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Assessment of the Need for a Criticality Accident Alarm System

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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

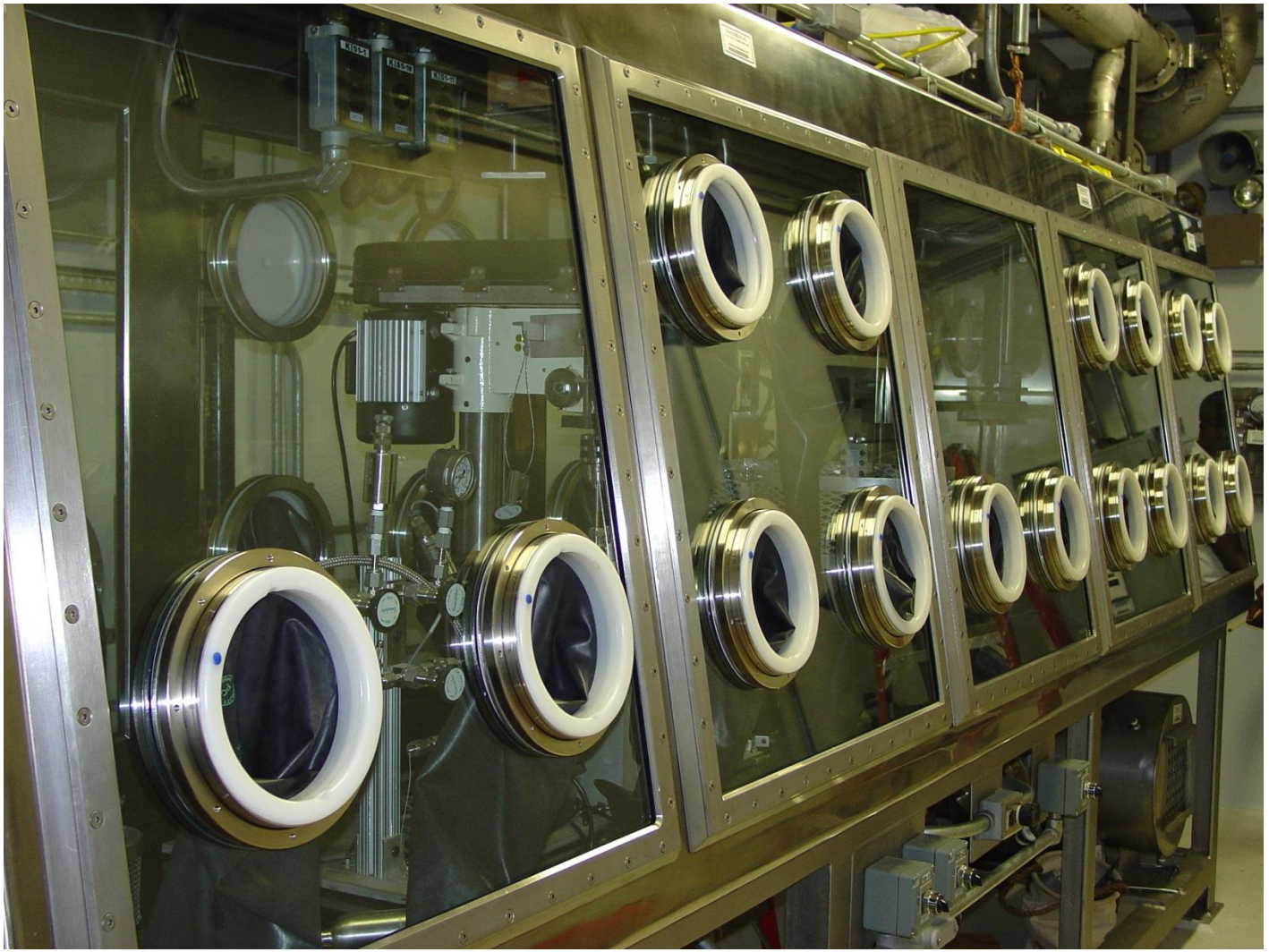
PCV/SCV Leak Test Unit

Digital Radiography

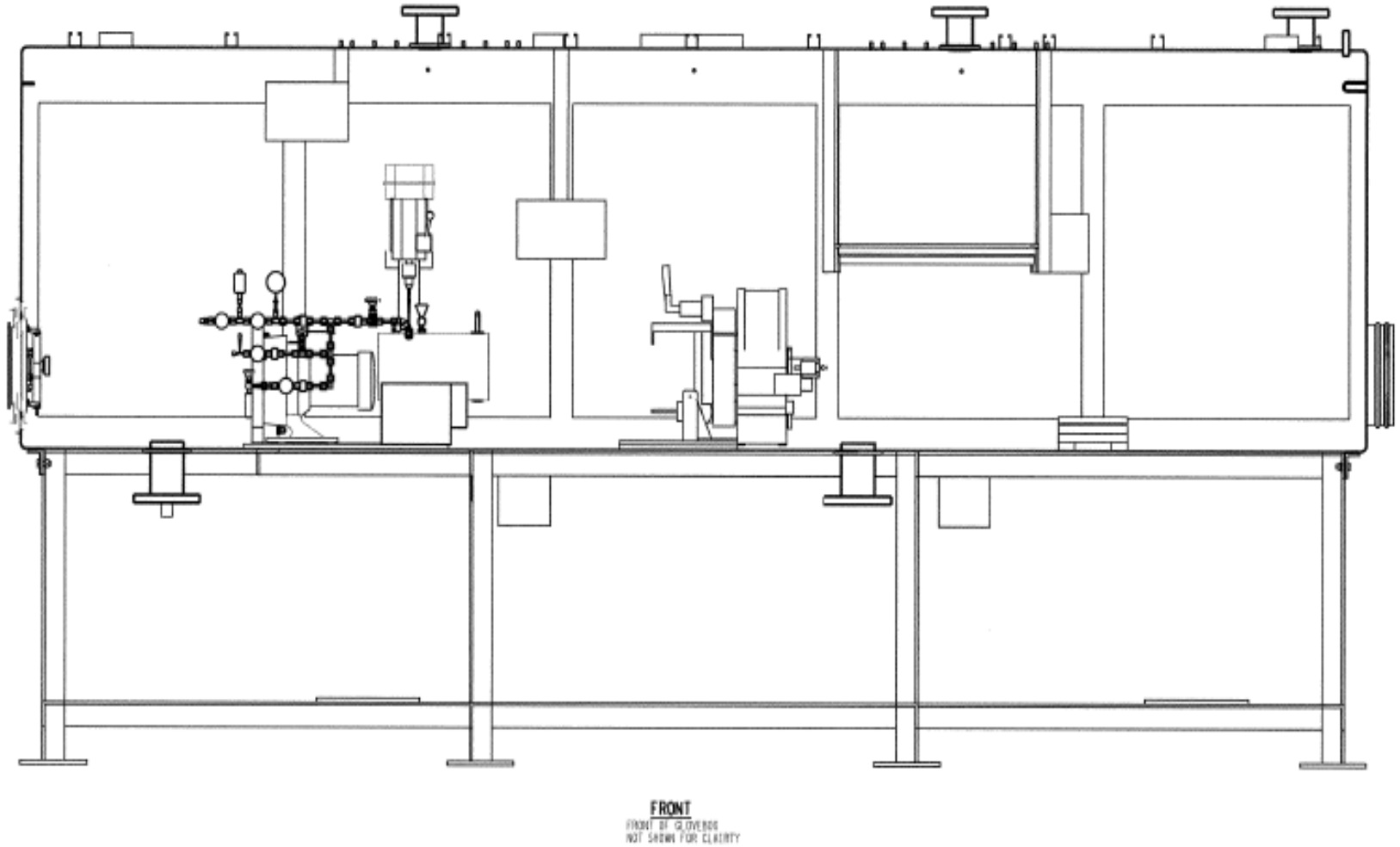
Prompt Gamma

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?