APPENDIX C

TECHNICAL BASIS FOR OCCUPATIONAL RADIATION SAFETY SIGNIFICANCE DETERMINATION PROCESS

1 ALARA

Section 1101.(b) of 10 CFR Part 20 states that licensees "shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses that are as low as is reasonably achievable (ALARA)." The Statements of Consideration (SOC) published with this regulation (*Federal Register*, Volume 56, dated May 21, 1991, at 23367) expressed the Commission's continued emphasis on the importance of the ALARA concept to an adequate radiation protection program. However, the SOC clarifies that "compliance with this requirement will be judged on whether the licensee has incorporated measures to track and, if necessary, to reduce exposures and not whether exposures and doses represent an absolute minimum or whether the licensee has used all possible methods to reduce exposures." While admitting that this is subjective criteria, the SOC goes on to state the expectation that the "level of effort expended [with regard to ALARA measures] should reflect the magnitude of the potential exposures...."

Reactor licensees currently have mature ALARA programs to plan significant work, estimate the resulting collective dose, and make the determination as to what dose reducing radiological and engineering controls are reasonably achievable. Consistent with the above regulatory basis, the NRC inspections verify the reasonableness of the licensee's ALARA program. The effectiveness of the ALARA program is assessed on a work activity-by-work activity basis. The actual dose outcome of a work activity is compared to the planned, intended dose for that work activity. A mismatch between the planned, intended dose and the actual dose experienced in completing a work activity is an indication of a possible program weakness or failure. In addition, the SDP employs dose criteria to represent "magnitudes of exposure" that reflect differences in the level of effort that is reasonably expected to be applied by the licensee with regard to ALARA measures. These dose criteria have been selected, based on regulatory experience and typical industry practices, solely to judge the relative significance of ALARA concerns as they relate to the regulatory requirement for an ALARA program. The dose criteria should not be construed to imply a staff position or regulatory guidance beyond their application within the context of the SDP and the reactor oversight process.

For the purpose of this cornerstone, unplanned, unintended occupational collective dose is the total sum of the occupational radiation doses (collective dose) received by individuals for a work activity in excess of that collective dose planned or intended (i.e., that dose the licensee determined was ALARA) for that work activity. A work activity is one or more closely related tasks that the licensee has identified as a unit of work for the purpose of ALARA planning and work controls. Planned, or intended, collective dose can be the results of a realistic dose estimates (or projection) established during ALARA planning or the dose expected by the licensee (i.e., historically achievable) for the reasonable exposure control measures specified in ALARA procedures/planning. These do not include "stretch goals" set by a licensee to challenge their organization to strive for excellence in ALARA performance. Collective dose associated with reasonably unexpected changes in the scope of work, material conditions, or radiological conditions, during a work activity (and for which measures are implemented to track, and if necessary, to reduce these doses) should also be considered intended dose.

Situations where the unplanned, unintended collective dose for a work activity does not exceed 50% of the planned, intended dose, should normally be considered as minor issues and screened out from SDP consideration (see IMC 0612, "Power Reactor Inspection Reports," for a discussion of the screening process). This criterion reflects a reasonable

expectation of the accuracy for the licensee's ability to predict the collective dose resulting from a work activity during ALARA planning. In addition, failures that exceed this 50% criterion for work activities where the actual total collective dose is less than 5 person-rem should also generally be considered as minor. However, situations where the licensee has arbitrarily divided the radiological work into very small "work activities" for the purpose of avoiding inspection findings (i.e., tolerate weaknesses in the program that result in several or wide-spread failures to plan and control exposures), should be considered more than minor.

The 5 person-rem criterion represents a level of actual dose associated with a work activity at which it is reasonably expected that the licensee will, at a minimum, apply measures to review and plan work, track dose and, if practical, to reduce exposures. Reactor licensees generally conduct formal ALARA planning and controls at levels below this (typically, one person-rem). The 5 person-rem dose criterion should not be taken to represent a level of collective dose that is "risk-significant." However, failure to plan or control work activities at this level is a possible indication of a more significant weakness in the ALARA program, and could reasonably be viewed as a precursor to a more significant failure. Thus, a failure to "establish, maintain, or implement procedures or engineering controls, intended to achieve occupational doses that are ALARA, and that resulted in unplanned, unintended occupational collective dose for a work activity" with an actual dose in excess of 5 person-rem will be evaluated as a finding, subject to whether the actual dose also exceeded the planned, intended dose by more than 50%.

The first decision gate, in the ALARA branch of the SDP, evaluates the significance of the inspection finding in terms of the licensee's overall ALARA performance (e.g., the three-year rolling average collective dose). Inspection findings associated with an ALARA program that have an average collective dose below the criteria are assessed at no greater than Green. The criteria in the SDP represents the median industry three-year rolling average collective doses (as reported at the initiation of the revised ROP). Several factors can impact a particular licensee's standing with respect to the collective dose criteria. In some cases (i.e., overall plant design, or significant plant modifications such as steam generator replacement) these factors may be independent of the ALARA program performance. However, the three-year rolling average collective dose is a high level indication of the radiological challenges the program faces. The SDP is intended to direct NRC inspection resources to those programs with the largest challenges. This criteria should not be interpreted as a de-facto definition of ALARA for occupational radiation exposures. Nor, as stated above, should a Green finding be interpreted as acceptable. It does mean that the significance of the finding is determined not to warrant further NRC oversight.

The 25 person-rem criterion in the SDP represents a level of actual dose associated with a work activity at which it is reasonably expected that there will be review and oversight by licensee management to confirm the adequacy of ALARA measures that are being applied. Accordingly, a "failure to establish, maintain, or implement procedures or engineering controls…" at this level of dose is deemed to be of relatively greater significance with regard to the regulatory basis of the SDP. Therefore, an ALARA concern that involves a work activity with actual dose greater than 25 rem will be evaluated as a White finding within the SDP.

If the actual collective job dose associated with the finding was not greater than 25 person-rem, and if there were four or fewer such occurrences in the assessment period, then the ALARA finding is Green. If there have been five or more such occurrences in the assessment period, then the finding is White. By its nature, collective dose is the sum of individual work activity doses. The aggregate impact on the licensee's overall collective dose from five, 5 person-rem work activities is the same as one, 25 person-rem activity. This White finding reflects program performance, and an associated aggregate impact, where prior licensee management intervention is expected.

2 Exposure Control

With the exception of shallow dose limit from discrete radioactive particles, the failure to control exposures to an individual, resulting in an occupational dose in excess of the 10 CFR 20 dose limits, is at least a Yellow finding. Occurrences that result in dose(s) in excess of five times the 10 CFR 20 occupational dose limits are designated as Red findings. An exposure attributable to a discrete radioactive particle which exceeds the shallow dose limit in 10 CFR 20, is assessed as a White finding. An exposure to a discrete radioactive particle that results in exceeding five times the shallow dose limit in 10 CFR 20, is assessed as a Yellow finding.

Breakdowns in the Radiation Protection Program, or unintended exposures, that do not exceed a dose limit can still be considered significant if they constitute a "Substantial Potential for Overexposure". A substantial potential, consistent with the current Enforcement Manual (NUREG/BR-0195, subsection 8.4.1), is an occurrence in which a minor alteration of the circumstances would have resulted in a violation of Part 20 limits and it was only fortuitous that the altered circumstances did not occur. In the SDP, the finding involving a substantial potential for overexposure can result in a White or Yellow finding depending on the dose rates (e.g., risk of a serious outcome) associated with the failure. In a Very High Radiation Area of 500 rads/hr, it can take as little as 3 minutes for a worker to receive 25 rem. Note that the Enforcement Process (and possible civil penalty) will not engage unless the event involved an "actual consequence" (in this case an actual overexposure). The Assessment Process, rather than the Enforcement Process, will determine further licensee and NRC action for events that do not result in "actual consequences."

The last decision gate in the Exposure Control Findings portion of the Occupational Radiation Safety SDP is intended to sort out significant issues and findings related to plant equipment and facilities. The Assessment Program is a risk informed process, and radiation dose is the measure of health risk associated with licensee activities. Therefore, this gate focuses on those issues that could or do compromise the licensee’s ability to assess dose. Since this gate culls out White findings, it is intended that only significant, programmatic, failures of radiation monitoring and personnel dosimetry trip this gate. Examples of findings intended to be addressed by this gate include; (1) the licensee's failure to use a National Voluntary Laboratory Accreditation Program certified dosimeter processor, (2) a generic and uncorrected failure of the electronic dosimeters to respond to, or record, radiation dose, and (3) improper calibration of instruments or monitors (thereby significantly biasing their response) which are used as a basis for establishing protective controls. An individual failure to survey or monitor should be considered a failure of a radiation safety barrier and should be evaluated for its potential for unintended dose or substantial potential for overexposure, as discussed above.