Appendix C

OCCUPATIONAL RADIATION SAFETY
SIGNIFICANCE DETERMINATION PROCESS

I. General

The objective of this cornerstone is to ensure worker health and safety from exposure to radiation from licensed or unlicenced radioactive materials during routine operations of civilian nuclear reactors. The health and safety of workers is assured by maintaining their doses within the limits in 10 CFR 20 and as low as is reasonably achievable (ALARA).

Section 1101 of 10 CFR Part 20 requires that each licensee develop, document, and implement a radiation protection program sufficient to ensure compliance with Part 20 and for keeping occupational radiation doses ALARA. Performance in this cornerstone is assessed by considering licensee reported performance indicators (PI) in combination with inspection findings. A baseline inspection is maintained to verify the accuracy and completeness of the PI data (i.e., work control in radiologically significant areas), supplement the PI data in areas where the PI alone is not sufficient to measure performance (i.e., problem identification and resolution), and complement the PI data with inspection findings of performance for areas not covered by the PI (i.e., ALARA planning and controls, radiation monitoring instrumentation, and personnel dosimetry).

The Significance Determination Process (SDP) is the mechanism in which the significance of individual events (follow-up of an operational occurrence, substantiated allegation, or other inspection finding) can be normalized and combined with the PI results to arrive at an overall cornerstone performance assessment. Logic flow charts are provided below to outline the process. A finding that gets through the process (flow chart) without tripping a decision "gate", or one whose significance is determined to be low, ends up as a GREEN finding. This does not mean that the performance on this individual finding is good, or even acceptable. The issue may be a non-conformance or a violation of a regulatory requirement. It does mean that the safety significance of the event is not large enough to warrant further NRC intervention. Licensees are still required to come into conformance with the regulations and their regulatory commitments. However, the licensees are given the latitude to self correct these non-conformances.

II. 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 work activities. Formal ALARA reviews that estimate the resulting collective dose, and make the determination as to what dose reducing radiological and engineering controls are reasonably achievable are generally performed on work activities that exceed one person-rem collective dose. 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 reasonably grouped together as a unit of work for the purpose of ALARA planning and work controls. In determining a reasonable grouping of radiological work, factors such as historical precedence, industry norms, and special circumstances should be considered. Planned, or intended, collective dose can be the result 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 Appendix B and Appendix E to MC 0612 (formerly 0610*) for additional guidance on 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 be considered as 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 has an average collective dose below the criteria are assessed at no greater than GREEN. The 135 person-rem/unit and 240 person-rem/unit criteria in the SDP represents the median industry three-year rolling average collective doses (for the years 1995 through 1997) for PWRs and BWRs, respectively. 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 within a calender year, then the ALARA finding is GREEN. If there have been more than four such occurrences within a calender year, 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.

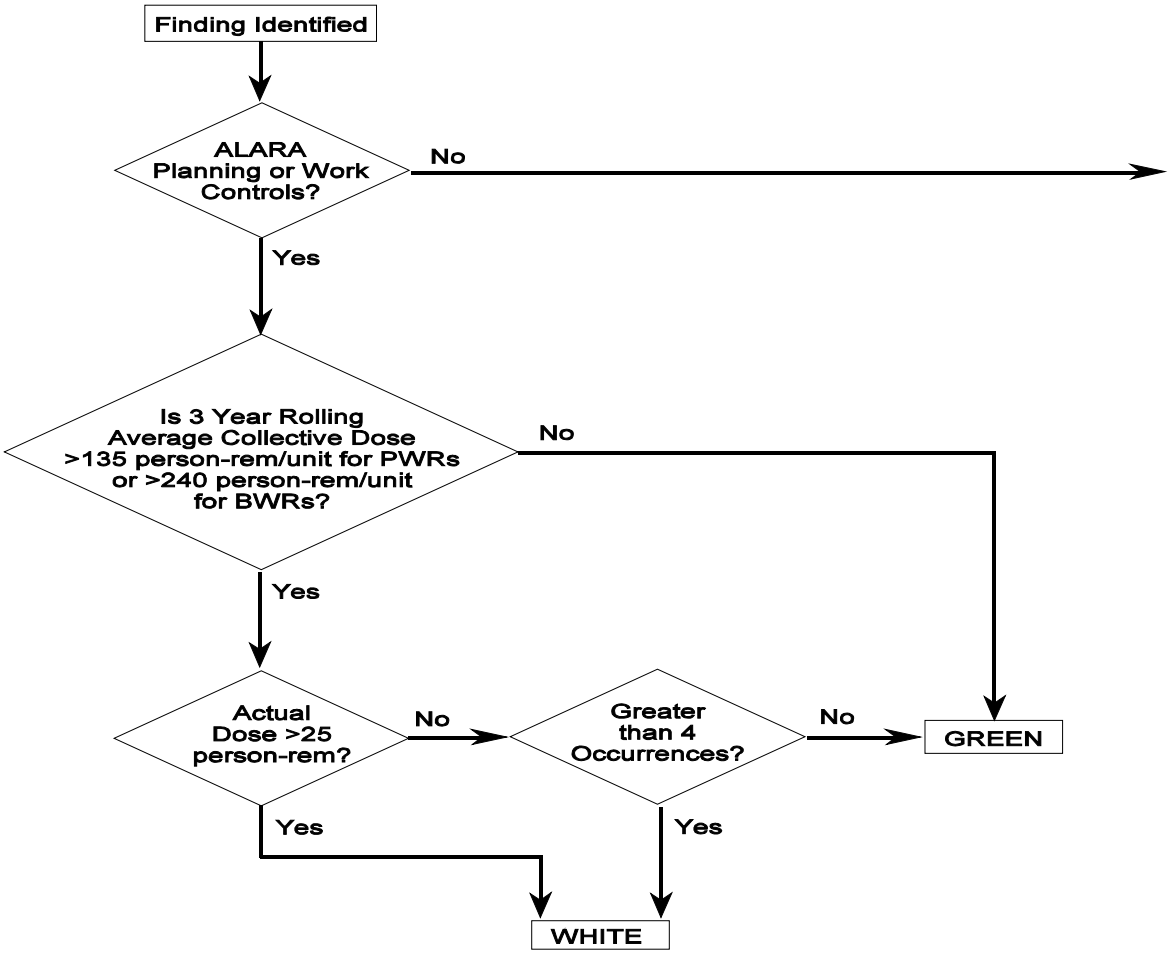
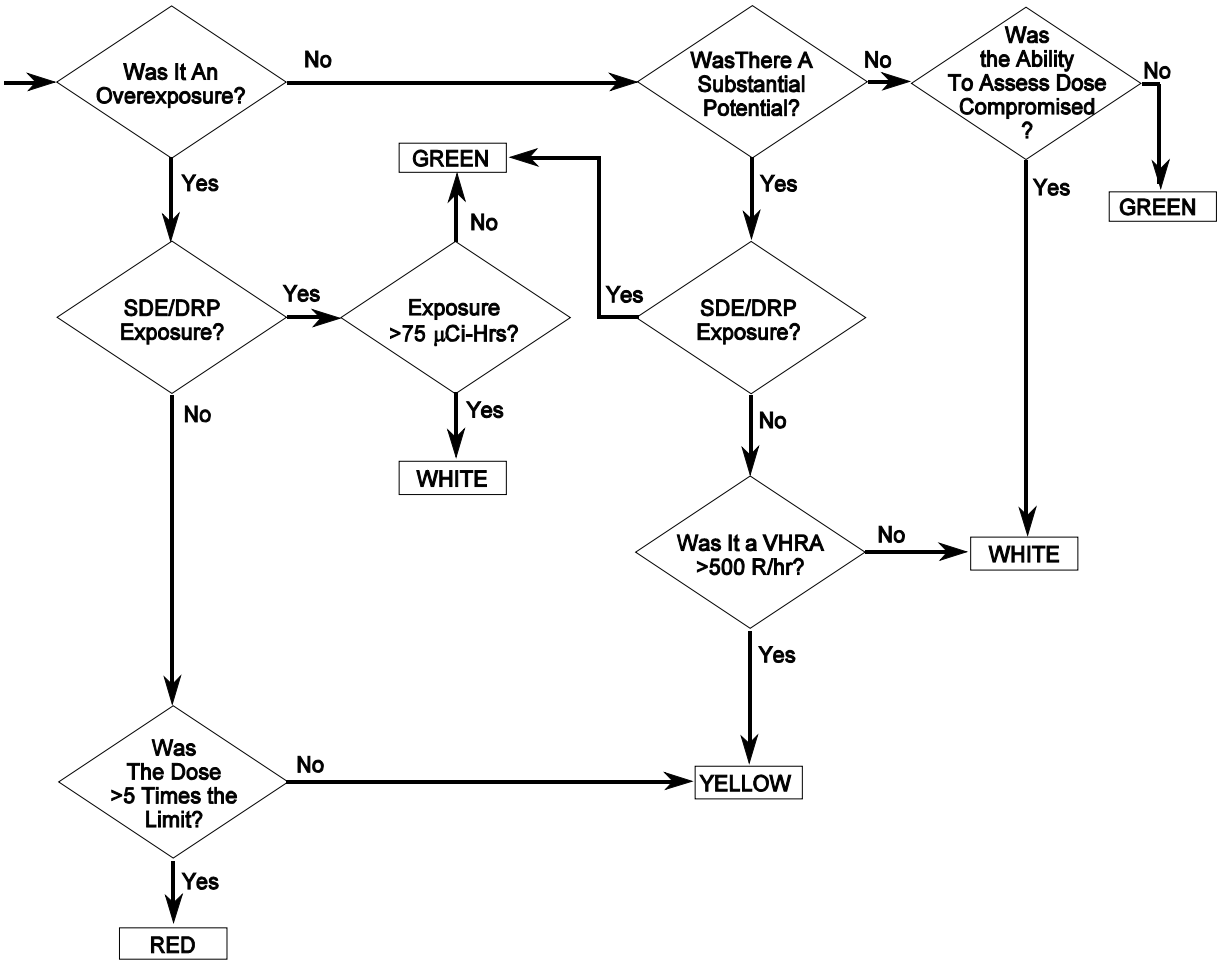
III. EXPOSURE CONTROL

With the exception of shallow dose limits from discrete radioactive particles (DRP), the failure to control radiation exposures to an individual resulting in a dose in excess of the 10 CFR 20 dose limits is at least a YELLOW finding. An exposure attributable to a DRP which exceeds the Enforcement Discretion of 75 μCi-hrs (as discussed in subsection 8.4.2 of the current Enforcement Manual (NUREG/BR-0195)) is assessed as a WHITE finding. Occurrences that result in dose(s) in excess of five (5) times the 10 CFR 20 dose limits are designated as RED findings.

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 NVLAP certified dosimeter processor, 2) a generic and uncorrected failure of the electronic dosimeters (EDs) 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.

Occupational Radiation Safety SDP



Occupational Radiation Safety SDP