EFCOG Best Practice #89

Best Practice Title: Emergency Preparedness Contributes to Correct Radiological and Medical Response Actions

Facility: Savannah River Site

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Brief Description of Best Practice:
While repackaging TRU waste at the F-Canyon Waste Remediation Facility, a waste remediation technician working in a modified glove enclosure sustained a puncture to the palmar side of his right index finger from a wire survey flag he was inserting into a punctured TRU waste can. The rapid emergency response to this incident constitutes a Best Practice which includes the following:

- Advanced and periodic training of Medical Personnel by The Radiation Emergency Assistance Center/Training Site (**REAC/TS**) out of Oak Ridge. The Medical and Internal Dosimetry staff conduct joint training with REAC/TS every two years. The training includes a day of classroom training and an exercise involving a simulated contaminated patient. This periodic training of Internal Dosimetry and Medical personnel occurred one month prior to incident.
- Initial emergency response actions taken by both the individual and responding radiological control personnel prevented additional contamination and minimized personnel radiological impact.
  - The injured technician remained calm, immediately notified the Radiological Protection Inspector (RPI) and Person in Charge (PIC), and kept his hand in the enclosure gloves until the RPI responded.
  - A new waste bag located near the gloveport was used to receive the punctured hand from the enclosure glove.
  - Localized exhaust (DAC Scoop) was used to assist with contamination control while removing the arm from the enclosure glove.
  - A bag was used to seal the punctured enclosure glove to prevent release of contamination into the room.
  - A survey was taken of the injury location. The RPI conducted a survey of the outer surgical glove and the contamination levels were observed. Another RPI conducted a probe survey of the wound area on the right index finger.
  - A clean rubber surgical glove was placed on the wounded hand and the technician was escorted to the personnel contamination monitor (PCM-1B) where he was monitored twice and cleared both times.
- With the patient’s consent chelation therapy was administered within 83 minutes of the incident. Swift administration of chelation greatly enhances the effectiveness of material removal.
- The site physician performed a tissue punch (3 mm in diameter) approximately 2 hours after the incident to excise tissue from the wound along the projected wound path. The activity level was tested with a hand-held meter. Later analysis of the removed tissue plug indicated that this procedure removed the greatest amount of source material of any of the tissue excisions.

- Upon receipt of the initial urine sample and prior to introduction into the bioassay laboratory process, an aliquot was counted on a Liquid Scintillation Counter (LSC). The results of this screening indicated that the activity in the sample was too great for introduction into the low-level bioassay laboratory processes. An aliquot was diluted and the sample analysis completed. This pre-screen greatly reduced the potential of contamination of the low-level process equipment which may have raised the background to unacceptable levels. Cross contamination of the low level counting equipment in the Bioassay Lab is unacceptable due to the high volume of samples which need to be routinely run.
- Daily Chelation therapy continued for 16 days post intake with Day 2 being the only exception. After, the decision was made to reduce chelation from daily to twice weekly.
- Activity analysis in urine samples was expedited by a rapid screening process which allowed for approximate results to be known within a 24 hour period (as compared to radiochemical analysis in 5-7 days). This rapid screening method has been available at SRS for over a year. The availability of excretion data in such a timely fashion essentially allowed for "real time" evaluation of the chelation efficacy and supported continuation of this mitigation technique.

Why the best practice was used:

- Additional potential contamination of the individual and the Facility was prevented and additional radiological impact to the affected technician was minimized.
- Early chelation therapy greatly enhanced the effectiveness of the material removal.
- Pre-screening of the initial bioassay sample by LSC was used to confirm that the sample was unacceptable for introduction into the laboratory processes and needed to be diluted.

What are the benefits of the best practice:

- Expeditious administration of the chelating agent greatly mitigated the potential dose. Additional therapy has continued to show efficacy of the agent and additional mitigation.
- "Pre-Screening" the bioassay sample using LSC minimized the probability of contamination of the low level analytical systems.
- The use of the "Rapid Analysis" provides essentially "real time" feedback to aid in decisions regarding continuation of the chelation therapy.

What problems/issues were associated with the best practice:

- Radiation Emergency Assistance Center/Training Site (REAC/TS) from Oak Ridge noted that failure to administer the chelating agent on Day 2 resulted in a missed opportunity to remove an additional approximate 0.5 rem Committed Effective Dose (CED). The administration of additional chelation on Day 2 was not performed because staff was awaiting analysis of the initial 24-hour urine sample. The availability of rapid analysis provided support for continuation after the initial collection period and analysis results were available.

- While no evidence was found that treatment of the patient was impacted by the lack of a dedicated location for treatment of contaminated wounds, medical personnel stated that a room dedicated to contaminated wound treatment at the medical facility would enhance overall treatment of patients.
- The Type B Accident Investigation Board determined that instructions given to the technician did not include all of the precautions listed on the pharmaceutical insert regarding the control of bioassay voids to minimize contamination of others. The Board directed the contractor to notify the technician about the precautions included in the “Information for Patients” listed on the package insert for the use of the DTPA (diethylenetriamine-pentaacetate) chelating agent. The precautions give specific guidance on controlling voids to prevent the spread of contamination.

How the success of the Best Practice was measured:

- The expeditious and effective removal of the affected worker from a High Contamination / Airborne Radioactivity Area with no additional contamination supported quick treatment of the wound and administration of the chelating agent.
- The availability of analytical results provided effective feedback to guide additional treatments.
  - Direct measurement of deposited activity using portable instruments.
  - Direct measurement of deposited and residual materials using wound counters.
  - Rapid Analysis of bioassay data (within 24 hours as opposed to previous 5-7 day turnaround).

Description of process experience using the Best Practice:

- Periodic training with REAC/TS reinforces response protocols and identifies areas for improvement.
- Timeliness of data upon which to make recommendations for treatment spawned the identification and certification of a more rapid analytical technique.
- Concern regarding the level of activity in the initial bioassay sample prompted a screening by LSC which identified activity levels that exceeded the introductory limits for the lab.
- Training and preparation of the worker, response personnel, and long-term care staff proved to achieve effectiveness in response and mitigation.
- Open communication with the affected worker and family promoted a high level of trust and confidence which has facilitated continuation of dose mitigation and monitoring activities.