Hazard Analysis and Criticality "Incredibility"

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Criticality "Incredibility"

- Why do we care?
  - It cost money
  - It affects the safety basis for the facility
  - For DOE facilities, it affects the need for a criticality accident alarm system
  - **BUT** – the concept of "incredibility" does not protect people
- Need to put "incredibility" into perspective of true risk to the worker
  - Then, money could be spent on the "non-trivial" risks to the worker rather than on the "trivial" risks

What you don't know …

- To know the risk, you have to know your operation
- What do we know?
  - "There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. There are things we don't know we don't know."
    – Donald Rumsfeld

What I won't talk about today

- DOE-STD-1027
  - "Nature of Process"
  - "Segmentation"
- Terminology
  - Criticality "not credible" vs "incredible"
- Probability as it pertains to "Incredibility"
  - e.g., Frequency of 10^{-6} /year

What I will talk about

- Where criticality is truly not credible
  - i.e., precluded by physiochemical reasons
- Where criticality is not credible, but has "Facility Level" NCS controls
  - Sequence of events are so numerous or trivial, that facility level controls are only needed to protect "assumptions"
- Where criticality is not credible, but has "Operational" NCS controls
  - Controls that are so robust, they preclude a criticality from occurring

Scenarios by Example – Physiochemcal basis

- Depleted UF_6 Cylinder Yard
  - Known Knowns – Depleted uranium won't achieve criticality in the form contained (solid UF_6)
    - Meets the "physiochemical" criteria
  - Possible Known "Unknowns"
    - How do you know the uranium is depleted?
      - Operational process during filling
      - Sampling during process
      - Tracking and Inventory of cylinders

Scenarios by Example – Facility Level Controls

- TRU-Waste Processing Center, Oak Ridge
  - Known Knowns
    - Facility wide container mass limit – 200 g FEM/container
    - At this limit, criticality not credible
  - Known Unknowns
    - How do you know the mass content in the container?
      - Known inventory to be processed
        - All but a few containers have data indicating less than 200 g FEM inventory
      - Measurement accuracy and errors
      - Additional measurements taken at site
      - Analysis contains significant safety margin to bound "known unknowns"

Scenarios by Example – Operational Level Controls

- Isotek 3019 Facility – Storage of U-233
  - Known Knowns
    - Material in favorable geometry
    - Material in shielded environment
- Handling of U-233
  - Known Knowns
    - Only one container handled at a time
    - Material in shielded environment
    - Singular container subcritical under all credible scenarios

- Processing U-233 Downblended Material
  - Known Knowns
    - End processing does not use favorable geometry
    - Material to be downblended to less than single subcritical limit for “enrichment”
    - Process relies on sampling analysis and an engineered feature to ensure mixing
  - Known Unknowns
    - Potential exists for credible failure to allow for 2% enriched material to be passed to end processing
    - End process still subcritical for 2% enriched material
    - Is it enough to be “criticality incredible” on an admin program?

- Bechtel Jacobs LLC – K-25 Demolition
  - Known Knowns
    - Facility has uranium holdup
  - Known Unknowns
    - There may be significant holdup deposits of enriched uranium in the process equipment
    - Previous analyses of burial sites don't address migration of uranium that is in soluble form
  - Operational NCS Controls
    - Related to characterization of process equipment
    - All disposal limits are based on analyses to bound the known unknowns

Summary

- Knowing what you have and what risk exists are fundamental to establishing “criticality incredible” status
- But remember:
  - “It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so.” – Mark Twain