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savannah river site

A Disciplined Approach to Accident Analysis Development and Control Selection

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Background

- In support of a new DOE-STD-3009 compliant Safety Bases (SB) for the SRS Tank Farm Facilities, a lessons learned review identified the following concerns:
  - Facility engineering staff did not consistently display strong ownership or understanding of the facility SB
  - No formal and clear communication mechanism existed between the facility and the safety analysts
  - Inconsistent Operations involvement in SB development, particular with regard to control selection
  - Senior management was not actively engaged in SB development

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Safety Input Review Committee (SIRC) Process

- SIRC process expressly developed to address lessons learned
  - Key element of the process is to assign a facility Design Authority (DA) engineer to "own" each accident who is responsible to:
    - Develop accident progressions, facility inputs & assumptions
    - Lead control selection process
    - Identify and initiate further control evaluations (backfit analyses, NPH qualification, instrument uncertainty and Safety Integrity Level calculations, etc.)
    - Serve as principal facility reviewer of applicable DSA/TSR sections
    - Serve as primary spokesperson for assigned accident during SIRC meetings and subsequent DOE/DNFSB reviews
  - DA Engineer teamed with accident analyst to foster team approach augmented, as needed, with support from Operations, Regulatory Programs, etc.

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SIRC Structure

- **Two tiered structure:**
  - **SIRC Subcommittee**
    - **"Working group" – responsible for reviewing & approving**
      - **Unmitigated accident progressions**
      - **Unmitigated accident analysis approach and key inputs & assumptions**
      - **Control selection & associated mitigated accident results**
    - **Also used as a forum to address specific SB issues**
  - **Senior SIRC**
    - **Provides senior management review & approval of:**
      - **Selected key inputs & assumptions (at discretion of SIRC Subcommittee Chair)**
      - **Control selection & associated mitigated accident results**
      - **Control vulnerability dispositions**

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SIRC Membership

- SIRC Subcommittee composed of experienced representatives from:
  - Facility DA Engineering
  - Regulatory Programs
  - Operations
  - Safety Analysis
  - DOE Engineering
  - Augmented by other technical “experts” as needed

- Senior SIRC composed of senior managers from same organizations
  - DNFSB Site Representative invited to attend as an observer

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DOE Participation

- DOE is not a voting member of SIRC Subcommittee nor Senior SIRC
- Requires DOE to balance its role in SIRC process with its mandated oversight role
- Participation promotes open communication between DOE and contractor
  - Lends DOE perspective on key issues/concerns to process

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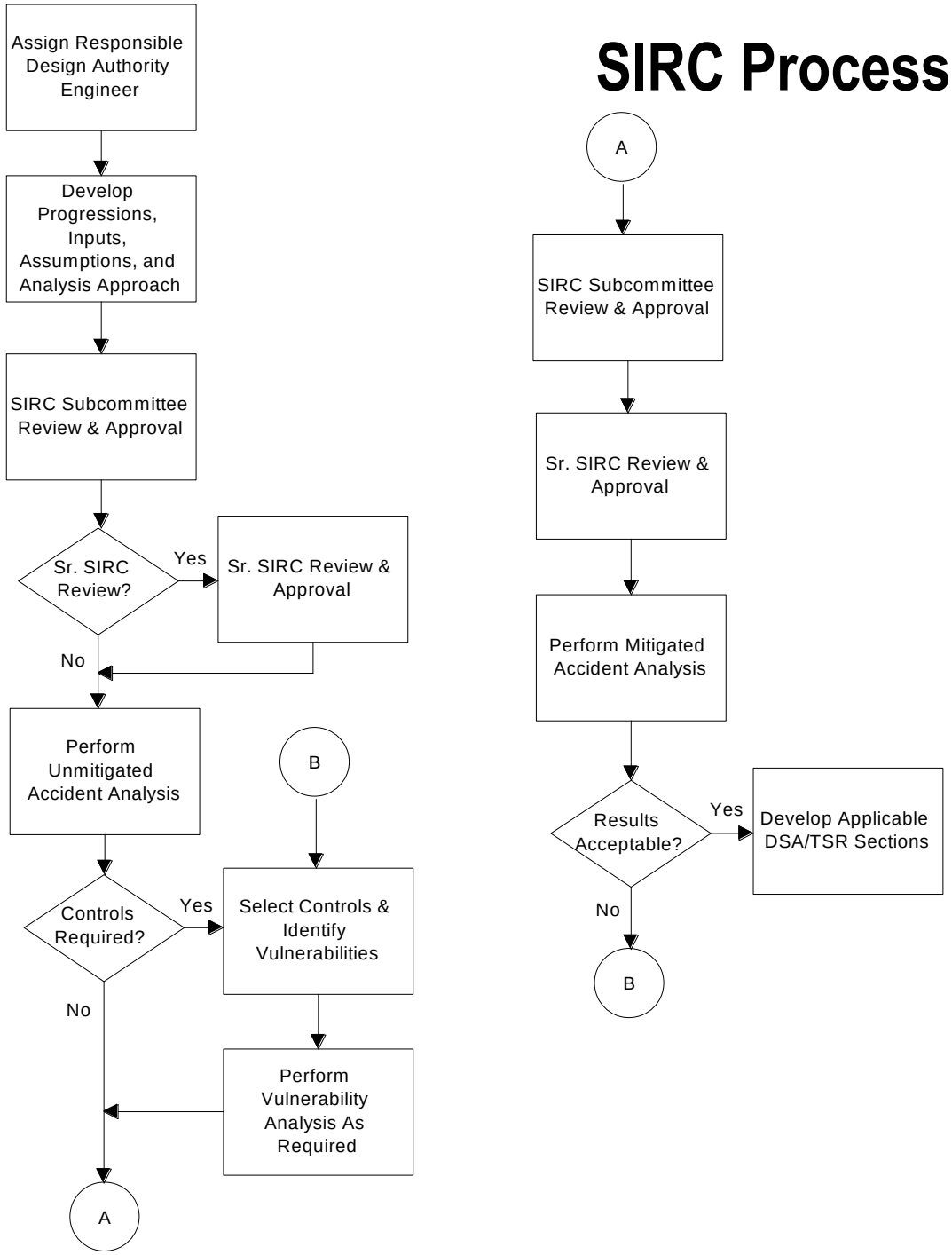
SIRC Process Flow Chart



Safety Analysis Input Sheet

Input Name	**Provide descriptive noun name (e.g., Pump Tank Volume)**
Conservative Direction	**Identify direction of input value that results in a higher consequence**
Safety Analysis Use	**Briefly describe intended analysis use(s)**
Normal Range	**Identify normal operating range of input parameter**
Inherent Controls	**Identify any controls that are inherent in the input/assumption and that must be protected to preserve the adequacy of the analysis**
References	**Identify supporting references (e.g., calculations, technical reports, handbooks, drawings, specifications)**
Historical Events	**Briefly summarize actual operating experience that may be useful to support the recommended input/assumption**
Physical Limitations	**Describe any applicable physical limitations inherent in the input/assumption**
Safety Analysis Value	**Specify value to be used in accident analysis**
Justification	**Provide technical justification for the recommended Safety Analysis Value addressing both its adequacy and appropriateness with references as needed**
Assumptions	**Identify and justify any assumptions made in arriving at the recommended Safety Analysis Value**

SIRC Protocol

- SIRC Subcommittee Reviews
  - Very detailed in nature
  - "Oral Board" format
    - Requires responsible DA engineer to vigorously defend proposed information
  - Approval requires consensus

- Senior SIRC Reviews
  - "Big Picture" approach focusing on broader implications of proposed information
  - Approval requires unanimous vote

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Control Selection

- **Selection is performed in team setting**
  - Led by responsible DA engineer
  - Includes Operations, Safety Analyst, Regulatory Programs

- **Controls selected with consideration of:**
  - Preferred hierarchy guidance
    - Administrative Controls must be evaluated against DOE-STD-1186
  - Effectiveness & completeness
  - Need for defense in depth
  - Implementation
  - Vulnerabilities
    - e.g., no available means to prevent flammable mixture in tank vapor space following a seismic event

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Vulnerability Disposition

- Responsible DA engineer performs vulnerability analysis as required
  - Includes development of cost/benefit analysis as needed
  - Presents to Senior SIRC
- Senior SIRC review/approves disposition options:
  - Eliminate via facility modification
  - Mitigate via compensatory measure
  - Accept as is
- Vulnerability disposition factored into final control selection and associated SB document sections

SIRC Subcommittee as a Working Group

- **Nature of SIRC Subcommittee lends itself well to developing facility positions on emergent SB issues**
  - **Used to identify and evaluate Specific Administrative Controls in accordance with DOE-STD-1186**
  - **Used to review and approve selected key inputs for Modular Caustic Side Solvent Extraction Unit Hazard Analysis (HA)**
    - **HA concluded that no event challenged Offsite Evaluation Guidelines nor Onsite dose criteria (no Safety Class/Safety Significant controls required)**
    - **SIRC Subcommittee used to validate Material at Risk inputs**

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What it Takes to Succeed

- Recognition that SIRC process is labor intensive upfront - requires
  - Preparation and recovery time on part of responsible DA engineer and support team members
  - Time commitment from SIRC Subcommittee & Senior SIRC members
- Responsible DA engineers must be willing to own their accidents
  - Requires unique blend of technical, oral communication, teamwork, and boardsmanship skills
- Commitment by SIRC members to demand technical perfection

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Benefits Derived from SIRC Process

- Facility DA engineers involved in process serve as Subject Matter Experts for their assigned accidents
  - Level of understanding & ownership significantly enhanced
- Use of Safety Analysis Input Sheets has proved to be a reliable and clear communication mechanism
- Consistent technical rigor built into the process during the development effort
- Implementation planning and execution significantly benefits from Operations involvement
  - No instances of “unimplementable” controls
  - Operations feels like part of the team
- Senior management understanding of key SB issues and residual risks
- Early involvement of DOE in the SB development process and opportunity for early DNFSB information sharing

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Acceptance of SIRC Process at SRS

- First developed and used in 2002 for Tank Farm facilities DSA/TSR development effort
  - Institutionalized and used for all subsequent new/revised accident analysis
  - SB submittals routinely reviewed and approved by DOE with no significant technical issues related to inputs, assumptions, consequence results, or control selection
- Adopted for all other Liquid Waste Facilities (Defense Waste Processing Facility & Saltstone) and the Solid Waste Management Facility in 2006
- Recommended as a good practice for implementation at all SRS Hazard Category 2 nuclear facilities

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