Integrated Safety Analysis (ISA) Approach and Method

International Isotopes, Inc.

FEP & DUF_6 Deconversion Facility

ISA Methodology

- Follows methodology specified in 10 CFR Part 70, Subpart H
  - Uses NUREG-1520 and NUREG-1513 as guides for format and content
    - Specifically with respect to documentation and flow of analyses (NUREG-1520 used as an outline)
  - Relies on experience base from other NRC regulated facilities
  - Reviewed recent LES ISA Summary and other licenses for comparison

ISA Methodology (continued)

- FEP/DUF_6 Deconversion plant is considered a low-risk nuclear facility
  - No credible criticality safety concerns
  - Few scenarios lead to intermediate or high radiological consequences to workers or the public
  - Very few scenarios lead to offsite environmental consequences
  - Primary potential hazard is chemical dose to workers and the public from HF

ISA Team

- Several analysts with broad based experience
  - NRC ISA experience at chem-nuclear plants
  - PHA, accident analysis, risk and reliability expertise
  - Expertise in engineering, process and radiological safety, safety analysis, and HF, UF_6, uranium and fluorine chemistry

Key ISA Elements

- Hazard Identification
  - Identification, location, and inventory of potential hazards at the plant site
- Hazard Screening
  - Identifies hazards that have the potential to exceed low consequences categories as specified in 10 CFR 70.61
  - Excludes standard industrial hazards from further detailed analysis

Key ISA Elements (continued)

- Process Hazards Analysis (PHA)
  - What if/checklist methodology
    - Approved method per NUREG-1513
    - Appropriate method based on facility hazards and complexity
  - Identifies scenarios that can lead to intermediate or high consequences to workers and the public
    - Chemical, radiological and environmental consequences

PHA Example

Plant	UF_4 to SiF_4
Drawing	SF4-002
Drawing Date	01/07/09
Drawing Revision	

Node	3
System	Fusion Calciner
System Description	Fusion calciner and associated equipment

Scenario Number	What if...	Causes	Likelihood Category	Consequences	Consequence Category	Prevention Features	Mitigation Features	Comments
103.9	A fire occurs in the fusion calciner area	Ignition of area combustibles Natural gas leak and subsequent ignition Fire from an external event and/or adjacent area	-2	Potential process system breach	CD(W) = 3 CD(P) = 3	Robust process system design Fire detection and suppression system Limits and controls on combustibles and ignition sources Fire fighting response prevents system breach	Facility structure limits offsite consequences Off-gas scrubber reduces source term of hazardous gases released Remote and local shutdown of fusion calciner to limit hazardous gas and uranium release Area hazardous gas detection system and alarms	Ignition of routine combustibles cannot alone result in a process breach. A failure to adhere to combustible limits and/or the existence of additional flammable material must coincide with this upset condition.

Consequence Types:	**Consequence Receptors:**
RD = Radiological dose	W = Worker
CD = Chemical dose	P = Public
Sol U = Soluble uranium uptake	Env = Environment

Consequence Analysis

- Three basic consequence types
  - Chemical dose, radiological dose, and soluble uranium uptake
- Consequence level criteria is from 10 CFR 70.76
- Exposures are based on hazardous material type, inventory, flow rates, and release methods/fractions

Items Relied On For Safety (IROFS)

- IROFS are the credited prevention/protection features or mitigation features that are relied upon to meet acceptable risk levels for accident scenarios
  - IROFS are identified and assigned as needed during the risk analysis
  - Credit for IROFS as prevention or mitigation is based on the type of IROFS (passive, active engineered, etc.) as described in NUREG-1520

Likelihood Analysis

- Frequency of the initiating event
  - Frequency assignment is based on NUREG-1520 criteria
- Failure probability of prevention/protection features
  - Failure probability assignment is based on NUREG-1520 criteria
- Failure duration may or may not be used to determine likelihood
  - Criteria specified in NUREG-1520 is followed as applicable

Likelihood Analysis (continued)

- Likelihood category is determined by summing the Frequency index, failure probability index, and duration index numbers

Risk Determination

- Risk is determined by multiplying the likelihood category number by consequence category number to get a total risk index value
  - Risk index values of 4 or less meet the performance criteria in 10 CFR 70.61 and are acceptable
  - Risk index values greater that 4 require additional prevention/protection features and/or mitigation features to reduce the risk to an acceptable level

ISA Status

- Drafted methodology outline/footprint
- Preliminary PHAs for the primary processing facilities (UF_4 plant, SiF4 plant). HF storage and loading will be also be done. Design of HF storage includes containment and engineered controls for release mitigation.
  - Iterative process, especially with concurrent design
  - Close coordination with process and system design engineers

ISA Status (continued)

- Drafted preliminary consequence categories for PHA scenarios
- Drafted preliminary risk index tables (likelihood, consequence, and risk value) for intermediate and high consequence event scenarios for the three main processing facilities
- Drafted a preliminary list of IROFS for the main processing facilities

ISA Process (ongoing work)

- Prepare for and complete PHA sessions with key process and systems engineers and safety analysts following CDR completion
- Update PHA, risk tables, and IROFS list following sessions
- Complete supporting analyses and documentation
- Develop ISA summary documentation