Successfully Increasing DOE-STD-1027 Hazard Category 3 (HC-3) Threshold Quantities (TQs)

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For:
Safety Analysis Working Group 2007

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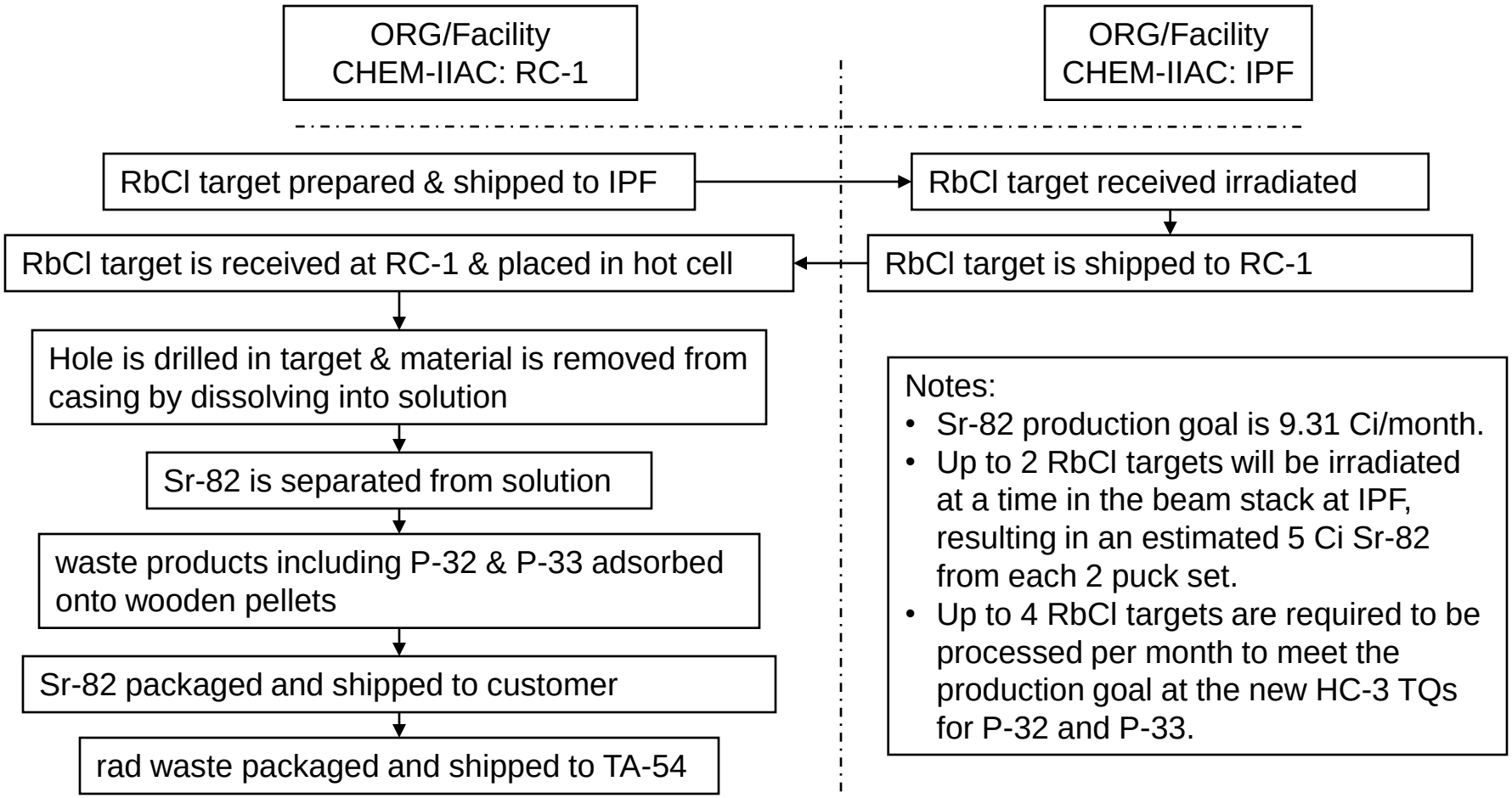
Problem and Solution

- The Problem:
  - Sr-82 production is limited by HC-3 TQ for P-32 (by-product of Sr-82 production).
- Safety Analysis Solution:
  - Prepare a request submission that demonstrably executes the NTSP 2002-2 methodology for increasing HC-3 TQs (and obtain NNSA approval).

Sr-82 Production Background

- Sr-82 is the parent isotope of Rb-82, a positron emitter used in Positron Emission Tomography (PET) studies of cardiac perfusion.
- DOE's Office of Nuclear Energy Science and Technology (DOE-NE) provides Sr-82 to GE Healthcare.
- Current Sr-82 production involves the irradiation of RbCl targets, which leads to production of P-32 and P-33 as byproducts.

Production Process Flowchart (Simplified)



Path of P-32/33 during Sr-82 Recovery from Irradiated RbCl Target

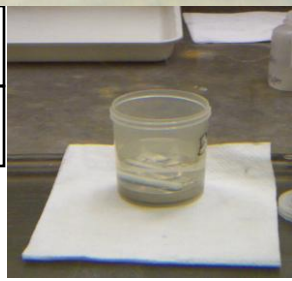
Target Inspection

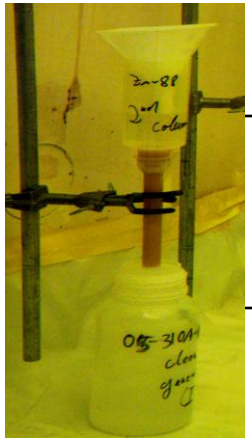
Cleaning target in 0.5 M HCl and H_2O

Puncture RbCl Target prior to Dissolution

RbCl Target Dissolution in 100 mL H_2O

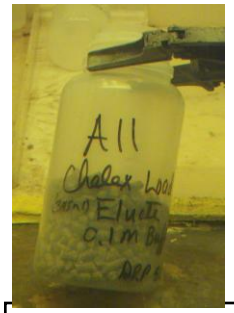
Filter Solution and adjust pH>9





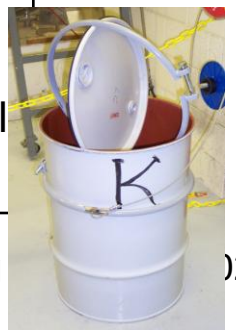
Ion Exchange using Chelex column:

- Sr retained on column
- Rb-isotopes and P in eluate



Preparation for Disposal of Eluate:

- Assay for Rb activity
- Neutralize and solidify on adsorbing material
- Package for immediate disposal at TA-54



Strip Sr using 6 M HCl

Continue Purification

Successfully Increasing [illegible]027 HC-3 TQs

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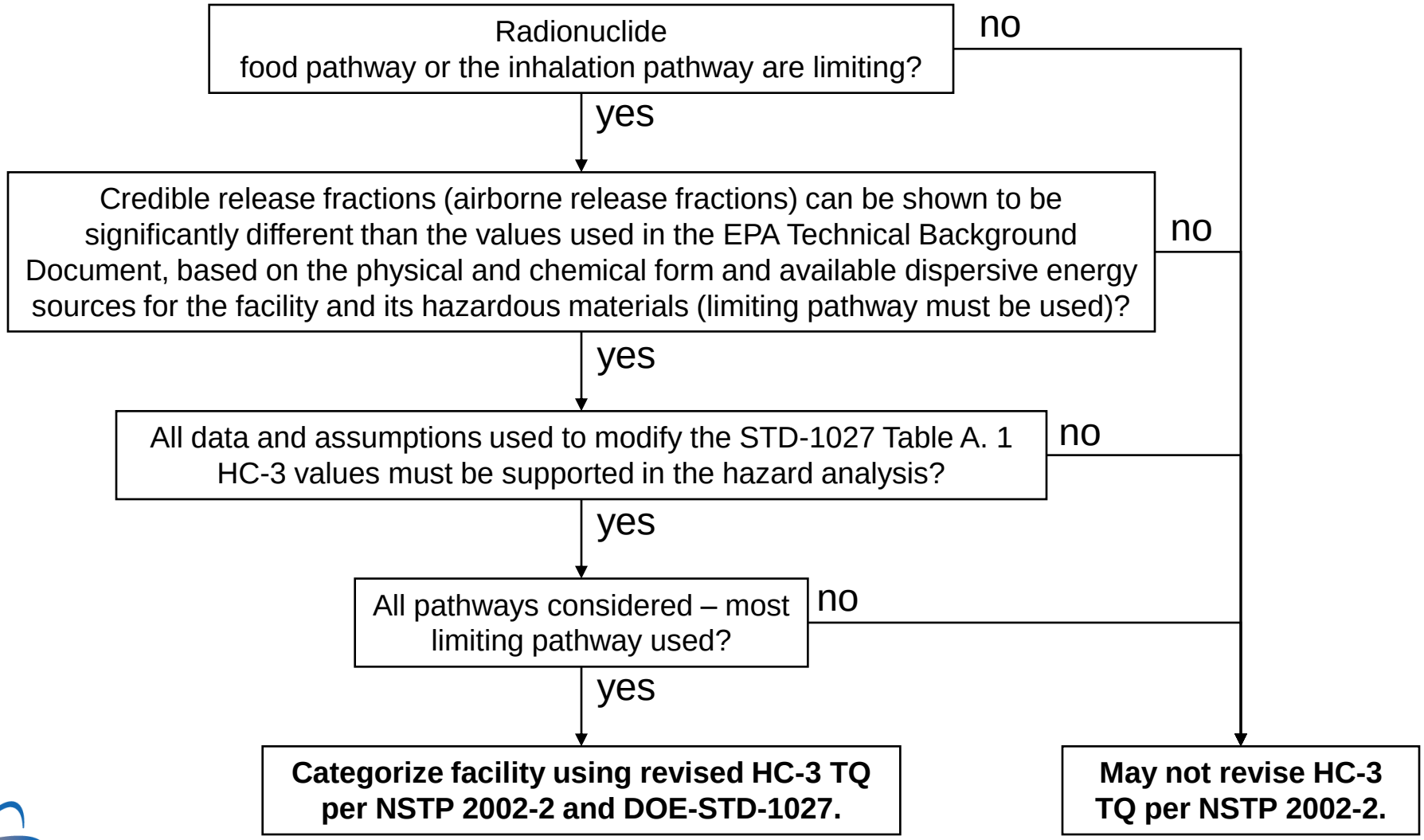
Problem History

- Two previous requests were submitted to NNSA LASO for approval, both of which were disapproved.
- The primary reason given by NNSA LASO for disapproval, was that an adequate unmitigated hazard analysis was not submitted supporting the request to adjust (increase) the HC-3 TQs.

Safety Analysis Solution

- The solution focused on:
  - developing an adequate unmitigated hazard analysis per DOE NSTP 2002-2, and
  - making a very clear and explicit demonstration for complete compliance and adherence to the methodology provided in NSTP 2002-2, Methodology for Final Hazard Categorization for Nuclear Facilities from Category 3 to Radiological.

NSTP 2002-2 Methodology



HA Assumptions

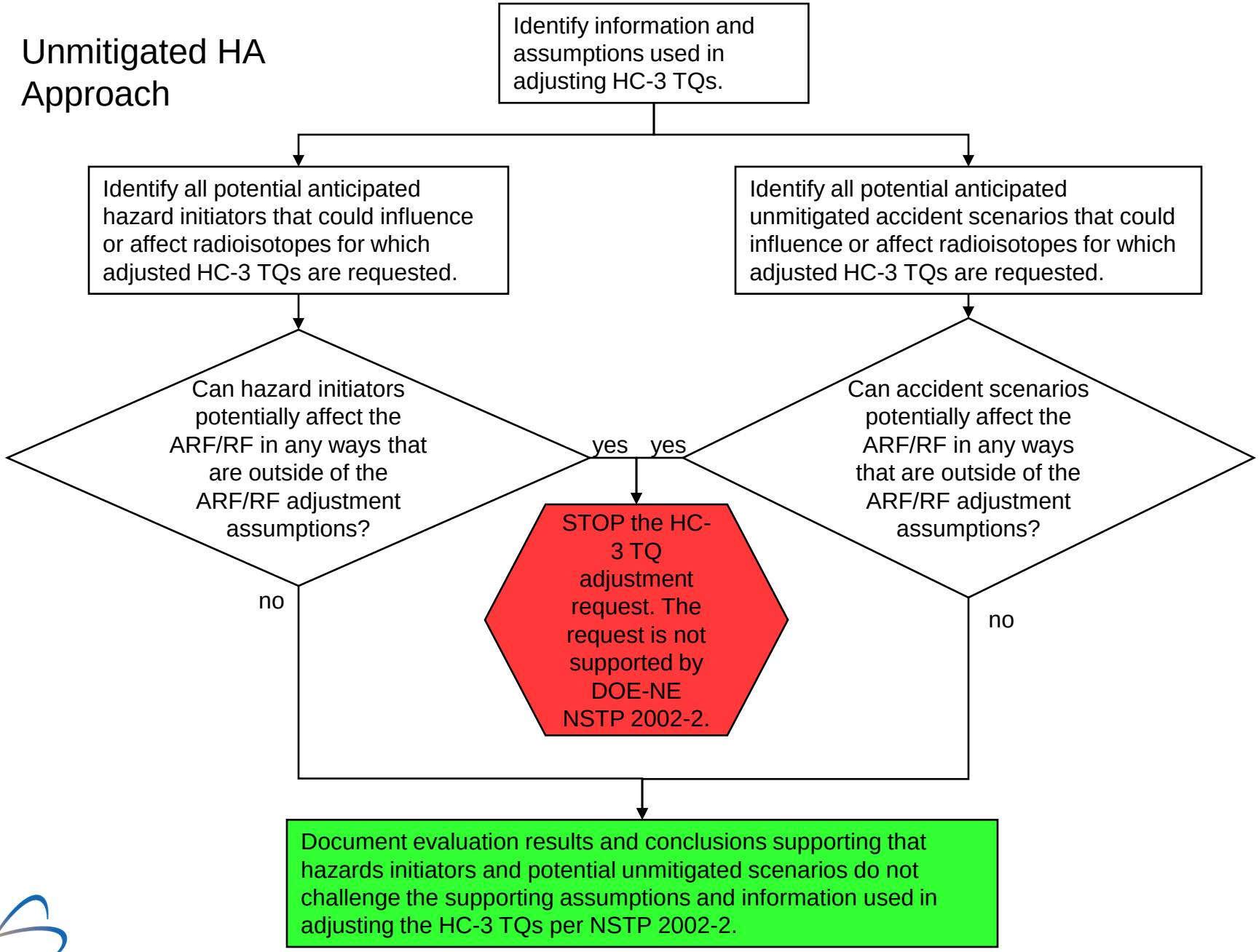
P-32 and P-33 inventory for which the adjusted HC-3 TQ applies, will be in one of the following physical or chemical forms:

- P-32 and P-33 are bound in a solid RbCl crystalline matrix (puck) inside a stainless steel containment (RC-1 and IPF)
- P-32 and P-33 will be in the form of phosphates in a chloride solution in dilute concentrations.
- P-32 and P-33 will be in the form of phosphate anions (PO_4^{3-}) during Sr-82 separation.
- P-32 and P-33 will be converted to hydrogen-phosphate adsorbed on hardwood pellets.

There are no explosive or flammable material sources present in significant quantities that would significantly influence the adjusted HC-3 TQs for P-32 and P-33.

An oxygen-rich environment does not exist in the vicinity of the materials or solutions containing P-32/-33 radionuclides.

Unmitigated HA Approach



Performance of Unmitigated Hazard Analysis

- Unmitigated HA was performed for each facility (IPF and RC-1) per the guidelines from the LANL Safety Analysis Handbook, which included:
  - performing or validating hazard identification
  - developing bounding hazard scenarios relative to the categorization assumptions
  - selecting appropriate ARF/RF values from DOE-HDBK-3010
  - adjusting the HC-3 TQs using the bounding selected ARF/RF for the bounding scenarios

Bounding ARF/RF Results from Unmitigated HA

	IPF	RC-1
Fire Scenario	2.5E-05	1.0E-02 (DOE-HDBK-3010, vol. I, section 5.2.1.2)
Impact Scenario	6E-04	6E-04 (DOE-HDBK-3010, vol. I, section 4.4.3.1.2 – spilled powder)

Groundwater Pathway

- LA-UR-01-2547, Hydrologic Behavior of Unsaturated, Fractured Tuff: Interpretation and Modeling of a Wellbore Injection Test and Implications of Contaminant Transport, was used to analyze for groundwater pathway release.
- The study indicated that it would take 8198 days for contaminates to reach the aquifer.
- Based on relatively short ½ lives of the radionuclides, no radioactive material could cause exposure via groundwater pathway.

Unmitigated HA Conclusions

- The limiting or bounding ARF/RF for RC-1 determined from this analysis is a value of 1E-02, which is associated with the following condition: “burning of surface-contaminated, combustible material” (burning of the wooden pellets contaminated with P-32 and P-33). The limiting or bounding ARF/RF for IPF determined from this analysis is a value of 6E-04, which is associated with the following the assumption that the P-32 and P-33 radioisotopes are not in the “highly volatile/combustible” form, but are in the “solid/powder/liquid” form. The limiting pathway for exposure for consideration, resulting from increasing the HC-3 TQs for P-32 and P-33 by 50 times, becomes groundwater ingestion. This pathway was evaluated and determined to not be of any consequence due to a very long transport time (years) compared with the relatively short half lives of P-32 and P-33 (14 and 25 days respectively).

Project Management

Date	Milestone/Event
4/24/06	SR-OPS (facility management organization) tasked with preparing the final submittal within a short timeline so that increased production could take place for the medical radioisotopes.
5/14/06	60% draft of final HC document released.
6/1/06	LANL management transition occurred.
6/15/07	90% cross-table review meeting held with involved LANL parties.
7/3/06	Final HC request submitted to NNSA for modifying HC-3 TQs.
8/15/06	NNSA approval of HC request received.
9/15/06	Implementation of related safety basis revisions implemented in IPF and RC-1.

Project Management Approach

- *Demonstrated Full Compliance with Approved Methodology*
- *Buy-in and Participation from Involved Parties*
- *Clearly Established and Defined Scope*

Questions?

- Thank you.

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