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MEMORANDUM TO: Larry W. Camper, Chief
Decommissioning Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards

FROM: William R. Ott, Acting Branch
Radiation Protection, Environmental Risk
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Division of Systems Analysis and Regulatory Effectiveness
Office of Nuclear Regulatory Research

SUBJECT: E600 SURVEY METER IMPLEMENTATION

The NRC's Office of Nuclear Regulatory Research (RES) has reviewed the limited information provided by NMSS, with regard to using an E600 survey meter with an alarm configuration in lieu of the surveyor's decision process in identifying elevated areas of contamination, otherwise known as "hot spots."

The fundamental question being asked is whether a digital alarm can be used to replace an analog rate meter. The answer is "yes."

The second question is whether the licensee has provided an adequate description of, and defense for, the use of an alarm system for scanning surveys to identify hot spots for their specific example and site. The answer is "no."

The Maine Yankee Atomic Power Station (MYAPS) procedure states that "The E600 calculates an average count rate 5 times every second. The average count rate is based on the last five 200-msec values." This is defined as a moving average, not an exponential smoothing average as implied by the memorandum, dated April 28, 2002, from Scott M. Rogers of Thermo Eberline to Jean Claude Dehmel of the NRC's Office of Nuclear Material Safety and Safeguards (NMSS). In addition, the licensee has not adequately presented the exact protocol of the E600 algorithm nor provided an adequate validation and verification test to provide assurance that the instrument and algorithm performs as the licensee perceives.

The third question is whether the probability of Type I error (α) can be divided as described, and still provide an adequate detector response. The answer is "yes." And from a practical point of view this will give a conservative result if the physical survey process remains constant and within appropriate quality assurance parameters for this specific case.

Enclosure

Dan Lurie (OCFO/DPBA) reviewed the Statistical Analysis System (SAS) attachments to MYAPS white paper titled "Affect of Soil Scan Survey Alarm Verification Procedure on Type 1 Error Rate and MDC," June 12, 2002. His review raised the following questions and comments:

(1) Why is exponential smoothing preferred over a moving average? The problem with exponential smoothing is that it is influenced, to some degree, by early readings. The smoothing, therefore, dilutes the immediate effect of a local hot spot. Of course, even a moving average dilutes such readings, but the effect of a moving average is not as pronounced as the effect of exponential smoothing.

(2) Why do we bother to average at all? A local hot spot needs attention. The probability of sounding the alarm is lower with averaging or smoothing, and may not deliver the advertised protection against false negatives.

(3) How is the weighing factor selected in the SAS algorithm? Clearly, a large weighing factor reduces the sensitivity to hot spots. What is MYAPS' intention for using a weighing factor in actual implementation, and will it provide the required assurance?

Dan also had some misgivings about the SAS routine appended to the white paper. At best, the routine verifies that the exponential smoothing is calculated correctly for the given case examples structured by MYAPS. However, ***this is not a proof.***

MYAPS calculates the joint event (alarm sound in each of two stages) by multiplying the individual probabilities. This multiplication is incorrect unless the two events (alarm 1 and alarm 2) are independent. However, because the two events are positively correlated, these calculations are conservative and deemed acceptable. This means that if contamination is identified during the first pass, you are very likely to confirm it during the second pass.

The SAS routine series does not simulate the "real picture," as it is a single-stage process. A two-stage simulation that accounts for different scan speeds and distances should be used to show that $\alpha = 0.05$ still holds.

The fourth question is: Can a numerical value of 1 be used for the surveyor efficiency? The answer is "no." Inherent in the surveyor efficiency term, are other parameters that affect its value other than the surveyors ability to hear a counting rate change which was based upon a Poisson statistical observer. These include the consistency of the speed and distance of the survey probe from the surface being measured and the objectivity of the surveyor. Based upon the currently available information in "Human Performance in Radiological Survey Scanning," NUREG-6364, it is recommend that a maximum value of .75 can be assigned to the surveyor efficiency parameter when an automated alarm system is used. However, it would be preferred if the detector and surveyor were calibrated as a unit.

Finally, it will be acceptable to use the proposed survey method to locate and flag potentially contaminated areas, using the E600. Providing that the alarm setpoints are established using an appropriate set of data quality objectives (DQDs) that are documented, defensible, and maintained for the specific survey to be conducted.

This assessment was carried out by Dr. George Powers of the RPERWMB staff with the assistance of others as noted above. If you have any questions please contact Dr. Powers at 415-6212 (e-mail GEP@NRC.GOV).

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