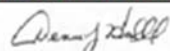


# SRS Puncture Wound Update

**J. Gordon Quillin**

**Radiological Protection Director  
Savannah River Nuclear Solutions, LLC  
October 18, 2011**

**UNCLASSIFIED  
DOES NOT CONTAIN UNCLASSIFIED  
CONTROLLED NUCLEAR INFORMATION**

ADC/RO		Health Physics Services
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(Name/Organization)

DATE: October 13, 2011

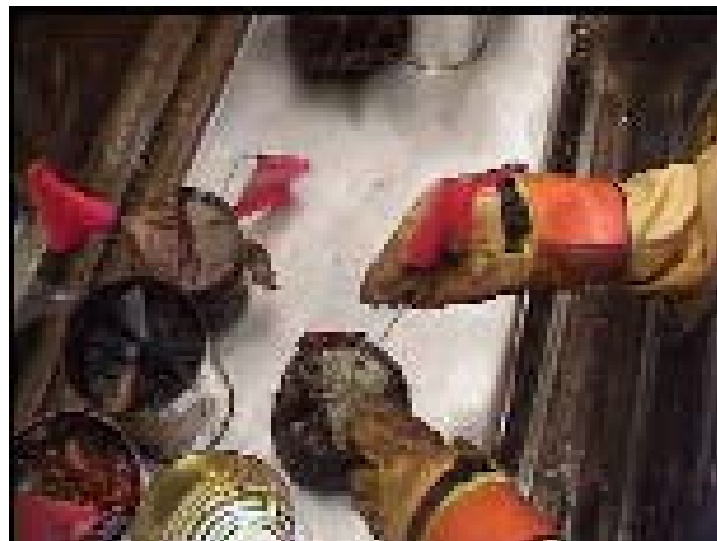
## Event Review

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June 14, 2010 a TRU operator punctured the base of right index finger while placing flag in a container from a TRU drum [ $^{238}\text{Pu}$ ].

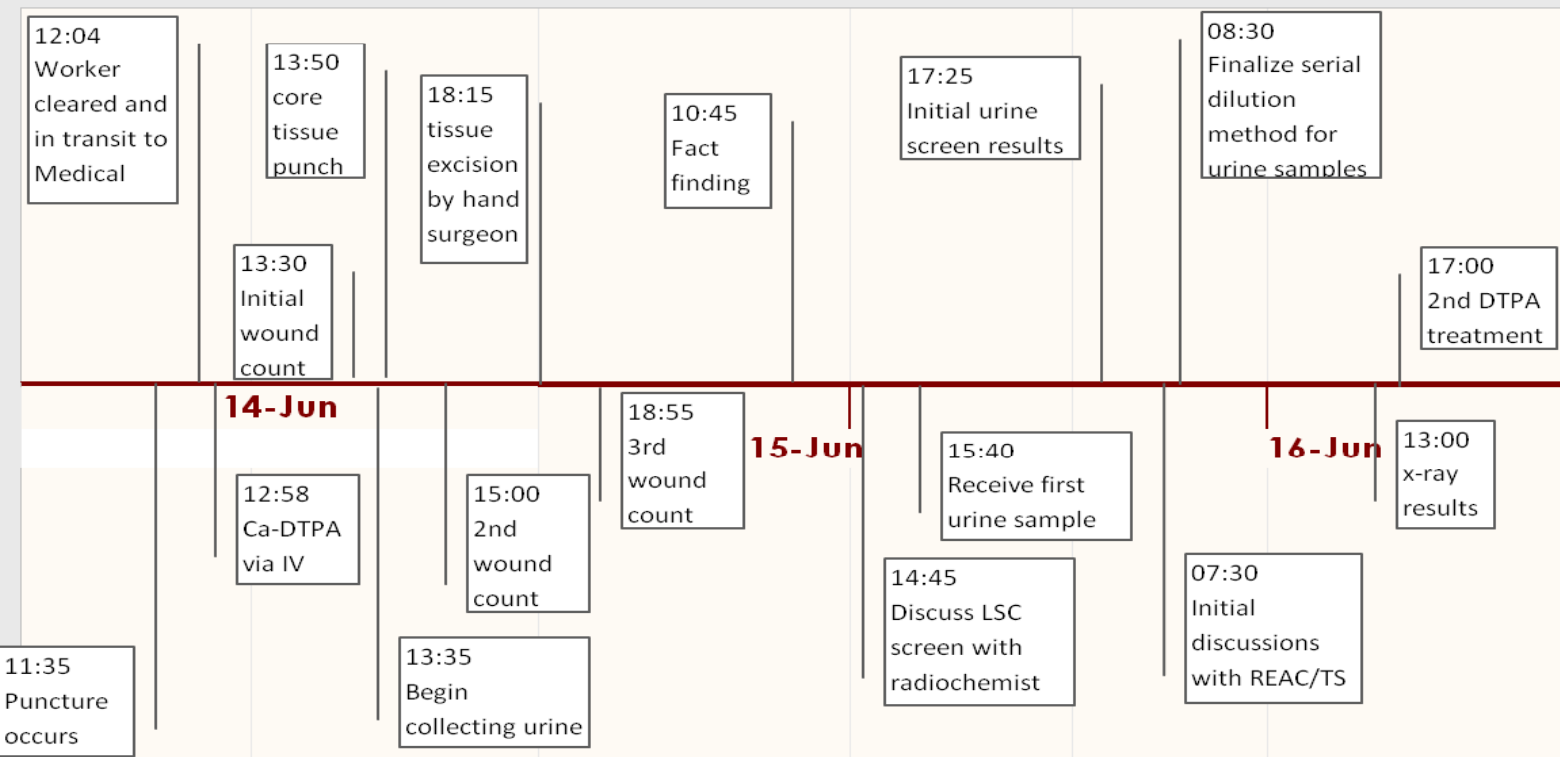
Operator wearing cotton liner, 3 pair surgical gloves, 20 mil glovebox (cabinet) glove, leather lineman glove.

To facilitate the flag placement, the operator bent end of flag 180 degrees upward and pressed flag into hole with the right hand.



# Timeline

## 6.14.10 SRS TRU Puncture Wound Timeline (first 3 days)



# Decorporation Therapy

## 1. Tissue Excision

- 99.75%  $^{238}\text{Pu}$ , 0.25%  $^{241}\text{Am}$  via radiochemical analysis
- Three (3) excisions
- 9.5 nCi total activity removed via tissue excisions

## 2. Chelation Therapy

- 71 DTPA treatments over 317 days
  - All slow IV push (25 g needle used)
  - Ca-DTPA on Day 0, all others Zn-DTPA
  - Daily from Day 0 to Day 16 (except Day 1)
  - Roughly 2X week<sup>-1</sup> for next six months
  - Frequency reduced to roughly 1X week<sup>-1</sup> for following four months
  - Five DTPA treatments performed by personal physician while on “paternity” leave
- DTPA therapy ended when  $^{238}\text{Pu}$  urinary excretion post DTPA treatment “flat-lined” and minimal dose mitigation gains realized.
- Over 25 nCi total activity “removed” via DTPA

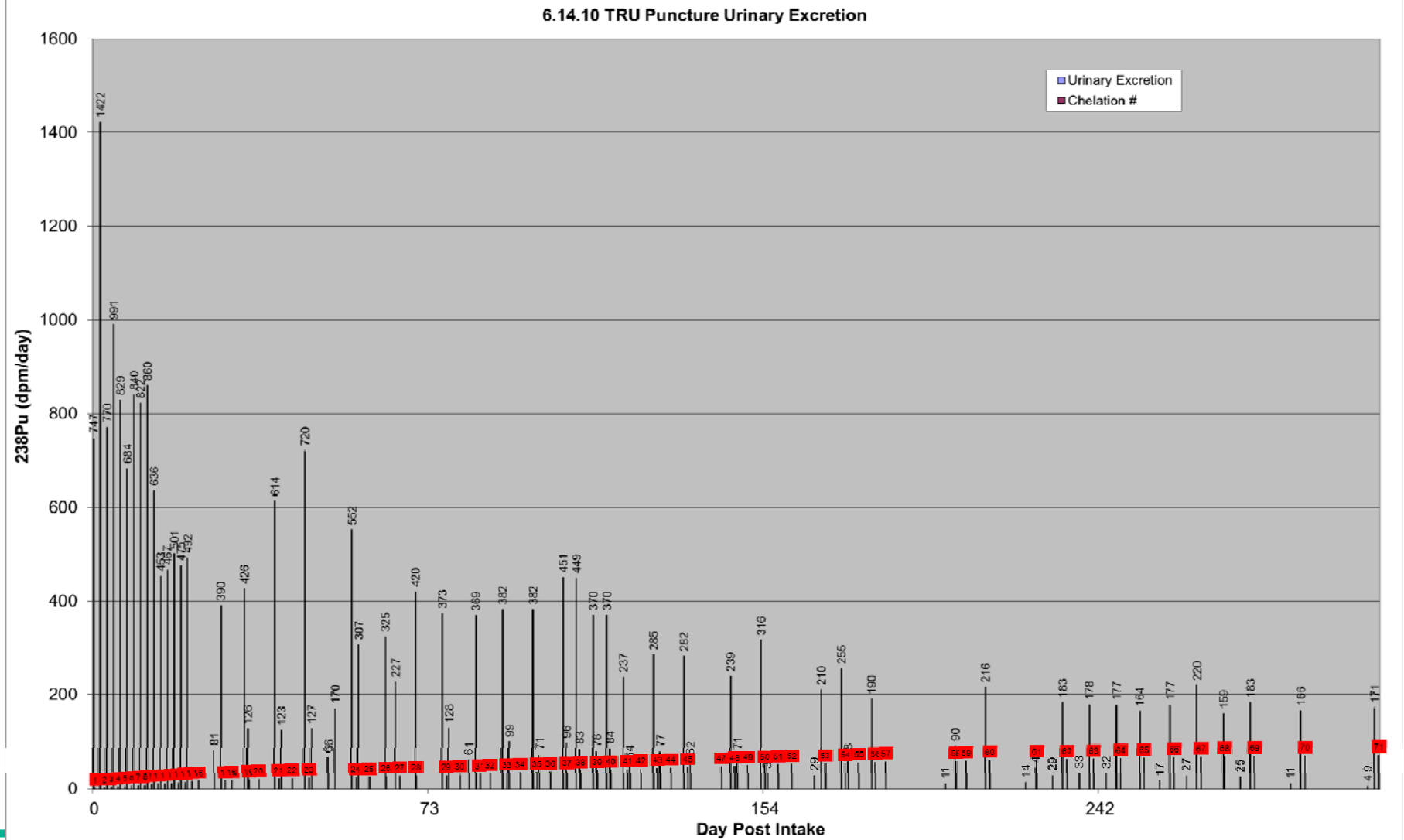


*Wound site post 3 mm tissue punch*



*Wound site post Day 9 tissue excision*

# Timeline of DTPA Treatments and Urine Results



# In-Vivo and In-Vitro Monitoring

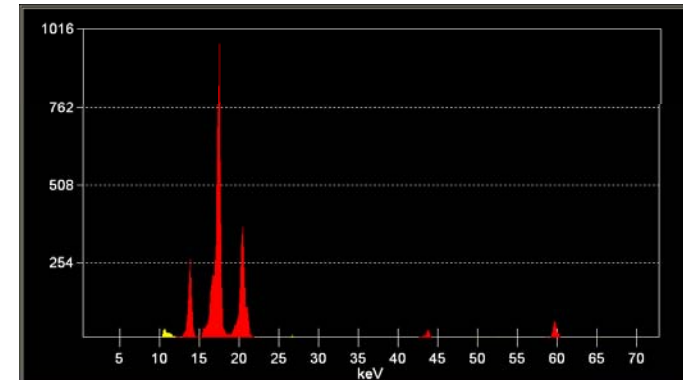
## In-Vivo

- Follow-up *in-vivo* monitoring of:
  - Right supratrochlear (elbow) lymph nodes
  - Right axillary lymph nodes
  - Liver
  - Skull and knee caps
  - Wound site
- 34 wound counts to date
- All counts but wound site counts discontinued because no activity detected.  $^{238}\text{Pu}$  detected only at wound site. (remember  $^{241}\text{Am}$  activity fraction only 0.25%)
- MCNP modeling used for quantification and estimation of deposition depth. Empirically verified.

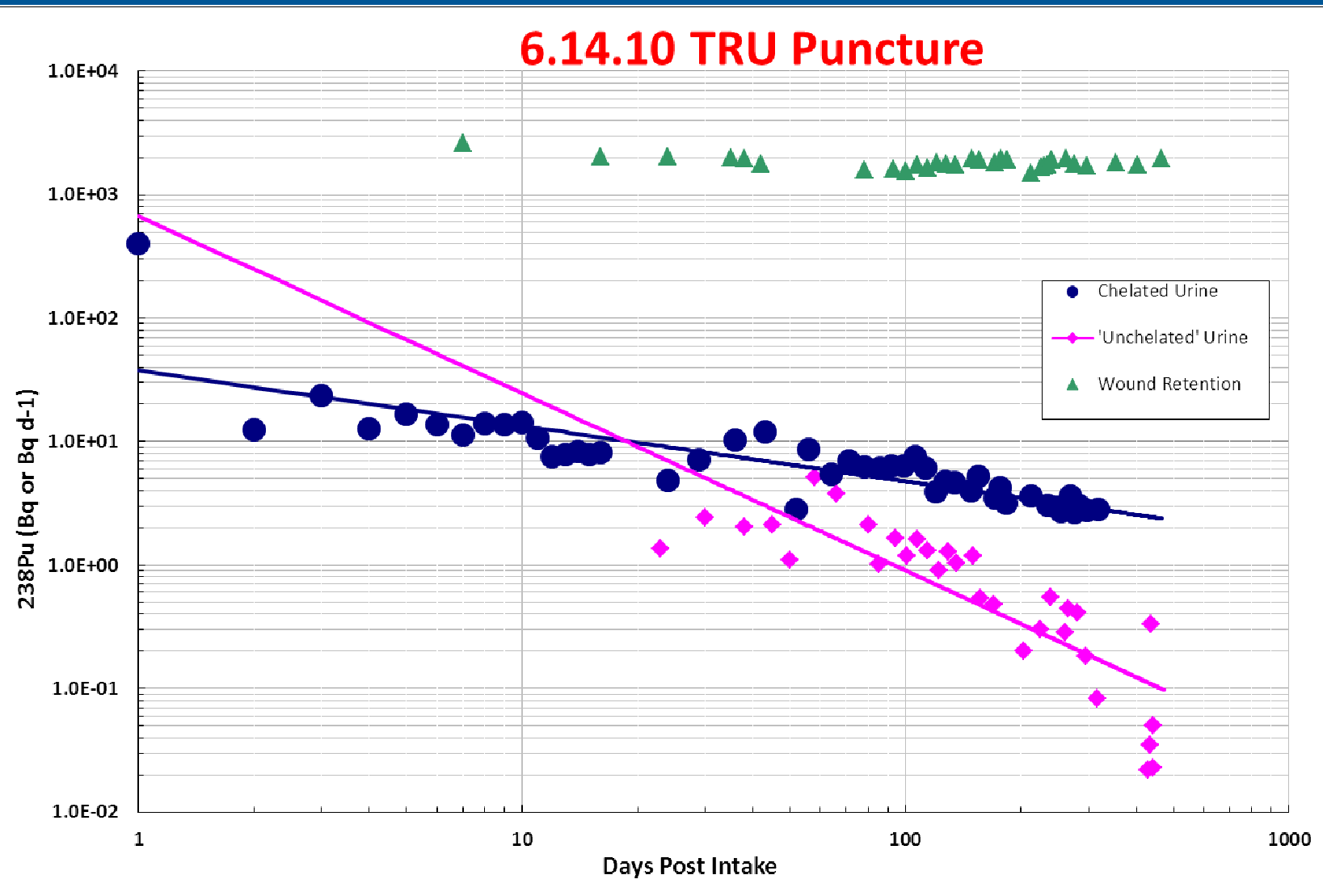


## In-Vitro

- Urine sampling begun in Medical shortly after first DTPA treatment
- 82 true 24 hr. urine samples collected to date
- Fecal voids collected at Day 11 and Day 175 post intake. Increased excretion rate also observed due to DTPA therapy.
- Five (5) urine samples collected after 100 days post last DTPA treatment (April 27<sup>th</sup>). Considered to have no effect from DTPA. Excretion rate for samples consistent (within analytical uncertainty).



# Radiobioassay Trends



## REAC/TS and External Reviews

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- REAC/TS contacted the day after the event. Good working relationship with REAC/TS staff already existed.
- SRS Internal Dosimetry and Medical staffs do biennial training with REAC/TS. Includes contaminated patient exercise. This training had just been completed the month prior to puncture wound.
- REAC/TS contracted to give independent peer review
  - Medical Response & Mitigation (Steve Sugarman)
  - Dosimetry response (Dick Toohey)
- Tom La Bone also brought in due to internal dose assessment and chelation expertise.
- Internal Dosimetrist traveled to Oak Ridge last October to provide update on case to REAC/TS staff. Will need to do final briefing and deliver all radiobioassay and chelation records to REAC/TS.

# Investigations

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- **SRNS**
  - SRNS Independent Investigation – July 2010
  - Fluor Corporate Oversight Investigation – July 2010
- **DOE-SR (Type B) Investigation**
  - Commenced - July 28, 2010
  - Final Report issued - September 1, 2010
- **DOE-Enforcement**
  - Enforcement Conference - April 11, 2011
  - Civil Penalty: \$243,750

# Beneficial Outcomes

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Substantial dose mitigation.

Worker agreed to be part of the REAC/TS radiation accident and DTPA registries.

Urine sample aliquots have been sent to the Centers for Disease Control and Prevention in Atlanta to be used for gaining experience in handling urine samples that contain metabolized chelated plutonium as part of their initiative to generate emergency response analysis protocols for radiation emergency event response.

Excellent wound healing. No loss of motor or sensory functions.

No adverse health effects associated with DTPA therapy or intake.

Affected worker now works 20 minutes from home.



*Healed wound site.*

# Current Status

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Wound retention is stable per wound counts.

Urinary excretion is consistent.

Long-term follow-up monitoring to include semi-annual wound counts and 24 hour urine samples for next year to ensure measured values agree with those predicted by modeled intake. Frequency may be adjusted based on need and worker availability. Long term clearance rate from wound needs to be established. Internal doses may need to be reevaluated based on long-term data.

## Dose Assessment

- External Peer Review
- Dose Assessment Review Board used at SRS to approve dose and ensure proper communications of results

## Results reported

- To worker first
- To SRNS Management & DOE-SR

Support Subsequent Modification to Reports, i.e., ORPS.

# Impact to SRNS

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- **Financial Impacts**
  - \$243,750 fine
  - Contractor support related to the event investigation is non-reimbursable
  - DOE can withhold fee
  - Undefined hidden costs (e.g., corrective actions, re-write of procedures, training, etc.)

# Impact to SRNS (continued)

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- **Operational and Radiological Impacts**
  - Identified as Judgments of Need (JON) in the Type B Investigation Report
    - Key JONs
      - Reinforce compliance with procedures
      - Provide initial dose estimate as soon as possible after intake
      - Ensure preservation of accident scene
      - Ensure rigor of methods in procedures
      - Ensure hazards and controls are identified in work documents
      - Management communications and enforcement of expectations
      - First Line Managers need to establish command and control
      - Improve pre- and post-job reviews
      - Improve engineered controls and PPE
      - Evaluate employee skill mix and experience

# Summary

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- Committed Effective Dose: 31.6 rem
- Committed Equivalent Doses of Interest:
  - Bone Surfaces            1043 rem
  - Liver                        220 rem
  - RBM                         52 rem
  - Gonads                     14 rem
- Estimated dose mitigated through tissue excision and DTPA therapy
  - Tissue Excision: 15.5 rem CED
  - DTPA Therapy: Minimum 41 rem CED (expect to be much higher after more thorough review)

# Questions

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