Waste Treatment Plant Project

Innovation in Design

The ISM Process at the Hanford Tank Waste Treatment and Immobilization Plant

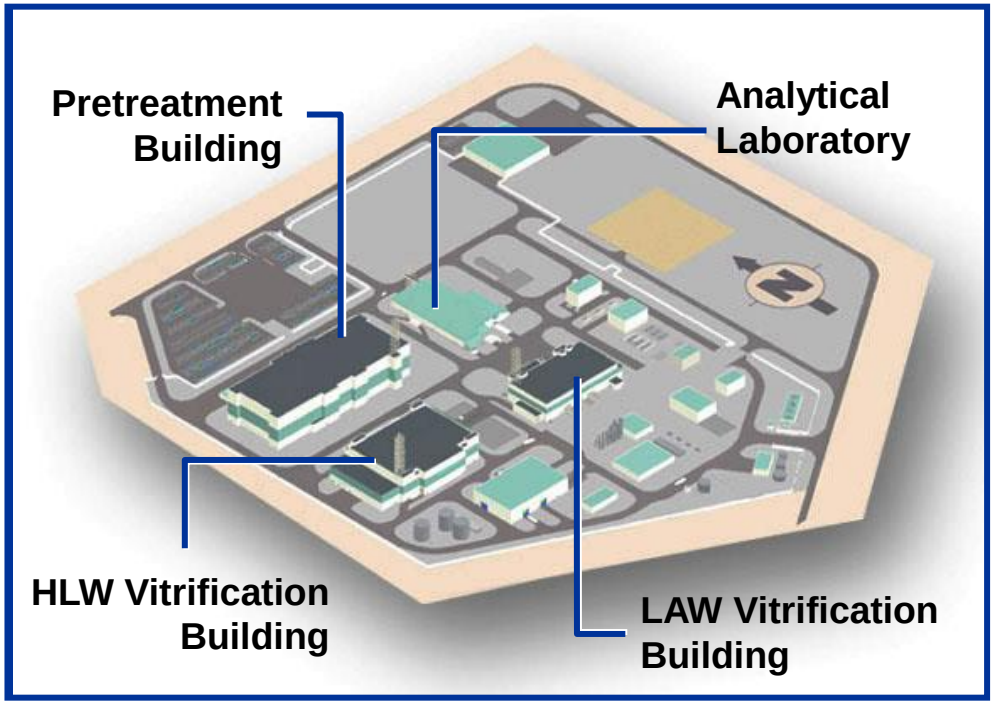
John Hinckley

August, 2009

U.S. Department of Energy
Office of River Protection
Bechtel National, Inc.
Washington Group International
A subsidiary of the Washington Division of URS Corporation
URS

What is WTP?

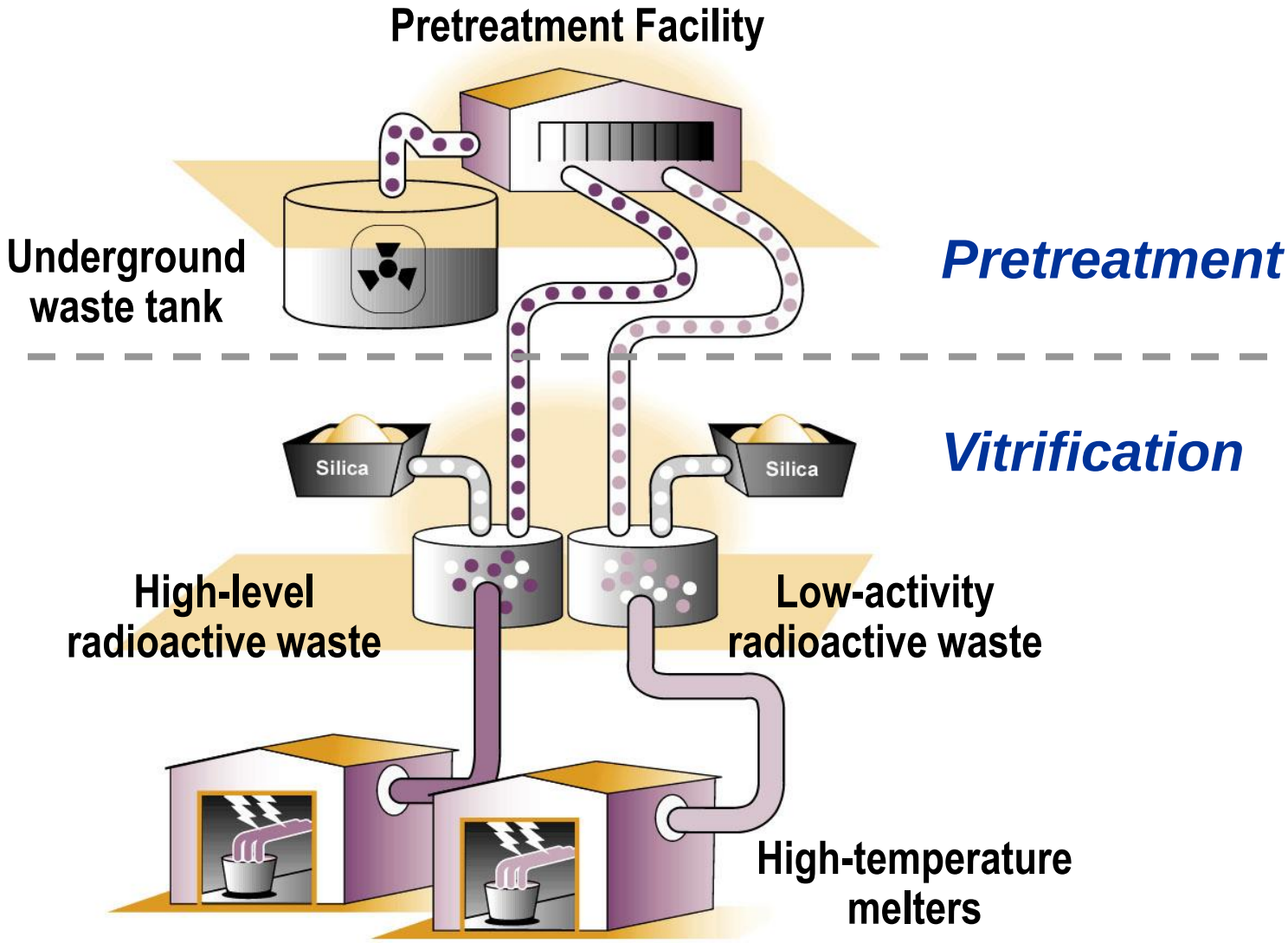
- WTP will be the world's largest radioactive and chemical waste treatment plant
- Pretreatment (PT) Facility
- Low-Activity Waste (LAW) Vitrification Facility
- High-Level Waste (HLW) Vitrification Facility
- Analytical Laboratory
- Balance of Facilities



Author's Bio.

- John Hinckley has been with the project since its inception in 1997. During that time he has been the ISM lead for two segments of the WTP facility, first LAW and second, PTF. Mr. Hinckley is a past president of the Northwest Chapter of the System Safety Society, and has been a system safety analyst since 1983. Mr. Hinckley is a Certified Safety Professional, and is the primary instructor on the WTP ISM process for the project. He was awarded a master's degree in nuclear engineering from Idaho State University in 1982.

WTP will convert Hanford liquid waste into glass



May 2009: Vit Plant is 49% Complete

WTP was among the first projects to implement the (then) new ISM concepts

"...those responsible for engineering the process...must be given more direct responsibility for hazard analysis, for the provision of safety control measures derived there from, and for the effectiveness of these measures."

DNFSB/TECH-16 Integrated Safety Management

ISM Process

- Identifies hazards and suitable controls for them
- Tailors safety standards and requirements to the hazards
- Ensures adequate protection from radiation and chemical exposures
- Contractually required

ISM Process

ISM Teams

- ISM Process uses an integrated team of E&NS, Engineering, and Operations personnel to
  - Analyze process hazards
  - Select hazard controls
  - Select appropriate codes and standards for Important to Safety (ITS) Structures, Systems and Components (SSC)
- The goal is to prevent/mitigate radiation and chemical exposures to workers and the public

ISM Process

ISM Team Characteristics

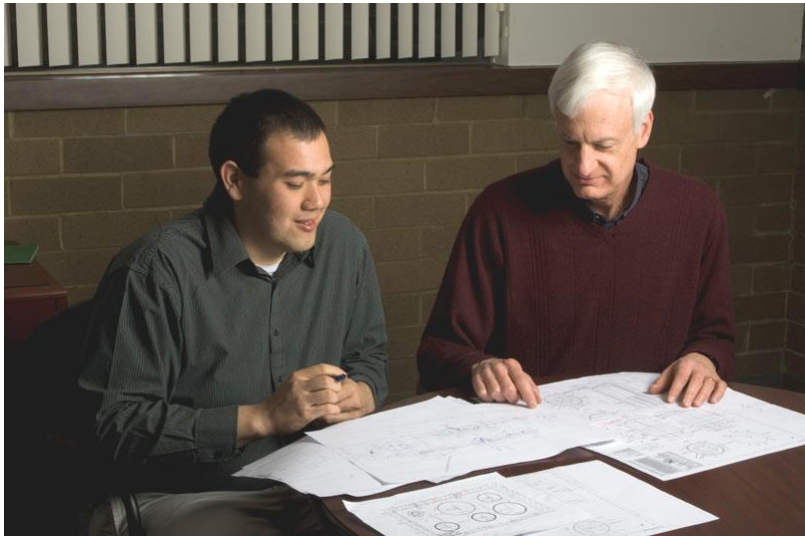
- Meetings
  - Scheduled to support primary design / design freeze
  - Organized and led by E&NS
  - Attended by representatives from Engineering, Construction, and Operations
  - Process Management Team (PMT) resolves conflicts within the ISM team
  - Project Safety Committee (PSC) addresses technical issues

ISM Process

ISM Team Characteristics

- Decisions are consensus based and concurrence from team members is required before
  - Initial issue of primary design documents for construction/procurement
  - Implementing changes that introduce new hazards or that alter the control strategy
  - Revising codes/standards specified by the SRD

ISM Process



ISM Team Members

Roles and Responsibilities

- E&NS
  - Manage and document process
  - Provide safety input
- Engineering
  - Provide design and performance details for system
  - Provide subject matter experts
  - Provide design standards for selected control SSCs
- Operations
  - Provide operations requirements/constraints
  - Provide relevant operations experience

ISM Process

ISM Team Members

- Engineering, Construction, and Operations Representatives
  - Must understand their Management's expectations on the issue
  - Must be able to make decisions regarding the issue for the discipline/function that they are representing
  - Must allow for time to be spent at the meetings, researching, or resolving the issue
  - Managers must ensure they provide adequate support for the process to succeed

ISM Process

ISM Team Results

- ISM meeting minutes
- Safety implementation notebooks (SIN)
- Standards Identification Process Database (SIPD)
- DBE calculations
- Safety envelope document (SED)

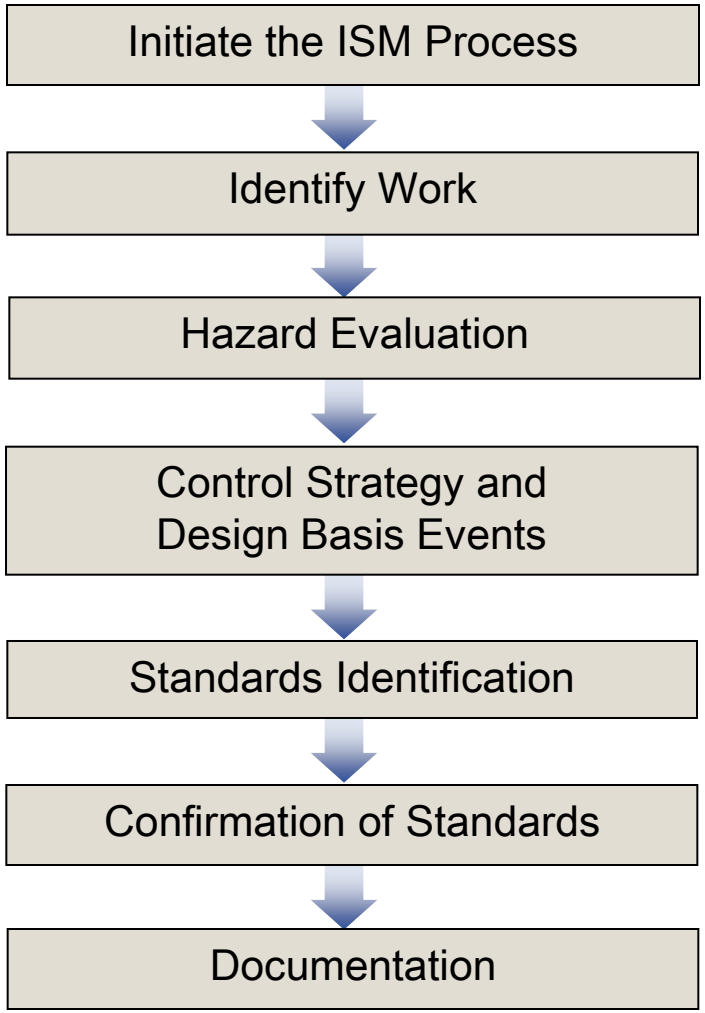
ISM Process

Procedures:

24590-WTP-GPG-SANA-002, *Integrated Safety Management*

24590-WTP-GPP-SANA-002, *Hazard Analysis, Development of Hazard Control Strategies, and Identification of Standards*

24590-WTP-GPP-SANA-001, *Accident Analysis*



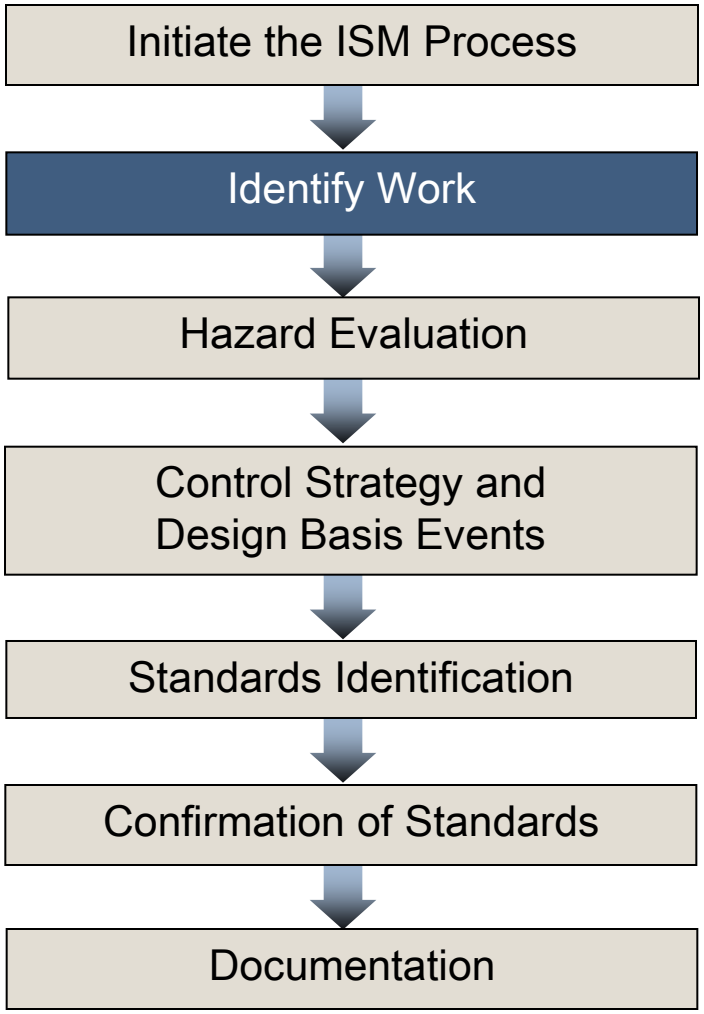
ISM Process

Process Initiation

- PMT assures adequate resources are available to carry out the ISM process
- PMT defines the minimum composition of ISM teams
- PMT forms special purpose ISM teams

ISM Process

Identify the Work



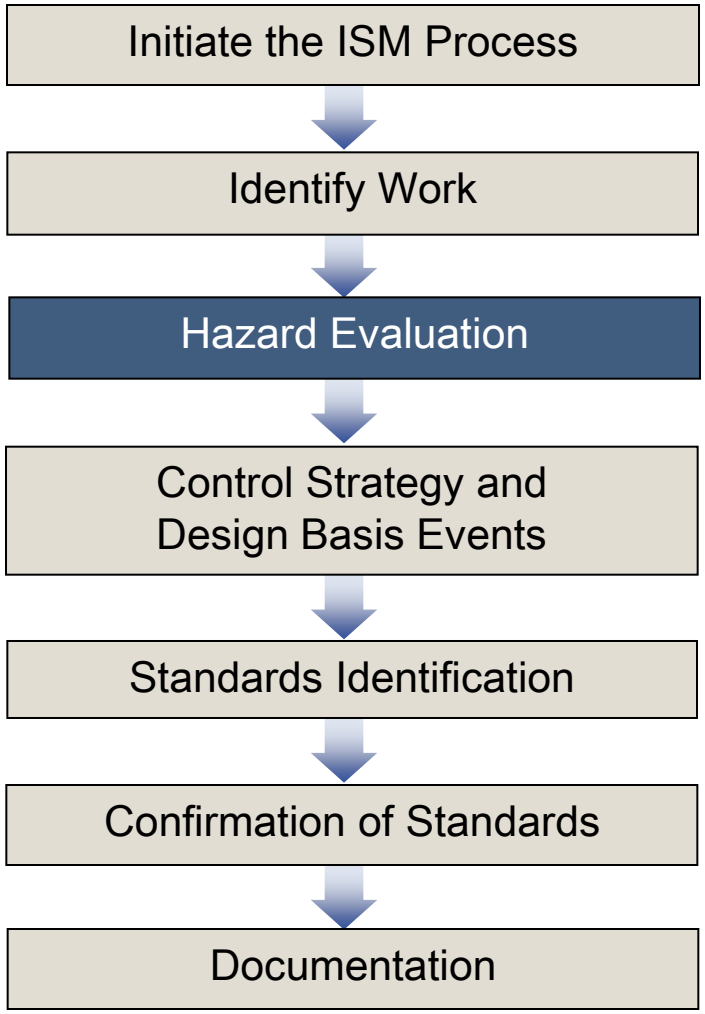
ISM Process

Work Identification

- Describe work that is to be performed
- Work can be identified in terms of any applicable design document

ISM Process

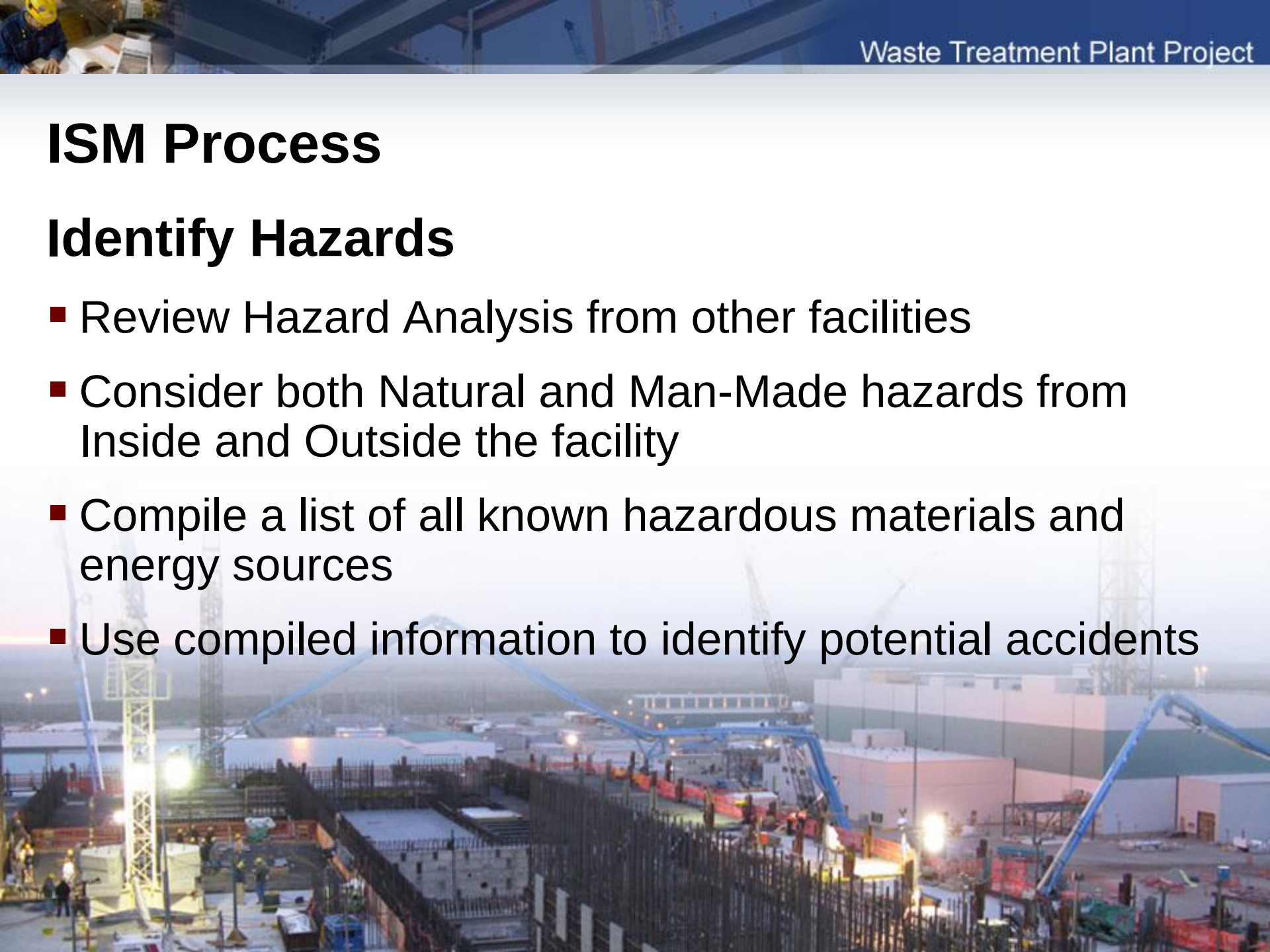
Conduct Hazard Evaluation



ISM Process

Identify Hazards

- Review Hazard Analysis from other facilities
- Consider both Natural and Man-Made hazards from Inside and Outside the facility
- Compile a list of all known hazardous materials and energy sources
- Use compiled information to identify potential accidents



ISM Process

Hazard Evaluation

- Accident Identification
  - Range of processing options
  - Performed by ISM team using PHA techniques (e.g., HAZOP)
  - Defines credible accidents associated with the work

ISM Process

Hazard Evaluation

- Consequence Assessment
  - Graded approach
  - Based on an unmitigated analysis
    - active safety features

ISM Process

Receptors of Identified Hazards

- Three Receptors identified by DOE
  - Public
    - An individual at a boundary established around the facility at the nearest locations of uncontrolled public access
  - Co-Located Worker
    - An individual within the Hanford Site and beyond the WTP controlled area, performing work for or in conjunction with DOE
  - Facility Worker
    - An individual within the WTP controlled area

Severity Level Assessments

Table 1: Severity Levels (SL)

SL	Rem*/Event	SL	Rem*/Event
PSL-1	>25	CSL-1	>100
PSL-2	>5 to 25	CSL-2	>25 to 100
PSL-3	>1.0 to 5	CSL-3	5 to 25
PSL-4	0.1 to 1.0	CSL-4	<5
PSL-5	<0.1	CSL-5	N/A

Public Severity Level (PSL)
Co-located Worker Severity Level (CSL)
*Total Effective Dose Equivalent (TEDE)

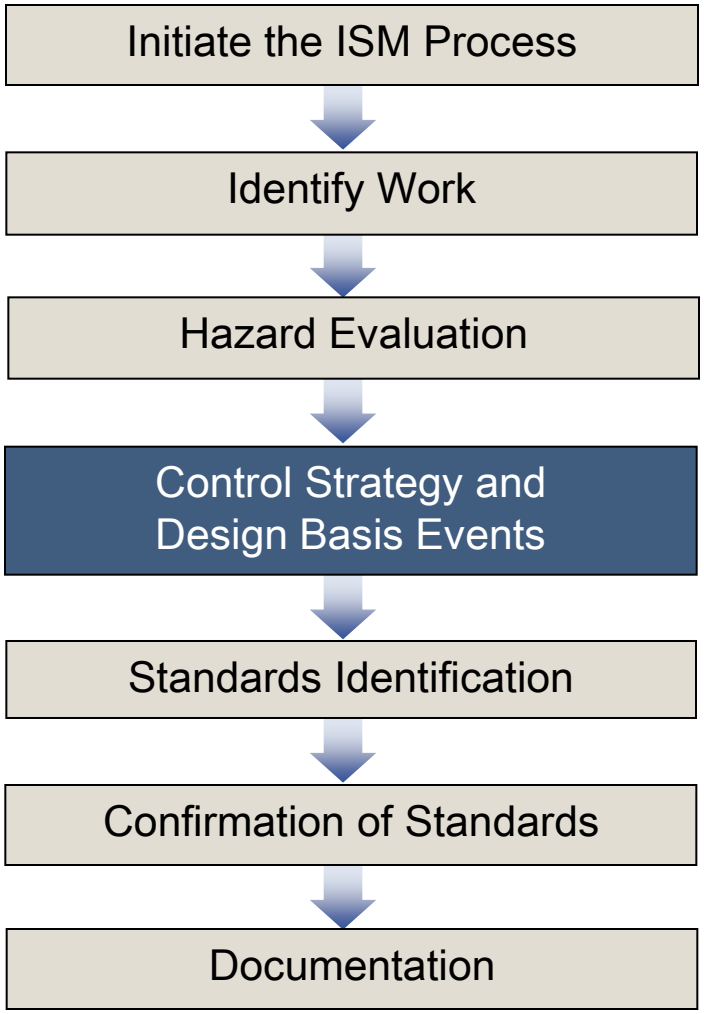
Consequence Ranking

Table 2: Facility Worker Consequence Ranking

Facility Worker Consequence Rank	Qualitative Criteria
High	Prompt worker fatality or serious injuries (e.g., immediately life threatening or permanently disabling) or significant radiological or chemical exposures. • >100 rem* • >ERPG-3
Moderate	Injuries that might require hospitalization but are not immediately life-threatening and are not permanently disabling • 5-100 rem* • ERPG-2 to ERPG-3
Low	Less than moderate consequences

ISM Process

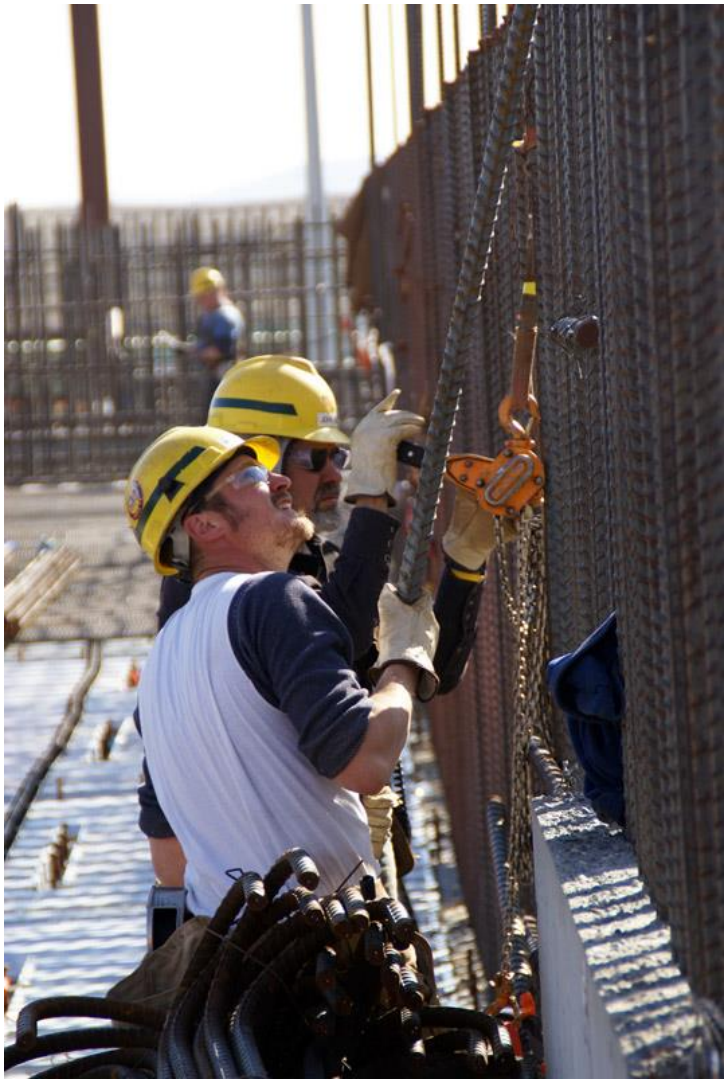
Develop Control Strategy



ISM Process

Control Strategy Development

- ISM team selects controls for each hazard
- ISM team classifies controls (system level)
- E&NS analyzes selected Design Basis Events for input to control strategy and standards
- Project team implements the controls



ISM Process

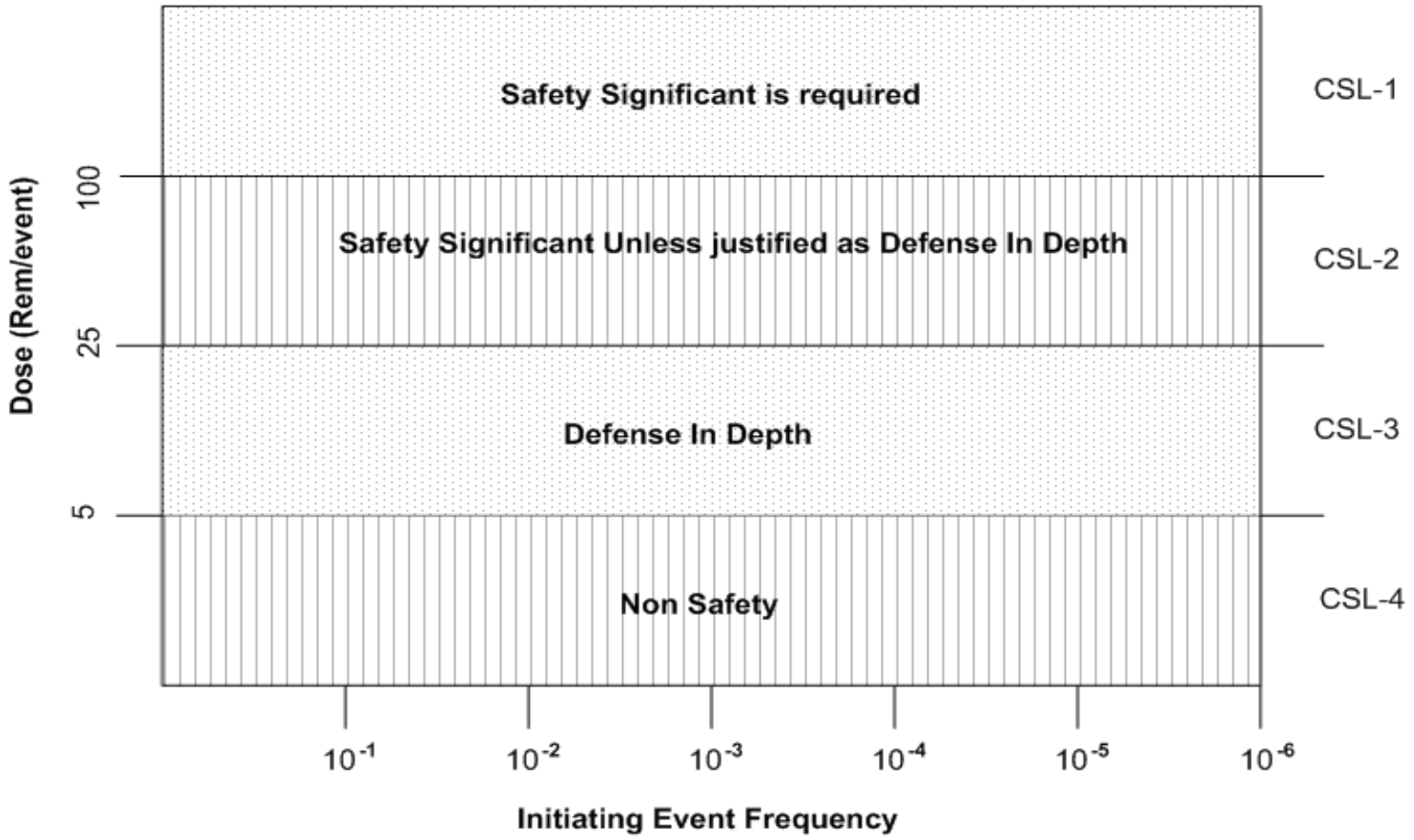
Functional Classification

- SSCs are classified as
  - Safety Class (SC)
  - Safety Significant (SS)
  - Defense in Depth (DiD)
- Classification depends on importance of Safety Function performed by SSC
- Not all components need to have the same classification
- Support systems classification

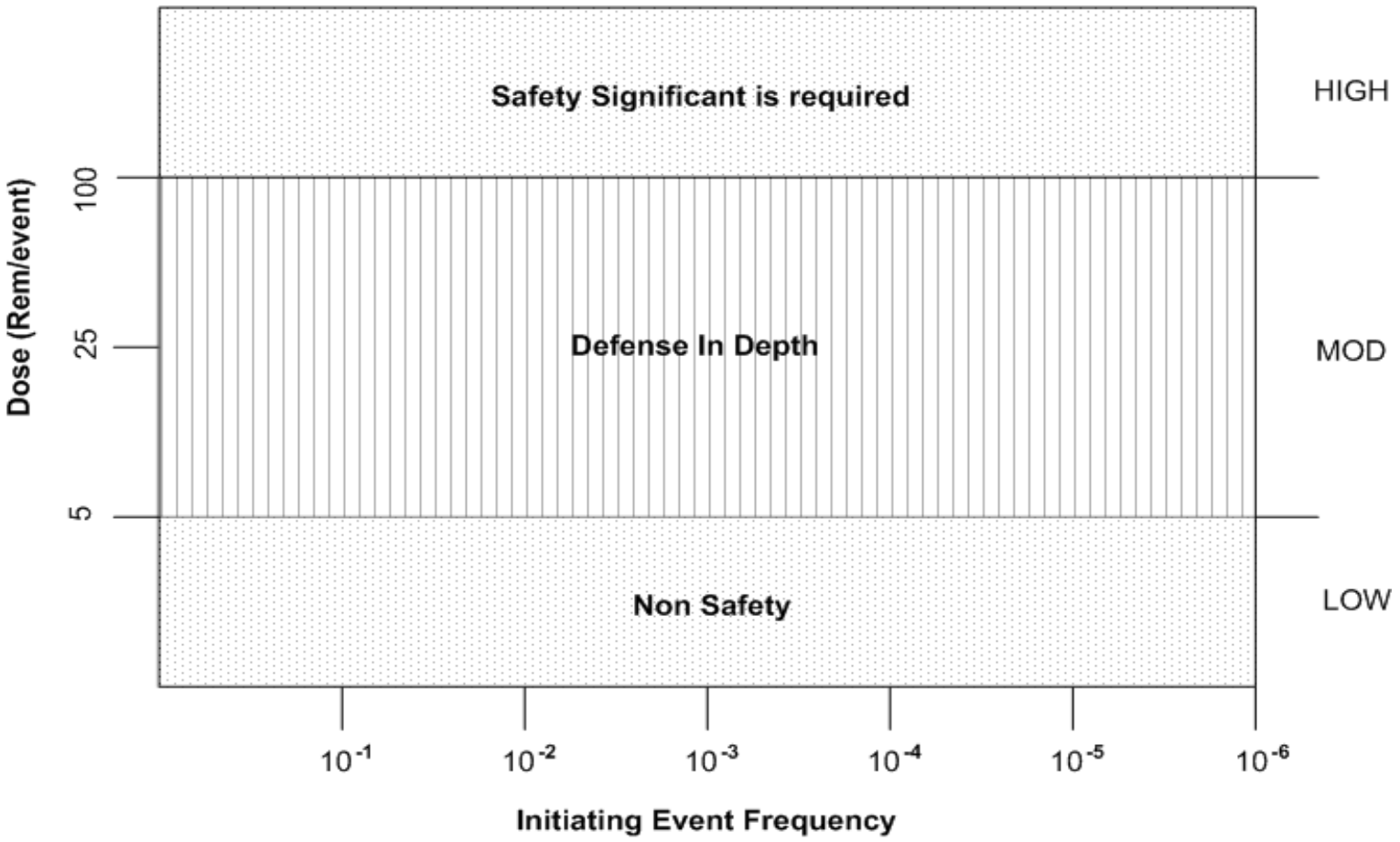
Public


Dose (Rem/event)
100
25
5
1.0
0.1
Safety Class is required
Safety Class Unless justified as SS
Safety Significant
Safety Significant
Defense in Depth
Defense in Depth
Non Safety
PSL-1
PSL-2
PSL-3
PSL-4
PSL-5
10-1
10-2
10-3
10-4
10-5
10-6
Initiating Event Frequency

Co-located Worker



Facility Worker



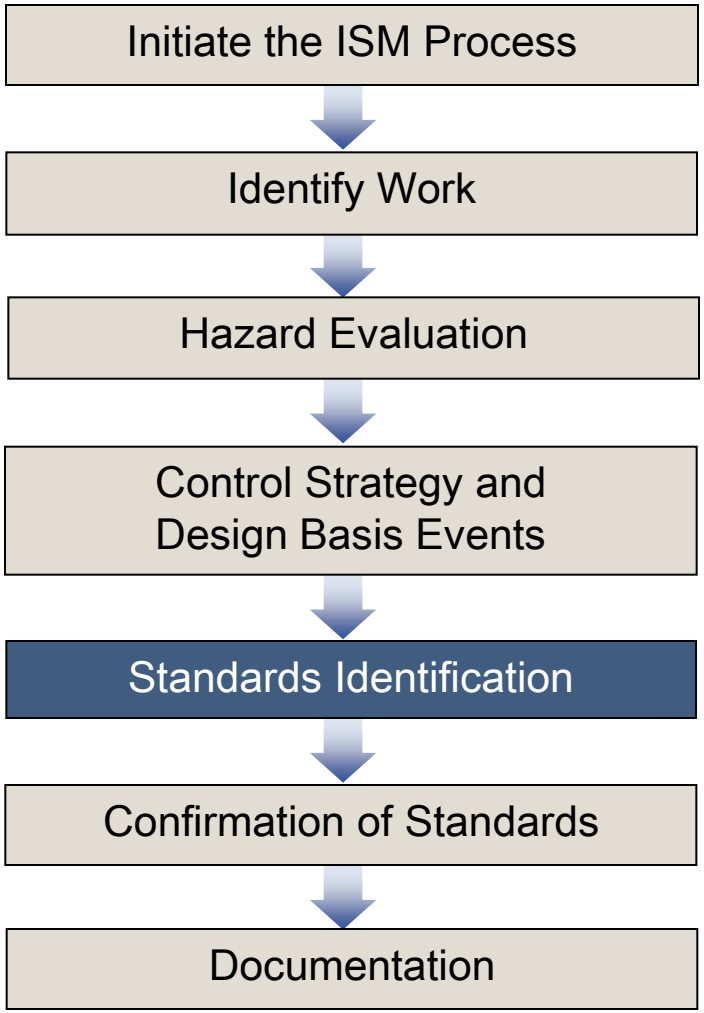
ISM Process

Defense in Depth

- Ensure selected strategies meet or exceed Defense in Depth requirements
  - Guidance from SRD, Vol. II, App. B, *Implementing Standard for Defense in Depth*
  - For Radiological Releases, Direct Radiation Exposures, Chemical Events
  - Emphasis on Passive SSCs over Active SSCs
  - Prevented Events vs. Mitigated Events

ISM Process

Identify Standards



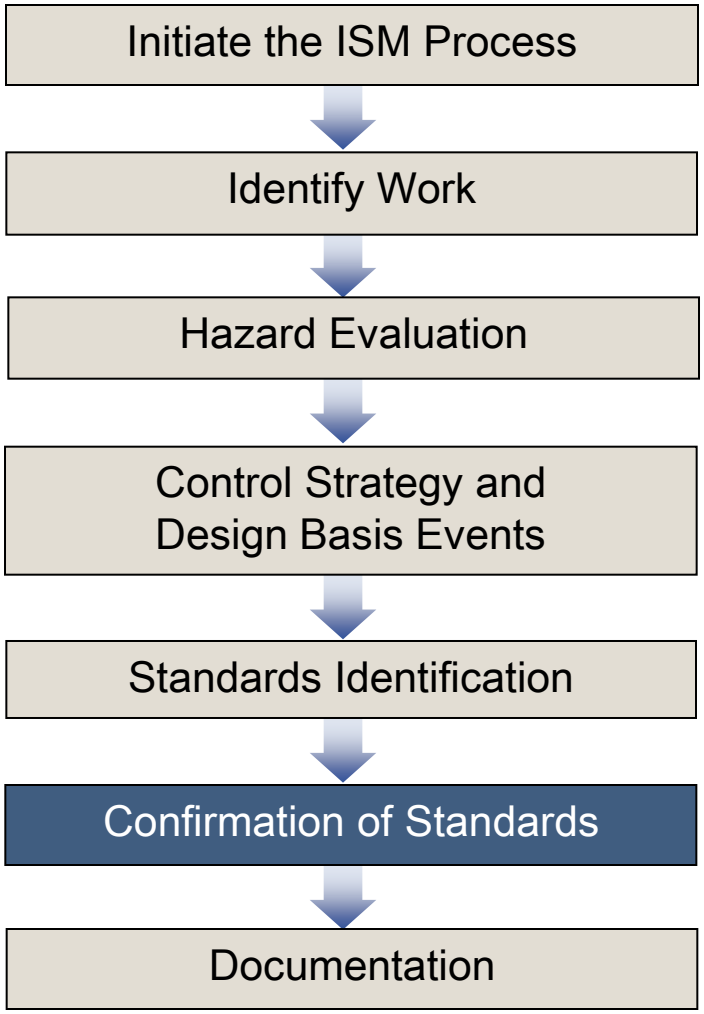
ISM Process

Standards Identification and Certification

- ISM team identifies standards for the credited ITS SSCs
- Special purpose ISM teams convened to
  - Consider adoption of standards not in the SRD
  - Tailor consensus standards
  - Produce ad hoc implementing standards

ISM Process

Confirm Standards



ISM Process

Confirmation

- The Process Management Team (PMT)
  - approves new standards
  - tailoring of existing standards
- The Project Safety Committee (PSC)
  - advises Project Director
  - confirms the standards by approving ABARs related to standards changes
- Project Director Certification
  - certifies to DOE that the set of standards provides adequate safety

ISM Process

Document Process