Assessment of the Need for a Criticality Accident Alarm System

Jim Baker
KAC Nuclear & Criticality Safety Engineering

Savannah River Nuclear Solutions, LLC
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Presentation Outline

• Why does a facility install a CAAS?
• What criteria determine if a CAAS is needed?
• How to approach assessing the need
• A real-world example
• Conclusions
• Questions/Comments
Where Do We Need a CAAS System? And Why?

• **ANSI/ANS-8.3:**
  - Purpose: Reduce risk to personnel
  - Installation implies non-trivial risk of an accident
    - *VERY non-trivial costs*
  - Need shall be evaluated
    - *For significant quantities of fissile material*
    - *Overall risk judgment*
  - But how do we judge the risk?
    - *LA-13638, A Review of Criticality Accidents, 2000 Revision*
Common Attributes of Process Accidents

• Communications, procedures
• Accountability & accumulation
• Vessel geometry, volume
• Operator knowledge
• New, restarted or one-of-a-kind operations
• Equipment malfunction
• Unanticipated movement of material
Observations from Accident History

- 21 of 22 process accidents occurred with solution (moderated) systems
- No accidents occurred in storage or transportation
- Local consequences only
- Avoid unfavorable geometry for high-concentration solution
Observations (cont’d)

- No accidents occurred due to equipment failure, or faulty NCS calculations
- Many occurred during non-routine operations
- Downtime was related to administrative considerations, not severity
- No new physical phenomena observed
Primary Lessons Learned

• Never a single cause
• “Human element” always present
• Risk factors:
  – Unfavorable geometry
  – Lack of written procedures, communications
  – Production pressures
  – Operations unfamiliarity w/ process
  – NCS not integrated with accountability
Primary Lessons Learned (cont’d)

• Risk factors (cont’d)
  – Operations training:
    • *Awareness of criticality hazard*
    • *Recognition & response to abnormal conditions*
    • *Stop work, alarm response & evacuation*
    • *Supervisory responsibility*
  – Are hardware failures apparent to workers?
  – Does equipment & configuration promote ease of operations?
Primary Lessons Learned (cont’d)

• Risk factors (cont’d)
  – Senior management support
  – Regulatory support and involvement
    • Sharing information
Assessment of a Specific Facility

- To judge aggregate risk consider:
  - Scope, or number of, operations
  - Inherent complexity
  - Are there changing forms? Holdup?
  - Unfavorable geometry
  - Processes subject to change?
  - Conduct of operations
  - Oversight
Aggregate Risk of a Criticality Accident is:

• Not a simple summary of NCS Evaluations
• Informed by evaluations and risk factors
  – Factors often inter-related
• Not quantitative
• Ultimately based on expert judgment
K Area Complex (Former Reactor Facility)
K Area Primary Mission: Storage of SNM
Secondary Missions: Surveillance, Testing and Recertification

PCV/SCV Leak Test Unit

Digital Radiography

Prompt Gamma

Calorimeter (MC&A)
Destructive Evaluation Glovebox
Glovebox Cutaway Diagram
Example: Assessing Need for CAAS at K Area

• Scope of operations: Storage & surveillance
• No fissile solutions; no chemical processing
• Stable material inside shipping containers
  – Rigorous accountability
  – Few opportunities for upsets
• Aggregate risk dominated by KIS activities
  – One item in KIS at a time
• Formality of operations
• Safety culture
Conclusions for K Area Operations

• For K Area:
  – Extremely low aggregate risk of criticality accident
  – CAAS installation adds:
    • Non-zero risk of injuries
    • Significant costs
  – On balance, no CAAS is recommended
Application:

• What about the facilities that you support?

• Questions / Comments?