Integration of Case Studies

Risk Task Group
Office of Nuclear Materials Safety and Safeguards
U.S. Nuclear Regulatory Commission

October 25, 2001

Meeting Objectives

- Summarize insights from case studies
- Present plans for moving forward
- Solicit comments and recommendations

Agenda

- Poster Session
- Opening Remarks — L. Kokajko
- Risk-Informing Materials and Waste Safety — M. Federline
- Insights from Case Studies
  - Overview — M. Bailey
  - Screening Considerations — S. Shane
  - Safety Goals — D. Damon, R. Bari
  - Process Improvements — J. Smith
  - Where We Go From Here — J. Danna
- Feedback Session — ALL

Risk Informing Materials and Waste Safety

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Insights From Case Studies
Presentation Outline

- **Overview of Case Studies - Marissa Bailey**
- Screening Considerations - Raeann Shane
- Safety Goals - Dennis Damon
  - Robert Bari
- Process Improvements - James Smith
- Future Plans - James Danna

Overview of Case Studies

- Background Information
- General Insights from Case Studies

SECY-99-100
Moving Toward Risk-Informed Regulation

- Identify candidate applications
- Decide how to modify current approaches
- Change the approaches
- Implement risk-informed approaches
- Develop or adapt risk-informed tools

Additional Commission Direction

- Commission approved SECY-99-100 framework in June 1999 SRM
- Develop materials and waste safety goals analogous to reactor safety goal
  - Guide NRC staff and define “safety”
  - Consider property damage
  - Consider whether critical group can be defined
  - Give due consideration to 10 CFR 20

Screening Criteria

- Maintain or improve safety
- Improve efficiency or effectiveness
- Reduce unnecessary regulatory burden
- Help communicate a decision/situation
- Availability of sufficient information
- Implementation at a reasonable cost
- Existence of other precluding factors

Objectives of the Case Studies

- Test draft screening criteria and produce a final version
- Examine feasibility of developing safety goals
- Gain insights on risk-informing processes
- Identify tools, data and guidance needed

Case Study Questions

- Screening criteria/risk analysis questions
- Safety goal analysis questions
- Questions upon developing safety goals

Case Study Areas

- Gas Chromatographs
- Static Eliminators
- Fixed Gauges
- Uranium Recovery
- Site Decommissioning of Trojan Nuclear Plant
- Transportation of Trojan Reactor Vessel
- Dry Cask Storage of TMI-2 Fuel Debris at DOE/INEEL (Seismic Exemption)
- Paducah Gaseous Diffusion Plant Seismic Upgrades

Insights From Case Studies

- Screening Criteria/Considerations
  - Encompass relevant considerations
  - Should be ***considerations*** instead of criteria
  - Can be a useful decision-making tool
  - Application can be subjective, guidance needed

Insights From Case Studies

- Safety Goals
  - Development of safety goals is feasible
  - Multi-tiered structure, similar to reactors
  - Subsidiary objectives for each program area
  - Decision-making could be facilitated if clear set of safety goals existed

Insights From Case Studies

- Value of Using Risk Information
  - Helped to make decisions that were consistent with agency's current strategic goals
  - Can be useful in identifying shortcomings in our regulations or regulatory processes
- Information, Tools, Methods, Guidance
  - Mixed

Insights from Case Studies
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Case Study Objectives

For Screening Criteria

- To Test the Draft Screening Criteria
- To Develop a Final Set of Screening Criteria

Screening Considerations

- These 7 factors are one tool for use in the management decision to risk- inform a particular regulatory activity or process
- Criteria replaced with Considerations
- Revised screening considerations are very similar to the draft screening criteria
- Guidance needed for screening considerations use

Screening Considerations
Revised

- Could a risk- informed regulatory approach resolve a question with respect to maintaining or improving the activity's safety?
  - Role of risk information:
    - Maintain safety
    - Enhance safety
    - Clarify approach

Screening Considerations
Revised

- Could a risk- informed regulatory approach improve the effectiveness or efficiency of the NRC regulatory process?

  – Role of risk information:
    - Streamline processes
    - Improve consistency
    - Focus on safety

Screening Considerations
Revised

- Could a risk- informed regulatory approach reduce unnecessary regulatory burden?
  - Role of risk information:
    - Burden more consistent with hazard
    - Maintain overall safety

Screening Considerations
Revised

- Would a risk- informed approach help to effectively communicate a regulatory decision?

  – Role of risk information:
    - Clarify decisions
    - Transparent process
    - Defensible decisions

Screening Considerations
Revised

- Do information (data) and/or analytical models exist that are of sufficient quality or could they be reasonably developed to support risk- informing a regulatory activity?

– Quality of risk information:
  - Are studies relevant and complete
  - Are computer codes available

Screening Considerations
Revised

- Can startup and implementation of a risk- informed approach be realized at a reasonable cost to the NRC, applicant or licensee, and/or the public, and provide a net benefit?

  – Value of a risk informed approach:
    - Concept of net benefit

Screening Considerations
Revised

- Do other factors exist which would limit the utility of implementing a risk- informed approach?

  – Precluding factors:
    - Legislative factors
    - Judicial decisions
    - Agency policy
    - Social considerations

Conclusion

- Screening Considerations are a useful tool in the decision making process
- Guidance is being developed for Screening Considerations
- Your input is needed to suggest additional factors that should be addressed in the guidance document

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Introduction to Safety Goals

- The case studies have shown that safety goals, and quantitative measures of what is safe enough, could be useful in risk-informing specific situations within NMSS.

Introduction to Safety Goals

- What are "Safety Goals"?
  - Answer: How safe is safe enough?
    - A safety goal states a level of safety that is clearly safe enough.
    - There can be more than one type of safety goal needed.
  - Safety goals are aspirations, not requirements.

Introduction to Safety Goals

- What are "Safety Goals"? (cont'd)
  - Top level safety goals may be qualitative, more specific objectives may be quantitative.
  - Qualitative Example: 'Risks from nuclear accidents to individual members of the public near a facility should be an insignificant addition to other risks.'

Introduction to safety goals

- What are “Safety Goals”? (cont’d)
  - Quantitative Example: The frequency of accidental radiation exposures to the general public exceeding 100 mrem from a facility should be less than x.

Introduction to safety goals

- Risk-informed regulation is much more than just safety goals.
  - It involves all beneficial uses of risk-information.
  - Example use of risk information: Relative risk impacts of various alternative regulatory actions can show which is most effective.

Introduction to Safety Goals

- Why have safety goals?
  - Goals have proven useful in reducing burden and improving NRC effectiveness, when an application is already safe enough.
  - What risk metrics should you calculate?
  - What will you do with the risk information?
  - Consistency and completeness.

Purpose of Safety Goals

- To articulate safety philosophy
- To establish level of insignificant risk
- To address “how safe is safe enough”
- To facilitate risk management
- They are not *requirements*; they are *aspirations*

Background

- Early work by UK on risk criteria
- Safety Goals for power reactors by NRC in early 1980s. Approved Policy Statement in 1986.
- Parallel efforts by other countries
- IAEA, NEA efforts in aftermath of Chernobyl
- DOE initiatives in early 1990s
- New safety goal program in Japan

Materials Use and Waste Areas

- SECY 99-100 proposed development of metrics and goals
- Follow general structure of reactor safety goals
- Recognize risk to workers
- Consider accidents *and* normal operations
- Roles of other agencies/organizations
- Licensee capabilities
- Stakeholder input
- Commission concurred (SRM: 6/28/99)

Issues to Consider

- Individual and societal goals
- Voluntary and involuntary risks
- Worker and public risks
- Some of the risk to public and workers involve nonradiological hazards
- Operational phase risk and long-term risk

→Recognize that material use and waste areas present qualitatively different issues than reactors

Safety Goals Implied in Case Studies

- Transportation: accident probability of 1E-6 for vessel shipment acceptable to NRC
- Site Decommissioning: unrestricted release of site if annual dose is < public dose limit
- Uranium Recovery: prevent significant adverse impact to health and environment (GEIS)
- Gaseous Diffusion Plant: health risk (injury) to public determined to be sufficiently small to allow continued operation during seismic upgrade

Safety Goals Implied in Case Studies

- Gas Chromatographs: accident doses must meet criteria in 10 CFR 32.23, .24, .26, .27
- Fixed Gauges: manufacturer's design dose criteria in 10 CFR 32.51 are elements of safety goals
- Static Eliminators: zero release from sealed source
- Storage: 10 CFR part 72 statements of consideration recognized that dry cask risk < nuclear power plant risk

Where Safety Goals Might Have Helped

- Certification of gaseous diffusion plants
- Exemption for Trojan reactor vessel shipment
- Exemption for TMI-2 fuel debris storage at DOE/INEEL

Where Safety Goals Might Help

- Site Decommissioning: realistic long-term scenarios
- Uranium Recovery: remediation alternatives; nonradiological risk
- Transportation: worker and public risk
- Dry Cask Storage: risk perspective
- Byproduct Material: consistent basis for licensing

Three-Tier Safety Goal Structure

- Qualitative Goals *(Tier I):* **Items to consider**
  - Risk to Individual (Public and Worker)?
  - Risk to Society?
  - Environmental and Property Damage Risk?
- Quantitative Objectives *(Tier II):* **Items to consider**
  - Quantitative health objectives?
  - Quantitative environmental objective?
- Subsidiary Objectives *(Tier III):* **Items to consider**
  - Chronic?
  - Episodic?

Three-Tier Safety Goal Structure

	Reactor Operations	**Materials Use & Waste**	
Tier I Qualitative Goals	• Risk to individuals • Societal risk	• Risk to individual/society, including public and workers • Environmental and property damage risk	
Tier II Quantitative Goals	• Prompt fatality risk • Cancer fatality risk	• Quantitative health objectives • Quantitative environmental objective (QEO)	
Tier III Subsidiary Objectives	• Core damage frequency • Large early release frequency	Chronic	Episodic
		Dose Rate	Next slide

Example Subsidiary (Episodic) Objectives for Various Uses

Use or Facility	Subsidiary Objective – Likelihood of …
Uranium Milling	Yellowcake and chemical release
In Situ Leaching	Yellowcake and chemical release/groundwater excursion
Fuel Conversion	Yellowcake release/UF6 and other chemical release
Fuel Enrichment	UF6 and other chemical release
Fuel Fabrication	Large radiological and chemical release/criticality
Industrial Uses	Radiation dose to workers/public
High Level Waste	Defined in new 10 CFR Part 63
Low Level Waste	Release from waste disposal unit
Mill Tailings	Release from impoundment area
Decommissioning	Dose
Spent Fuel (Pool)	Fuel Damage/release
Spent Fuel (Dry Storage)	Loss of confinement, shielding, criticality control, and/or fuel retrievability
Transportation	Loss of containment, shielding, and/or criticality control
Reactor Operation	Core damage/large early release

Next Steps

- Seek stakeholder input on value and need for safety goals
- Obtain further insights from results of case studies and other risk information
- Consider development of draft safety goals

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Value Added Process Improvements
Introduction

- Training staff to fully realize the benefits of a risk informed regulatory framework, develop consistent processes
- Training the staff to fully realize the risk informed approach as the standard regulatory practice

Value Added Process Improvements
Use of Screening Criteria - Management Tool

- Introduce guidance to staff, by revising or introducing risk informed guidance on licensing, enforcement, inspection, and rulemaking

Value Added Process Improvements

Safety Goal - Use for Consistency

- Still need consistent set of objectives across materials and waste arenas
- Must address deterministic and stochastic effects
- May also consider property loss and public perception
- Recognize that zero" is not always possible in the real world

Value Added Process Improvements
Tools, Data & Methods

- All models of processes, e.G., ISAs, D&D, NUREG 6642 & NUREG 1717 provide consistent set of assumptions for generic cases
- All share weakness of the human factor

Value Added Process Improvements

Tools, Data, and Methods

- Could use NRR data/models for consistency in some generic case
- More data collected to aid regulatory decision making as deemed necessary relevant to the assumed risk. Specific cases can be reviewed on case by case basis, as in:
  - Irradiator petition
  - Materials inspection program review
  - In-situ leach study
  - Trojan reactor vessel shipment

Value Added Process Improvements
Summary

- To make risk informed regulatory processes effective and efficient and to maintain safety in the materials and waste arenas, the NRC should address:
  - Multi- tiered safety goals
  - Recognize zero is impossible in the real world
  - Address human reliability in a consistent and credible approach

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Where We Go From Here

- Phase 1: case studies, screening criteria, staff training, safety goal evaluation

- **Phase 2: systematic review of NMSS regulatory areas, to identify areas amenable to an increased consideration of risk insight and information**

  (I.E., Risk initiatives)

Basis for Phase 2: SECY-99-100

- Framework for using risk assessment in nuclear materials and waste regulation, and process to implement the framework
  - Define regulatory application areas in which risk assessment methods can play a role in NRC's decision making process
  - Identify candidate regulatory applications that are amenable to expanded use of risk assessment information

Phase 2 Approach

- Develop a plan defining Phase 2
- Identify all materials/waste regulatory areas
- Set aside certain areas, based on management, policy, or other considerations
- Categorize remaining areas, for efficiency
- Apply screening considerations
  - Use guidance, case studies, other initiatives

Phase 2 Product

Potential NMSS **risk initiatives**

- Regulatory applications where a risk-informed approach or modification:
- May result in a benefit in terms of safety, increased public confidence, increase regulatory efficiency/effectiveness, or reduced regulatory burden AND
- Would not likely be prohibited by technical feasibility, cost effectiveness, or other factors

Phase 2 Product (Cont'd)

- Document Phase 2 approach to:
  - Present the potential NMSS risk initiatives
  - Support identification of "missing" areas
  - Provide basis for areas "set aside"
  - Describe considerations in initial application of screening considerations
  - Provide basis for regulatory areas screened in or out

After Phase 2…

- Prioritize risk initiatives within existing NRC PBPM process, with other activities
- Identify higher-priority initiatives for near-term implementation
- Investigate and develop risk-informed approach/modification for individual initiatives (Phase 3)
- Re-apply screening considerations when necessary

Relation to Ongoing Activities

- Phase 2 will be conducted concurrently with ongoing risk-informed initiatives and activities
- Phase 2 will complement the existing avenues for identifying regulatory initiatives
  - Operating experience
  - Commission direction
  - Stakeholder suggestion
  - Staff initiatives
- Safety Goals, if desirable, parallel with Phase 2

Summary

- Screening Considerations
  - Tested and ready to be finalized
  - Need stakeholder input on application guidance
- Process Improvements, Tools and Guidance
  - Need stakeholder input on next steps
- Safety Goals
  - Feasible and could be helpful
  - Need stakeholder input on value and utility of safety goals, safety goal approach, other considerations