CRITICALITY ALARM SYSTEMS

PROGRAM APPLICABILITY: 2600

Note that criticality accident alarm systems are addressed in 10 CFR 70.24 and 10 CFR 76.89 which contain slightly different requirements. The regulations and license should be consulted for requirements applicable to a specific regulatee.

88017-01 INSPECTION OBJECTIVE

The regulatee establishes and maintains a criticality alarm system that will reliably detect the minimum criticality accident of concern in the monitored area and promptly cause an evacuation signal resulting in a prompt and complete evacuation of the facility.

88017-02 INSPECTION REQUIREMENTS

02.01 System Requirements.

a. Determine whether the regulatee's criticality accident alarm system complies with applicable NRC regulations and license commitments.

b. Determine whether the regulatee has a complete description of the system, components, installation, and logic, and whether response is available in the form of facility or vendor documentation.

02.02 Sensitivity. Determine that the criticality alarm system will adequately detect the minimum accident of concern in the most conservative location.

02.03 Response.

a. Determine whether evacuation will be signaled promptly upon detection of an accident.

b. Determine whether alarm set points can inadvertently be altered.

02.04 Audibility. Determine whether the alarm signal annunciated in the facility is loud enough to cause an evacuation by employees in the affected area but is not so loud as to cause hearing damage to employees close to the annunciator.

02.05 Reliability.

a. Determine whether the detector/monitor system is adequately reliable.

b. Determine whether the alarm annunciators are adequately reliable.

02.06 Emergency Plan. Determine whether the regulatee has a documented emergency plan for criticality alarm evacuations.

88017-03 INSPECTION GUIDANCE

03.01 System Requirements.

a. The regulatee should maintain sufficient documentation to demonstrate that the criticality alarm system is capable, available and reliable to monitor fissile material operations, detect the minimum accident of concern, and generate an adequate evacuation signal. Criticality alarm systems should have adequate detector coverage to detect the minimum criticality accident of concern as demonstrated by sufficiently bounding and conservative assumptions and calculations.

b. Criticality alarm system design features should include adequate detector coverage of areas, adequate electronic logic before sounding the alarm, audio alarms and, as necessary due to noise levels, visual alarms. System surveillance should be provided to warn of detector failure and secondary emergency power should be provided. Coverage may be based on 10 CFR 70 and 76, American National Standards Institute/American Nuclear Society (ANSI/ANS) 8.3, "Criticality Accident Alarm System," or NRC Regulatory Guide 8.12, “Criticality Accident Alarm Systems.”

03.02 Sensitivity. Alarm set points should cause an alarm when radiation levels exceed regulatory limits.

a. The trip point should be set low enough to detect the minimum accident of concern.

b. The alarm trip point should be set high enough to minimize the probability of an alarm from sources other than criticality.

c. The trip point should be set to minimize false alarms.

d. The alarm trip point should account for normal or operational background at the monitoring point.

e. Minimal transients should be considered in the selection of radiation detectors.

03.03 Response.

a. Evaluation should demonstrate that the minimum accident of concern in the most conservative location will result in a radiation field at the detector sufficient to exceed the detector threshold.

1. Detector response to a radiation field above the established threshold should occur quickly enough to cause evacuation before significant radiation exposure occurs.

2. The system should be designed to produce the criticality alarm signal within one-half second of activation by the minimum accident of concern.

b. Access to the alarm set points should be controlled by written procedures to prevent inadvertent modification of the set points.

03.04 Audibility. The alarm system should be for immediate evacuation purposes only and of sufficient volume and coverage to be heard in areas that are to be evacuated.

a. A sufficient number of audio generators should be installed to provide complete facility coverage with an appropriate evacuation signal.

b. The audio generators should produce an overall sound pressure level of at least 75dB, but not less than 10dB above the maximum ambient noise level typical of each area for which audio coverage is to be provided.

c. Because excessive noise levels can be injurious to personnel, the audio generators should not produce an overall sound pressure level in excess of 115dB at the ear of an individual.

d. The audio generating system(s) should be automatically actuated by an initiating event without requiring human action although a means for manual actuation of the criticality alarm signal may be provided.

e. After actuation, the audio generators should continue to function as required by emergency procedures, even if the radiation falls below the alarm point. Manual resets with limited access, should be provided outside areas that require evacuation (i.e., emergency operations center).

f. Areas with very high audio background may require that the alarm be supplemented with visual signals.

03.05 Reliability.

a. Review selected areas to determine that the criticality alarm system will remain available and reliable.

1. The system should be designed for high reliability and should utilize components that do not require frequent servicing, such as lubrication or cleaning.

2. The design of the system should be as simple as is consistent with the objectives of ensuring reliable actuation of the criticality alarm signal and avoidance of false alarms.

3. Design and installation of the system should be such as to resist earthquake damage.

4. Components of the system should be located or protected to minimize damage in case of fire, explosion, corrosive atmosphere, or other extreme conditions.

5. The location and spacing of detectors avoids the effect of shielding by massive equipment or materials. Shielding from low density materials or construction, such as wood framing, thin interior walls, hollow brick tiles, etc., may be disregarded.

6. The spacing of detectors should be consistent with the selected alarm trip point and detection criterion.

7. Consideration should be given to the avoidance of false alarms.

8. The system should not produce an evacuation signal due to component failure; however, a visible or audible signal should be provided at some normally occupied location to indicate system malfunction or loss of primary power.

9. The system should be designed to minimize the effects of non-use, deterioration, power surges, and other adverse conditions.

10. Process areas in which activities will continue during power outages should have emergency power supplies for alarm systems, or such activities should be monitored continuously with portable instruments.

b. Failure of audio generators should be detectable. Audio generator redundancy should mean that an annunciator relied on to back up another annunciator will be activated by the same event.

03.06 Emergency Plan. The facility should maintain emergency procedures for each area in which fissile material is handled, used, or stored to ensure that personnel withdraw to an area of safety upon the sounding of the alarm.

88017-04 RESOURCE ESTIMATE

An inspection performed using this inspection procedure is estimated to require 8 hours of inspector resources for Category 1 facilities, 8 hours of inspector resources for gaseous diffusion plants, 4 hours of inspector resources for Category 3 facilities, and 0.5 hours for small critical mass or fuel cycle facilities. This estimate is only for the direct inspection effort and does not include preparation for and documentation of the inspection.

U.S. Code of Federal Regulations, "Domestic Licensing of Special Nuclear Material," Part 70, Title 10, "Energy." §70.24, Criticality Accident Requirements

---"Certification of Gaseous Diffusion Plants," Part 76, Title 10, "Energy." §76.89, Criticality Accident Requirements

U.S. Nuclear Regulatory Commission, “Criticality Accident Alarm Systems,” Regulatory Guide 8.12, October 1988 (withdrawn)

---ANSI/ANS-8.3-1997, "Criticality Accident Alarm System," American Nuclear Society, La Grange Park, IL, August 29, 1997

END

ATTACHMENT 1

Revision History for IP 88017

Commitment Tracking Number	Issue Date	Description of Change	Training Needed	Training Completion Date	Comment Resolution Accession Number
	07/28/06 CN 06-019	IP 88017 has been issued because of the need for a new Inspection Procedure for Criticality Alarm Systems.	None	N/A	ML061780337