evaluating all the other future dollar impacts already included in the value impact analysis.

Offsite (Public) Property

PNL's best estimate and upper bound for avoided offsite property damage are $3.3E+4, and $3.6E+5 respectively. Our interpretation of the methodology employed by PNL to obtain these results is to multiply the estimate of offsite property damage (V), by the change in failure probability per transient (W), by the number of impacted reactors (X), by the number of transients per year (Y), by the present worth discount factor (Z). Applying this logic, we obtain estimates that are approximately one order of magnitude greater than those appearing in the contractor's report.

Best Estimate = (V)·(W)·(X)·(Y)·(Z) = $1.7E+9 X 4.1E-8 X 86 X 6 X 9 =

$3.2E+5

Upper Bound = (V)·(W)·(X)·(Y)·(Z) = $9.2E+9 X 8.2E-8 X 86 X 6 X 9 =

$3.5E+6

In addition, we note that PNL's estimate of offsite property damage (V) is obtained from Strip (Estimates of the Financial Consequences of Nuclear Power Reactor Accidents - NUREG/CR-2723), and therefore these dollar values are expressed in 1980 dollars. Strip's estimates should be adjusted by the GNP implicit price deflator to express these avoided costs in 1984 dollars.

Onsite Property:

Given the level of detail provided in the contractor's report, the CAG was unable to verify the methodology or final estimates being offered by PNL with respect to its estimate of avoided onsite property damage. However, there is some concern on our part that the analysis may contain two errors. First it appears that PNL adopts a present worth discount factor (multiplier) of 5.8 to

capture the present value of a cost stream spread over a 10 year period. However, in addition to capturing the distribution over a 10 year period, one must also account for the fact that the 10 year stream could commence any time over the remaining 25 year period. This phenomenon adds significantly to the multiplier. For example, in Strip, the multiplier used to capture a 10 year cost stream over a 32 year remaining life at 4% discount rate was 149. Given that PNL's analysis is predicated on a 10% discount rate and 10 year cost streams over a 25 year remaining life the multiplier should be 58 instead of 5.8. Second, CAG's attempt to replicate PNL's values of \$3.5 E+4 and \$1.1 E+5 for the value of avoided offsite property damage suggests that even the 5.8 multiplier was omitted from their calculations.

Editorial Comments and Error Identification:

P 2.1 Second paragraph, third line should be "Temperature" not "Temperture"

P 6.5 Table 4: The total core melt frequencies are presented as the sum of the frequencies of the individual release categories. However, the PWR upper bound estimate for the total core melt (6.8E-8) is not equal to the sum of the release categories (8.3E-8). It is not possible to determine if the error occurred in one of the addends or in the sum. If the sum or total core melt frequency of the PWR upper bound estimate is incorrect, there are resulting errors in tables 6, 7, 8, 9, and 10 as well as in the Summary of Value-Impact Assessment Table on page 7.1.

P 6.7 Equation: $D_{TOA} = NTD_{OA} = F\ (D_{IO} + D_{LTO})$ is not correct given the variable definitions provided on that page and is not consistent with the results contained in Table 8.

P. 6.10 Table 10: Headings "Offsite Property Damage" and "Value of Avoided Offsite Property Damage" should both read "Onsite".

P. 6.11 First equation: (2 hours lost time) ($300,000/day) = $2.5E+4 needs to be restated with a conversion factor of (1 day/24 hours) so that the units are correct and the consistent answer may be calculated.

P. 7. 1 First paragraph, last sentence: "the cost of one man-rem avoided is estimated to be in the $80,000 - $90,000 range." Should be "...in the $80,000 - $100,000 range." Using the data from the "Summary of Value - Impact Assessment" Table, the "Best - Estimate" Cost is 1.8E+8/1.81E+3 or $99,000.