

Jeffrey Geuther  
Reactor Manager, Kansas State University  
112 Ward Hall  
Manhattan, KS 66506



Department of Mechanical  
and Nuclear Engineering  
3002 Rathbone Hall  
Manhattan, KS 66506-5205  
785-532-5610  
Fax: 785-532-7057

US Nuclear Regulatory Commission  
ATTN: Document Control Desk  
11555 Rockville Pike  
Rockville, MD 20852

7 October 2010

LICENSE R-88 (KANSAS STATE UNIVERSITY) - PERSONNEL EXPOSURE INCIDENT – SUPPLEMENT TO 10-DAY REPORT

The following list of follow-up actions to a personnel exposure incident on 9/22/10 supplements the required 10-day report that was submitted on 10/1/10. The list provides more detail and additional follow-up actions to those itemized in the required report. Note that the generic term “procedure” as used in this Supplement pertains to operational procedures, experimental procedures, and management orders.

Follow-Up Actions To Be Taken Prior to Restart

The following are planned follow-up actions resulting from the incident on 9/22/10. Most of these actions will be completed prior to reactor restart. Exceptions are noted below.

1. The reactor staff will be trained on the incident. (Completed 10/4/2010). Training included the following topics:
  - a. The details of the incident including actions performed by the operator, ways in which the operator followed and did not follow ALARA principles, and the contribution of the poor use of the Byproduct Log;
  - b. Opportunities for improvement, with emphasis on prompt notification of the Reactor Manager following an accident, ALARA practices (see 1.d), and being critical of Byproduct Log entries;
  - c. The requirements of the revised procedure (detailed in Item 3 below);
  - d. The importance of ALARA practices and safety culture in general, (e.g., maintaining a questioning attitude, ensuring that proper safety equipment is available, working slowly and conservatively), especially in ensuring safe actions are taken when no clear guidance is given in a procedure;
  - e. The importance of checking the Tech Specs for reporting requirements following an unusual event or accident.
  - f. On a go-forward basis, requalification training will emphasize the importance of ALARA principles.

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2. The reactor staff will be required to read a memorandum from the Reactor Manager about safety culture. (Completed 10/1/2010) The memorandum leverages the exposure incident to reinforce issues of safety in a broad sense, and is not targeted at the exposure incident in particular. It discusses:
  - a. The importance of attentiveness while operating;
  - b. The need to follow procedures step by step, and to call management attention to deficiencies in the procedure being followed;
  - c. The importance of working in a conservative manner when no procedural requirement exists;
  - d. The need for personal protective equipment for working with chemicals, working with the crane, etc.;
  - e. The importance of calling others to task and maintaining a questioning attitude;
  - f. The expectation that senior staff members set a positive example for junior staff members;
  - g. The importance of professionalism.
  
3. Each procedure will be reviewed for radiological safety risks and will be revised, if necessary, prior to use. (This will not necessarily preclude reactor operation, provided that each specific procedure is reviewed prior to its use).

The experimental procedure being used during the incident (Experimental Procedure 1) has been re-written with:

- a. Requirements for ring dosimetry;
- b. A two-person rule (i.e., one person to monitor the survey meter while the other person withdraws the samples), with exceptions for certain low-activity irradiations to be granted by the Reactor Supervisor on a case-by-case basis;
- c. Maximum sample withdrawal rates of 10 seconds from the irradiation location to 2 feet below the surface (approximately 1.5 feet per second), and then 1 foot every three seconds thereafter to allow reaction time if a sample is more active than expected;
- d. Requirements for sample holder irradiation testing at low fluence to extrapolate expected dose rate during experiments;
- e. Threshold exposure / dose rates for ceasing sample withdrawal and for preparing shielding on the reactor deck. Specifically, shielding will be prepared for samples exceeding 50 mrad / hr at 30 cm, and samples exceeding 500 mrad / hr at 30 cm shall not be removed from the reactor tank. If future operations require more highly active samples to be handled, engineering controls or procedure modifications will be incorporated prior to such operations.

Experiment Procedure 1 has been approved by the RSC as revised. No specific guidance for the use of a specific sample holder is given in the revised procedure, but the experimenter will know the expected activity of the sample holders (item 3.d), and will need to plan the experiment to avoid reaching dose rates that prohibit withdrawal (item 3.e).

The Reactor Safeguards Committee will need to approve any procedures which are revised during this process. Approval of a new procedure shall be followed by staff training on the changes instituted by the new procedure. The procedure review will consider whether the safety bases for the procedures are adequate and reflect the current conditions (i.e., license power level, beam port configurations, etc.) of the reactor, and will include necessary updates.

All procedure changes will be reviewed per 10CFR-50.59 to ensure that the following changes to the SAR analysis will not result from the procedure change:

- i. More than minimal increase in the frequency of occurrence of an accident evaluated in the SAR;
  - ii. More than minimal increase in the likelihood of malfunction of a structure, system, or component (SSC) important to safety;
  - iii. More than a minimal increase in the consequences of an accident analyzed in the SAR;
  - iv. More than a minimal increase in the consequences of the malfunction of an SSC important to safety;
  - v. Create the possibility of an accident of a different type than any previously evaluated in the SAR;
  - vi. Create the possibility of malfunction of an SSC important to safety with a different result than any previously evaluated in the SAR;
  - vii. Result in the design basis limit for a fission product barrier being altered or exceeded;
  - viii. Result in a departure from a method of evaluation described in the SAR.
  - ix. No changes to procedures shall be permitted which degrade facility physical security or emergency preparedness.
- 4) The Reactor Safeguards Committee will meet to determine whether other actions are necessary. (Completed 10/4/10). The Committee had several small changes for the draft of Experiment Procedure 1, but did not have any significant additional requirements beyond what had been suggested by the Reactor Manager.
- 5) The Reactor Safeguards Committee will discuss the event at their next regularly scheduled meeting, which is expected to be held in November or December 2010. Specifically, the Reactor Manager will bring the following topics to the table:
- a) The importance of active and critical oversight of reactor operations, and what additional actions are necessary to catch procedural deficiencies on a go-forward basis;
  - b) The role of the Radiation Safety Officer in connection with the operation of the reactor. The facility Technical Specifications (6.1.b) provide for the possibility of a Reactor Facility Safety Officer to assist the RSO in performing some radiation safety functions at the reactor facility. This option will be considered as a means of increasing radiation safety oversight without increasing the burden on the RSO.
  - c) The Reactor Manager will propose review of select procedures on a rolling basis as part of the annual Reactor Safeguards Committee audit of reactor operations and records required per TS 6.2.7.
  - d) The Reactor Manager will propose a minimum of three non-nuclear faculty members needed to constitute a quorum at RSC meetings, to ensure that the interest of academic progress does not take precedence over concern for the safety of the reactor when reviewing or approving proposed actions or procedures. This proposed requirement is not intended to mean that such conflict occurred in the past, but rather identifies the potential for such a conflict and its possible effect on reactor safety.
  - e) The Reactor Safeguards Committee will be trained on commonly-used reactor facility experimental procedures, operational procedures, and conduct of operations over the course of several meetings. The procedures discussed in training will be chosen based on frequency of use, use in upcoming scheduled experiments, and time since last being reviewed.
  - f) The Reactor Safeguards Committee currently does not use a specific list of guidelines for reviewing new procedures. The Reactor Manager will recommend a list of general guidelines for

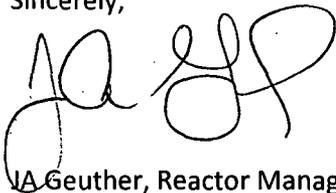
procedure review to avoid approving procedures that can allow unsafe situations. The following list of guidelines is given as an example of what will be considered:

- i) Does the procedure prescribe appropriate PPE, shielding, and dosimetry?
- ii) Does the procedure require the right number of participants for its complexity?
- iii) Does the procedure provide sufficient guidance for the participants to help them keep radiation dose ALARA?
- iv) Can other controls be added to the procedure, without significantly increasing its cost or complexity, to improve its ALARA posture?
- v) Is the procedure clear?
- vi) Does the procedure follow facility and federal requirements?
- vii) Is special training required?
- viii) Are risks identified and discussed in the procedure?
- ix) Does the procedure provide protection against radiation and other hazards both in routine performance and in potential accident scenarios (such as an operator error, equipment malfunction, etc.)?

The actions discussed in item 5 are not considered to be prerequisites to reactor startup.

- 6) The Byproduct Log used in conjunction with Experiment Procedure 1 will be revised for clarity and to provide additional content. It will include separate sections for materials for which dose rates were calculated, and those for which small samples were irradiated in low-fluence tests and dose rates were then measured. The section for measured dose will include a decay time at the time of measurement such that the dose upon the completion of the irradiation can be calculated. Each Byproduct Log entry will be signed and dated by the person who performed the experiment or analysis. The existing Byproduct Log entries will be removed, and will be checked and signed by the reviewer prior to re-entry into the Log.
- 7) Reactor operation will be suspended until the facility receives verbal or written feedback from the NRC regarding the proposed recovery actions detailed in this Supplement.
- 8) The staff member who was exposed will be prohibited from receiving significant extremity dose or handling samples until 01 January 2011.

Sincerely,



J. A. Geuther, Reactor Manager