Integrated Safety Management - Panel
1999 American Nuclear Society Winter Meeting
Long Beach, California

Session Chairman: J. J. DiNunno, Member, DNFSB

The Department of Energy (DOE) has embraced the concept of Integrated Safety Management (Policy 450.4, dated 10/15/96) and is making Integrated Safety Management (ISM) the focus of its institutionalized program for ensuring protection of the public, workers and the environment and for practicing good stewardship of government property. Under ISM, safety programs hertofore targeted at individual sectors(public, workers and environment), individual media (air, water, land) and material categorizations(hazardous, toxic, radioactive) are being managed in a holistic way. The Department's is finding this concept useful and adaptable to its multiplicity of activities, short term and long, production type and R&D. The sharing of this experience with the wider nuclear industry and the opportunity to benefit from reaction of peers about this upgrade initiative could prove to be helpful to DOE in its continuing effort to ensure that its hazardous work is done safely.

The panel members will be invited to make introductory remarks covering their unique perspectives and will then will collectively discuss restructuring environmental and safety- related statutes and industry/government standards to facilitate holistic safety management. Integrated Safety Management was born of necessity. The current drivers for the safe management of activities involving toxic and hazardous materials are a myriad of laws aimed at different protected sectors(workers, public, environment) and administered by different government agencies. The proposition to be explored is the need and timeliness of statutory reform to achieve a more cohesive whole of government-mandated protection programs and a more efficient government administration of them.

Session Chairman: J. J. DiNunno, Member, DNFSB
Introductory Remarks

Deputy Secretary of Energy T.J. Glauthier
Integrated Safety Management: Concept Description (short video)

Frank McCoy, Deputy Manager, DOE Savannah River Operations Office
A Manufacturing/Production Site Perspective

Mark Spears, Kaiser Hill, Rocky Flats Environmental Technology Site
A Clean Up/Environmental Restoration Site Perspective

Bruce Matthews, Division Director, Los Alamos National Laboratory
A National Weapons Laboratory Perspective

Dennis C. Parzyck, Special Assistant to the Director, Oak Ridge National Laboratory
A National Research laboratory Perspective

William C. Gibson, Project Manager, SORP
A Non-Nuclear Application: Strategic Oil Reserve Program

Bob Perry, Center for Chemical Process Safety
Chemical Process Safety Management: Integration of Process Safety, Environmental, Safety, Health and Quality

These short presentations will be followed by a panel discussion with the focus on *Restructuring Environmental and Safety-related Statutes and Industry/Government Standards to Facilitate Holistic Safety Management.* Dr. Andrew Kadak, President, American Nuclear Society will serve as the "Provocateur" of this discussion.

REMARKS

BY

JOSEPH DINUNNO
MEMBER
DEFENSE NUCLEAR FACILITIES SAFETY BOARD

ON

INTEGRATED SAFETY MANAGEMENT

AMERICAN NUCLEAR SOCIETY WINTER MEETING

NOVEMBER 16, 1999

HYATT REGENCY LONG BEACH, CALIFORNIA

Good morning. Welcome to all of you who have elected to join us in this session on Integrated Safety Management. Like the airlines's hostess announcement at the end of a flight, we know you have had the opportunity to choose among many good options and we are glad you have selected ours.

Although the concept of Integrated Safety Management (ISM) represents the safety philosophy and practices of safety management that is the mainline program of the Department of Energy (DOE) and its contractors, it embodies some approaches and practices that many of us consider universal and common to doing work safely, regardless of the hazards involved. In sharing the experience of thinking and acting in a holistic sense about doing hazardous work safely, we hope to stimulate your own thoughts on the subject and to benefit from your reaction.

As many of you know, this country's protective programs aimed at (1) ensuring no undue risks to the public from the generation and uses of hazardous materials, (2) a safe working environment for workers, and (3) protection of the environment do not represent a cohesive whole. Laws directed at each of these protected sectors have been enacted as separate acts and are being administered largely under separate regulatory regimes. The situation is further complicated because environmental protection programs are partitioned by media (air, water, land disposal) and by material classifications (radioactive, mixed chemical/radioactive hazardous, toxic). Even the most dedicated and enlightened industrialist, government or commercial, whose work entail a use of both radioactive and non-radioactive hazardous material and processes, has the daunting task of establishing environment, health, and safety management programs responsive to all of these statutes, and the different regulators who administer them. In practice, a plethora of management programs and practices intended to be responsive to applicable statutes have evolved separately and advanced largely as single sector protective initiatives.

Under ISM, safety programs heretofore targeted at individual sectors (public, worker, environment) individual media and material categorizations are being managed in a much more holistic way. ISM is an attempt to achieve cohesiveness to these programs. It is, in effect, a practical, engineered solution to a statutory problem. Under ISM, all hazardous work is subject to an integrated work planning/safety planning process consisting of 5 basic steps or functions. Work so planned is accomplished by a work force operating to seven principles of good management and quality performance. Both functions and principles will be addressed more explicitly by speakers in this session. The Department of Energy is finding this concept useful and adaptable to its diversity of activities short-term and long-term, production type and Research and Development (R&D), nuclear and non-nuclear.

Following a brief video statement by DOE's Chief Operating Officer, Deputy Secretary T. J. Glauthier, this panel of speakers will share some of their experience with Integrated Safety Management as applied to:

- A Manufacturing/Production Facility **-** Speaker: Frank McCoy, Deputy Manager, Department of Energy, Savannah River

- A Cleanup/Environmental Restoration Site - Speaker: Mark Spears, Vice President, Kaiser-Hill

- A National Weapons Laboratory - Speaker: Bruce Mathews, Division Director, Los Alamos National Laboratory

- A National Research Laboratory/Oak Ridge National Laboratory - Speaker: Dennis Parzyck, Special Assistant to the Director, Oak Ridge National Laboratory

- A Non-Nuclear Application-Strategic Oil Reserve Program - Speaker: William Gibson, Project Manager, Strategic Petroleum Reserve

- A Integration of Process Safety, Environmental, Safety, Health and Quality - Speaker: Bob Perry, Center for Chemical process Safety

These presentations will be followed by a Panel Discussion with the focus on *Restructuring Environmental and Safety-related Statutes and Industry/Government Standards to Facilitate Holistic Safety Management.* Dr. Andrew Kadak, President, American Nuclear Society will serve as the "Provocateur" of this discussion.

With this introduction, let us begin.

Comments for Panel Discussion

Various studies have addressed different aspects of our current national protective programs. For example:

- National Academy of Public Administration, "Setting Priorities, Getting Results: A New Direction for EPA," NAPA, April 1995

- Debra S. Knopman, "Second Generation: A New Strategy for Environmental Protection," Progressive Policy Institute, April 1996

- US EPA, "Re-inventing Environment Protection," 1998 Annual Report, Office of Administrator, EPA, 100-R-99-002, March 1999

- Center for Risk Analysis: Harvard School of Public Health, "Reform of Risk Regulation: Achieving More Protection at Less Cost," March 1995

- Defense Nuclear Facilities Safety Board, "Integrated Safety Management," DNFSB/Tech 16, June 1997

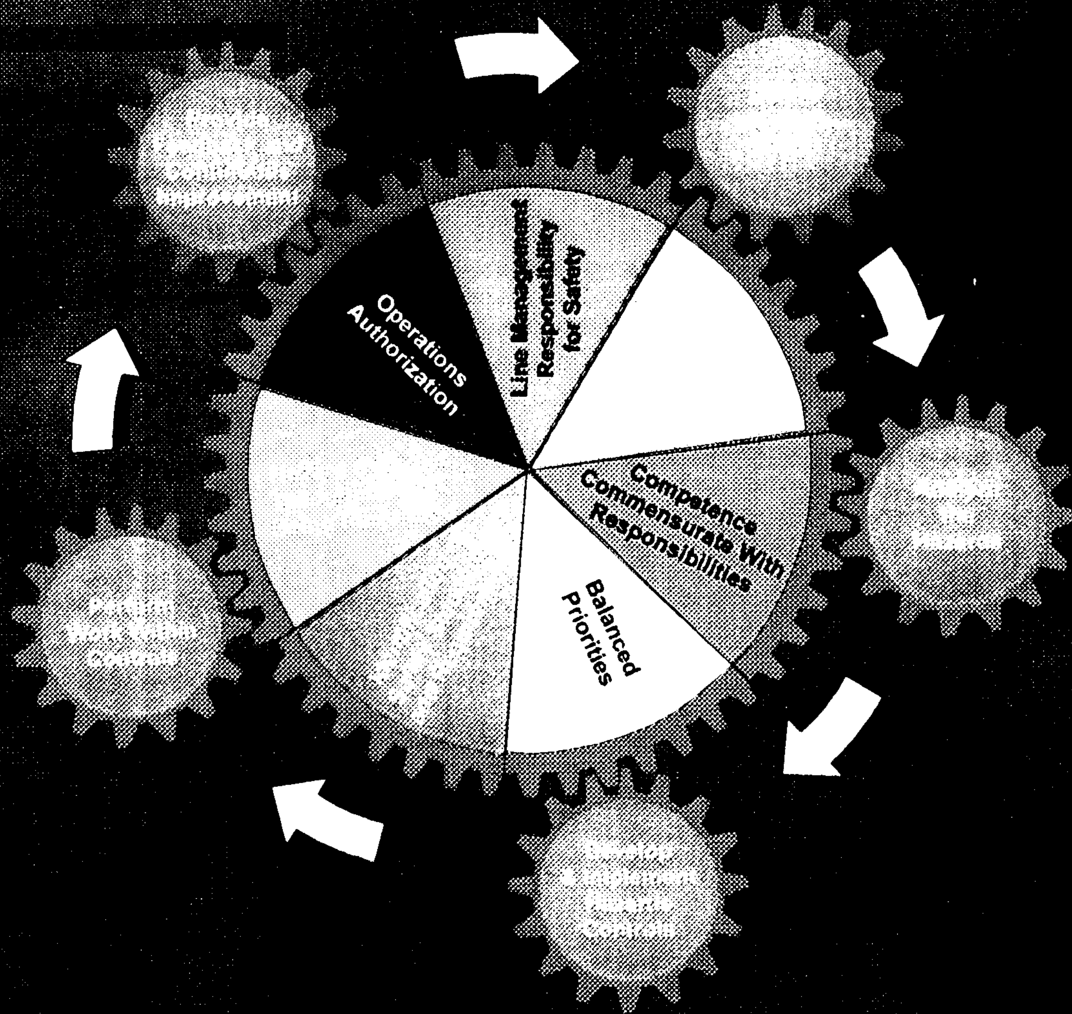
The Need for Congress to review our national program as a whole and to reform it, based upon experience accumulated over the past 45 years (since passage of the Atomic Energy Act of 1954) is a recurrent theme in these and related studies. However, the various statutes that make up our national program have been championed by different committees and interests in Congress. Any holistic statutory program is not likely to emerge unless Congress is willing to structure something like the old Joint Committee on Atomic Energy. Such a Committee would need to be delegated authority to take a holistic review of our protective statutes and advance proposed legislative reform. I know of no such initiative. Without pressures from industrial and government agencies to do so, the fractured, near-chaotic situation that now exists is likely to continue. The case of the Waste Isolation Pilot Plant, WIPP, is a classic example of regulatory impasse. It is time for adversely affected parties to speak up. Better protection at less costs and cleaner lines of regulatory jurisdiction should be target objectives.

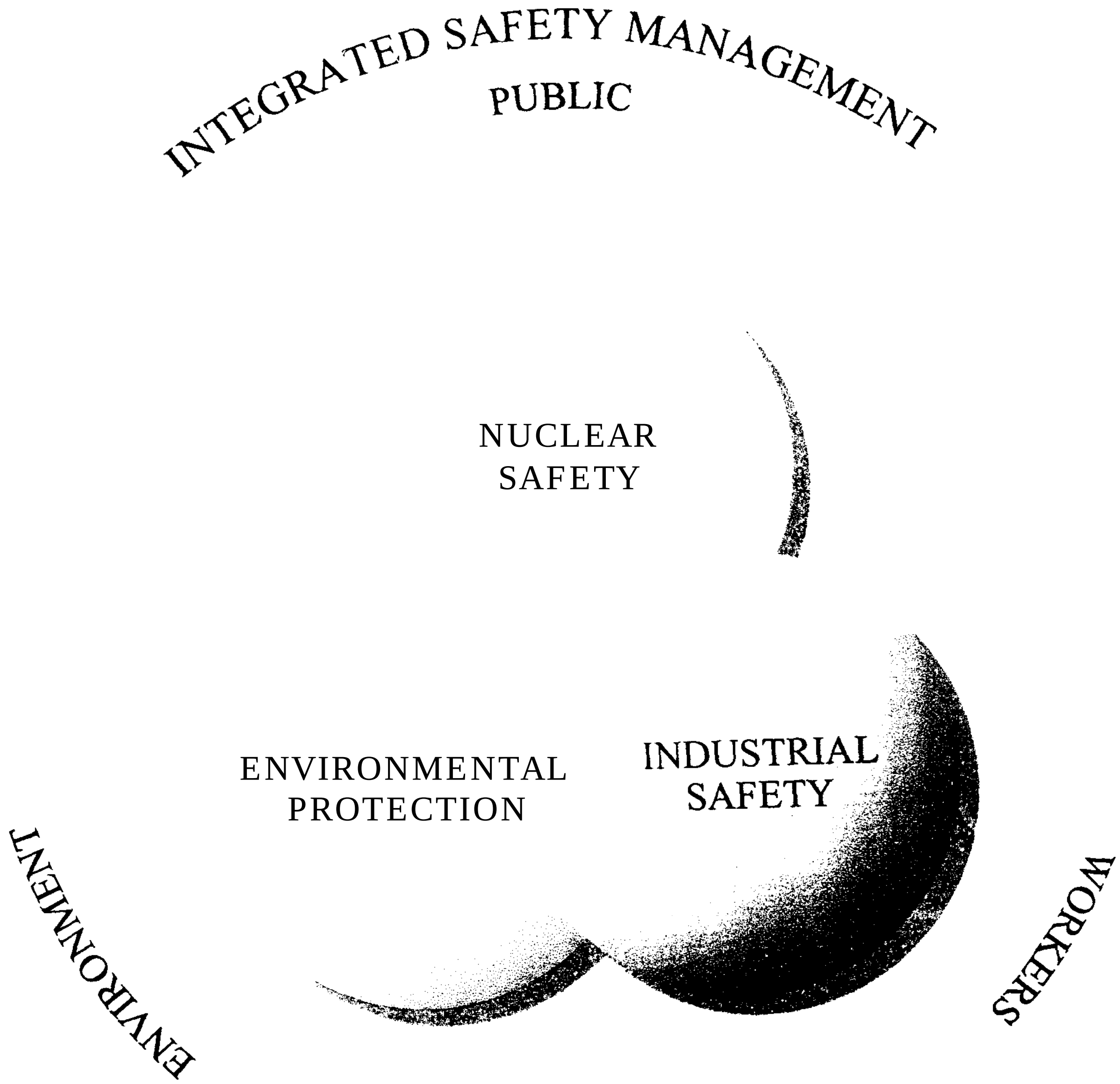
Deputy Secretary of Energy T.J. Glauthier

Integrated Safety Management: Concept Description

(short video presentation)

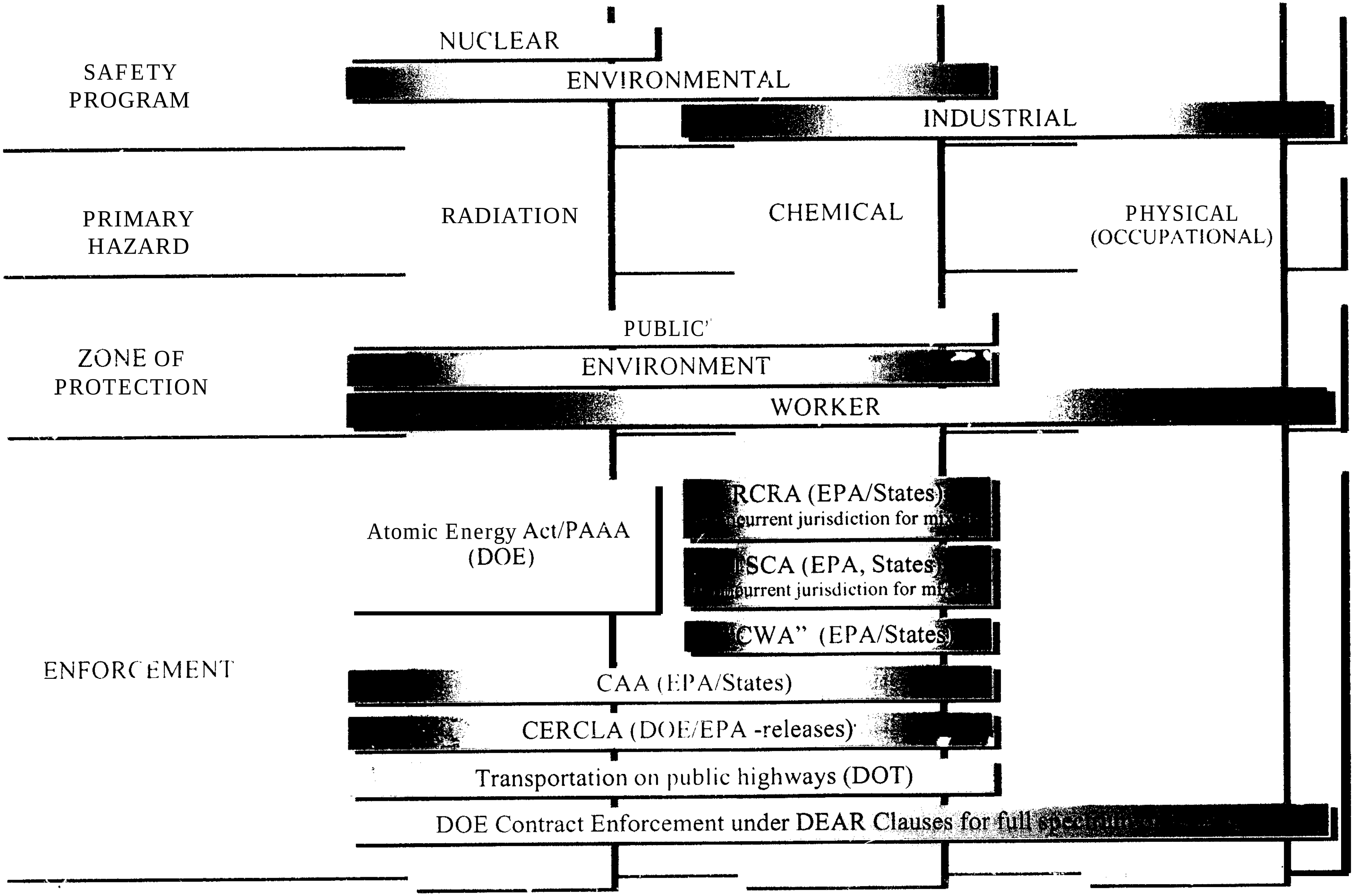
Integrated Safety Management





J.J. DiNunno, J.A. MacEvoy November 9, 1999

PROGRAMS, HAZARDS & ENFORCEMENT



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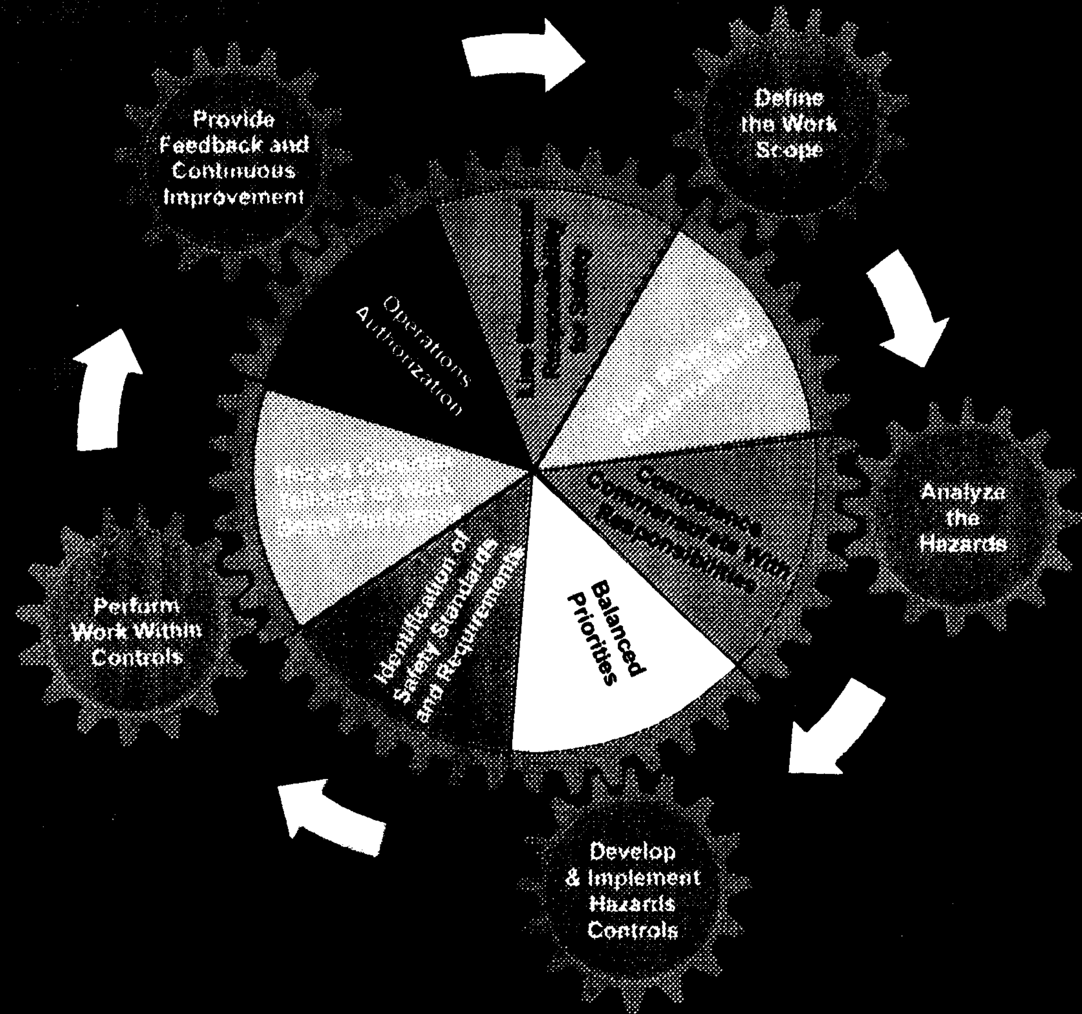
Integrated Safety Management



Integrated Safety Management: A Manufacturing/Production Perspective

Presented to ANS on November 16, 1999

by

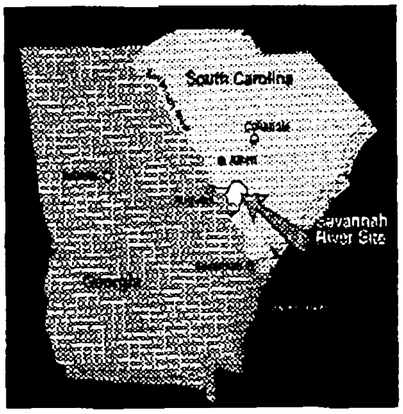
Frank R. McCoy, III, Deputy Manager
Department of Energy
Savannah River Operations Office

•In this presentation, T will briefly introduce you to the Savannah River Site, our tritium mission, facilities and program, and then describe for you how one task in the tritium program - ttitium extraction - applies the functions of our Integrated Safety Management System.

*Following this illustration of a manufacturing perspective of TSM, 1 will show how ISM also applies to the rest of the life cycle by briefly describing its application to **a** project related to the tritium program.

•I will conclude with some remarks about the guiding principles of ISM and how such a management system can apply **to** any size of organization regardless of the **complexity.**

U.S. Department of Energy
Savannah River Site (SRS)



Stockpile Stewardship

- Tritium production
- Jritium recycling

Nuclear Materials Stewardship

- Plutonium management
- Spent fuel management

Environmental Stewardship

- Environmental remediation
- Waste management

•Let me begin by introducing you to the Savannah River Site (SRS)

- SRS is located on the border of South Carolina and Georgia.

•300 square miles in size.

-About 1/3 the size of Rhode Island.

•Approximately 14,000 employees.

*Annual budget ~$1.5 billion.

*Primary missions, noted above, are associated with stewardship in three key areas - support of the nuclear weapons stockpile, management of nuclear materials, and protection of the environment.

SRS Defense Programs
Tritium Facilities

- 4 major process facilities
- 700 employees
- $100 M operating budget
- $500 M projects in progress

3

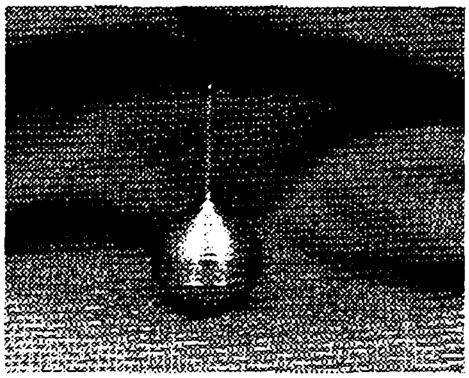
*One of the major processing areas at the Savannah River Site in support of the stockpile stewardship mission is the Tritium Facility.

•The Tritium Facility is composed of 4 major process facilities and many support buildings. It operates around the clock, 365 days per year. Approximately 700 people work in the facility and it has an annual operating budget of $100M.

•The Tritium facility has over $500M in capital projects in progress at this time. These range from projects being completed to support new missions, modemizatioo and consolidation of existing processes, and upgrades to infrastructure.

SRS Defense Programs Missions

- Tritium extraction
- Tritium reservoir exchange program
- Tritium boost system function testing



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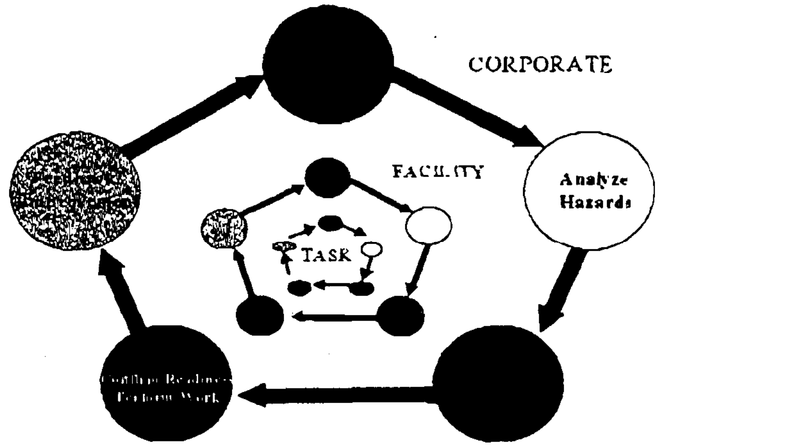
•As the name implies, the tritium facility deals with tritium, which is a radioactive gas used in some atomic weapons in the nuclear stockpile. The tritium program is a long-term, sustained mission that includes storing the tritium gas until it is needed, loading and unloading of reservoirs with tritium gas, packaging the reservoirs and shipping them to the military, and, until recently, included extraction of tritium gas from targets irradiated in nuclear reactors. In addition, the facility is responsible for testing selected reservoirs to ensure they work as designed.

•Because of the enduring nature of the tritium mission, it is important for the SRS to establish a well-structured, long-term management system to sustain the mission and maintain continuity and consistency with the rest of the SRS mission as well as with the rest of the tritium program elsewhere in the DOE Complex.

•The Integrated Safety Management System is the system to provide this maintenance and long-term continuity,

*Before I begin to illustrate the benefits and application of ISM to the tritium effort, let me say a few words regarding the structure of our ISMS and the need for a multi-level approach to implementation and application of ISM.

Integrated Safety Management System Applied at Multiple Work Levels



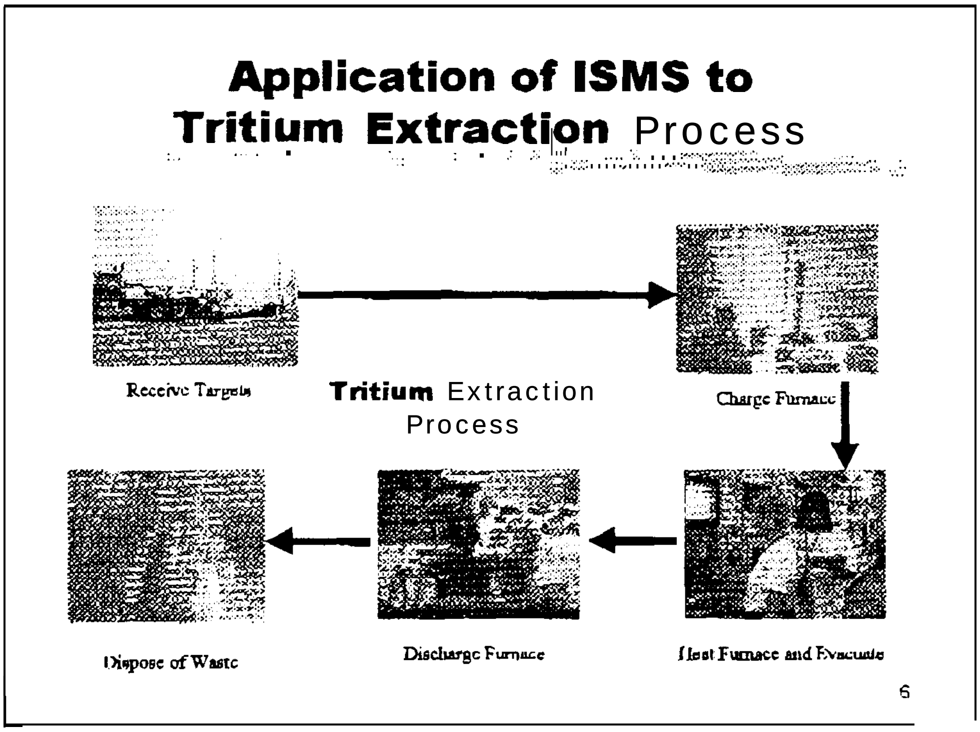
•Integrated Safety Management is a systems approach to planning and performing work safely, and applies equally to running a broad scale production plant, laboratory or facility, and, on the narrowest scale, to a particular activity, like packing a valve.

•As a systems approach, ISM provides us with the opportunity to examine, at many different levels, all salient aspects of the work under consideration, the associated hazards, and the controls and processes put in place to prevent or mitigate potential consequences from the hazards.

•Our ISM system at SRS is structured around a series of corporate (site), facility and task/activity level procedures (implementing mechanisms) based on a standard set of well-defined requirements in five core safety functions. The requirements and implementing mechanisms are aligned and integrated to ensure safety of the workers, the public and the environment in all aspects of job planning and performance.

● Since the Tritium Facility is a nuclear facility, it is required to have an Authorization Basis defined by a SAR and TSRs, which define the hazards and establish the derivative safety controls for operations within this nuclear facility. These requirements are then translated into operating procedures and training materials for operators. Examples of controls specified in the AB include engineering controls, such as a safety class fire suppression system, and administrative controls, such as control of combustible loading. An Authorization Agreement is signed by both DOE and the contractor to document formal agreement that the identified safety controls, if properly implemented, are adequate for safe operation during facility operation.

•This structure is particularly important for complex, multifaceted, and enduring production missions such as the tritium program, since it enables establishment of a comprehensive and coherent set of safety requirements and controls which is aligned with the work. This facilitates better understanding of requirements and controls by all involved in the operation which, in turn, facilitates safe and effective operation. For shorter duration or one-of-a-kind activities, the system can be tailored to a less-structured approach at the task level.



- As I stated earlier, until recently, one of the tritium program activities involved extraction of tritium gas from irradiated targets, and I will focus the rest of my discussion on this particular activity.

•The tritium extraction process was conducted in a facility designed and constructed in the late 1950's

•The tritium extraction process was conducted as follows:

 •Lithium aluminum targets that had been irradiated in a reactor were received. Part of the lithium in the target was converted to tritium in the irradiation process and the targets themselves were highly radioactive

 •They were removed from the cask using remote equipment and charged to a vacuum furnace in a stainless steel crucible.

 •The furnace was heated, the tritium was released from the targets and pumped to tanks where it was held for further processing.

 •The crucible containing the solidified "spent melt" was discharged from the furnace.

 •The crucible was prepared for disposal, put in a cask trailer, and sent to above ground waste storage vaults elsewhere on site.

•To accomplish this activity safely we implemented an integrated safety management system that required us to:

 •Define the scope of work

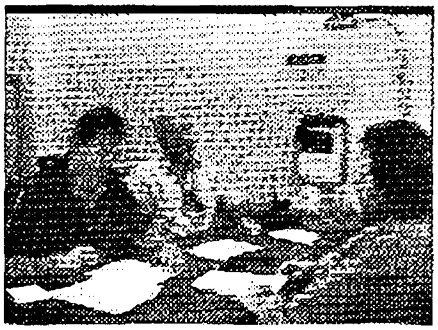
 •Analyze the hazards

 • Implement hazard controls

 •Do the work

 •Continuously reevaluate the job to do it safer each time

Define Scope of Work



CORPORATE

SRS Strategic Plan

FACILITY

Annual Operating Plan

TASK

Planning Meetings

Schedules

Work Packages

Procedures

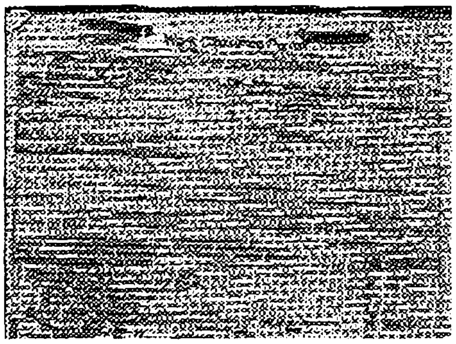
•Safe extraction of tritium started with defining the scope of work.

•One way this was done, at the corporate level, is in the SRS Strategic Plan In part, the strategic plan states that SRS will support the Department of Defense in maintaining a credible nuclear deterrent.

•At the facility level, this requirement was translated into an Annual Operating Plan that describes the extraction goals for the year.

*The scope of work was described in more detail at the task level in schedules and procedures.

Analyze Hazards



FACILITY
- Safety Analysis Report
- Process Hazards Reviews

TASK
- Job Hazards Analysis
- Radiation Work Permit
- Work Clearance Permit

*The hazards associated with tritium extraction were mainly analyzed at the facility and task levels.

•The facility has a SAR that includes a hazard analysis that leads to engineered safety features, LCO's and administrative controls necessary to prevent accidents. In addition, a process hazards review was conducted to determine if lesser significant hazards exist as a result of the extraction process.

*Specific tasks associated with the extraction process were analyzed by job hazards analysis, radiation work permits, and work clearance permits,

Define/Implement Controls

CORPORATE

Hazardous Energy Control

FACILITY

SAR

TASK

Radiation Work Permit

Work Clearance Permit

Procedures

Pre-job Briefing

9

*Once all the hazards were identified, controls were implemented. At the corporate level, an example of a control was required use of the hazardous energy control procedure for lock/tag outs.

*The SAR and TSRs once again play a key role by defining LCO's and administrative controls that must be implemented for safe operation. Examples of the types of requirements specified by these documents included engineering controls, such as a safety class fire suppression system and safety significant ventilation system, and administrative controls, such as minimum staffing requirements and control of combustible loading,

•At the task level, pre-job briefings, procedures, and various permits all describe controls that must be put in place prior to operation.

Perform Work

CORPORATE

Disciplined Operations

Operations Authorization

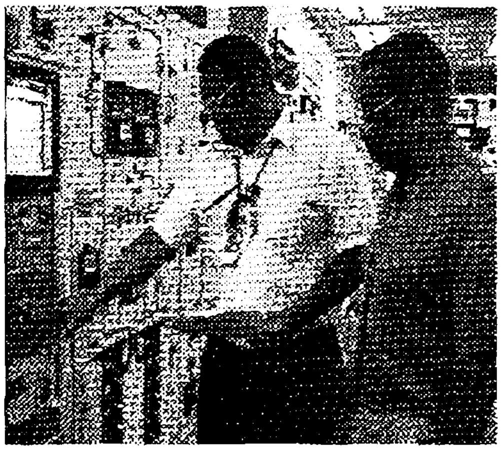
FACILITY

Safety Analysis Report

TASK

Training

Procedures



16

*Once all the hazard controls are in place, operations can authorize the tritium extraction process to begin. For routine tasks such as tritium extraction, authorization came after a prejob briefing; for complex, nonroutine tasks, a more formal readiness verification review process is required.

*We work to foster a culture of disciplined operationwhich ensures that we have good operating procedures that are followed by trained operators. All personnel have stop work authority and are commended when they use it to make an operation more safe.

TRANSITION

*Once the job has started, it is important that we learn as we go and try to improve all aspects of the job over time. One of the 5 imperatives at SRS is Continuous Tmprovement and the next core function is supported by that imperative. There are a variety of programs that are used to ensure we learn from our operating experience.

Feedback/Improvement

CORPORA-

- Independent Oversight
- Lessons Learned
- Corrective Action

FACILITY

- Assessments
- Post Job Reviews
- Focus Time
- Management Walkdowns

TASK

- Critiques

11

*The Tritium Facility has implemented a management assessment program that is composed of several different tools used to ensure that managers and supervisors critically evaluate operations and implement improvements. Examples of these tools include a strong observed evolution program and coaching tours, These tools ensure that managers spend time in the field, observing operations and coaching operators. We have found this to be one of the best ways of communicating standards to the workforce.

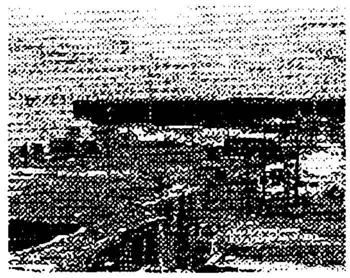
*At the corporate level, our contractor has implemented an independent Facility Evaluation Board process that provides valuable feedback on operations. In addition, DOE provides independent oversight of all aspects of operation.

*When things go worse or better than expected, critiques and post job reviews are performed to capture lessons learned.

•An important element of the feedback and improvement function involves learning from both internal and external feedback and then improving facilities, equipment, procedures and competency in response to those lessons learned.

Original Tritium Extraction Facility
Changing Times

- Mission - Extract Tritium from Irradiated Slugs
- Construction - 1953 to 1955 at Cost of $3.9M
- Operation - 1955 to 1957



- Post Operation - Process Flushed and Facility Deactivated in 1959
- Facility Decommissioned in 1997

•The tritium extraction process was successfully performed at SRS for the past 40+ years through two generations of processing technology.

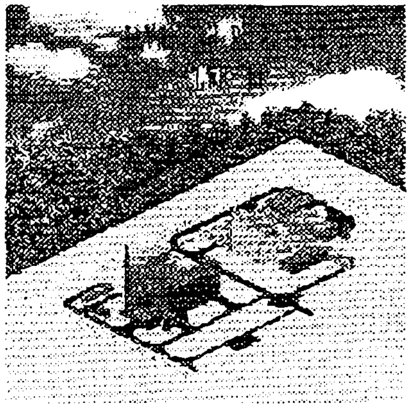
*The earliest processing took place in the facility shown on the left during the 1950s. However, that technology was discontinued due to limited capability and capacity and replaced by the current second generation facility in 1957. The first facility was deactivated in 1959 and eventually decommissioned in 1997.

•During operation of the second generation facility, many other significant changes took place world wide. These changes resulted from operating experience, improved technology, and changes in operational philosophy and standards.

-We were able to modify the facility or operating procedures to address many of these changes; however, to fully take advantage of our operating experience, improvements in technology, and to decrease risk to workers and the public, a new third generation facility is being designed in a manner which applies the principles and functions of ISMS.

Tritium Extraction Facility Project
Impetus for Change

- Improvement as part of any enduring mission
- Use of 40-year-old design technology in current facility
- Heightened focus on worker, public and environment protection
- Desire to capitalize on years of operations knowledge/experience



13

*Before I describe how we are applying ISMS to this new project, I will provide some background regarding this new facility.

•As I stated earlier, as part of the feedback and improvement function, any long-term mission has the responsibility to constantly learn from experiences and develop improvements based on results from many sources of feedback. Prior SRS tritium extraction processing was based on facility designs and technologies developed in the late 1950's and much has been learned since then.

*Environmental and worker impacts that were accepted in the past are no longer tolerated; the focus is now on maximizing protection to the workers, public and environment through design enhancements and processing practices. Examples of design changes that are being made to address these priorities in the new Tritium Extraction Facility include glovebox containment for process equipment and significant improvements in instrumentation that allow better process control.

•The new Tritium Extraction Facility will adopt current applicable laws, regulations and standards at the earliest stages of design. It will likewise take advantage of many years of operational knowledge acquired through the use of the current facility and factor required improvements into the design.

- This 3rd generation Tritium Extraction Facility will be designed and constructed to sustain the Tritium Program mission into the next century.

Tritium Extraction Facility Project Changes/Benefits

Environmental

Heavy Water Reactors	Use of existing commercial reactors
Tritium releases directly to atmosphere	Use of stripper systems
Cryogenic separation of hydrogen isotopes	Use of metal hydrides

Personnel

Use of fume hoods	Use of glovebox technology
Exposure to hazardous waste	Elimination of mercury and other hazardous wastes
Reliance on 40-year-old designs	Design changes to minimize exposure to high radiation fields

•I will now discuss some of the changes being factored into the new facility design.

*With the demise of heavy water reactors as a source of tritium, existing commercial reactors are being advocated to avoid environmental impacts from the construction of new production facilities.

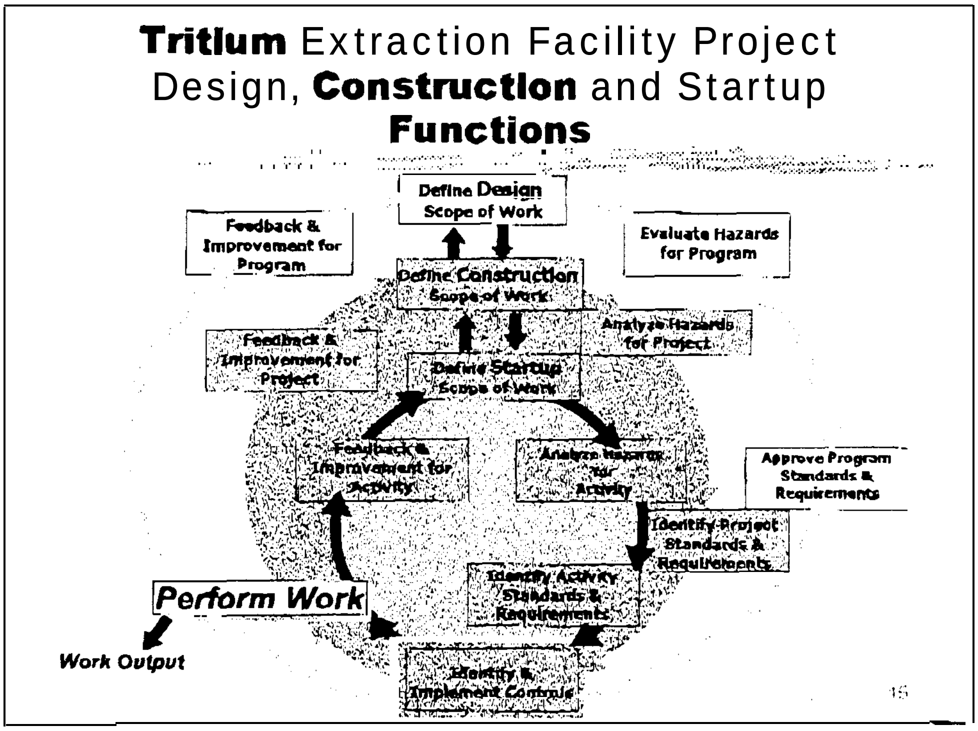
*Whereas the accidental or routine releases of tritium were previously directed to the atmosphere, stripper systems will now be used to capture the tritium and minimize stack emissions.

● The use of latest standards and technology will incorporate the use of metal hydride separation capability in the TEF design and avoid the need for cryogenic distillation which posed a higher risk to facility workers and the public.

*Personnel protection will be maximized through the use of glovebox technology to confine the tritium gas and avoid simple use of fume hoods.

● Similruly, the use of oil/mercury-free vacuum pumps will eliminate the generation of and exposure to mixed waste from mercury vacuum pumps,

•Because of the high radiation fields associated with processing commercial reactor materials, 40-year-old designs are being replaced by the use of hardened concrete vault areas and extensive remote handling equipment to minimize personnel exposures.



*Execution of a major project like TEF also requires a structured systems approach and uses the same multi-level models applied to operations.

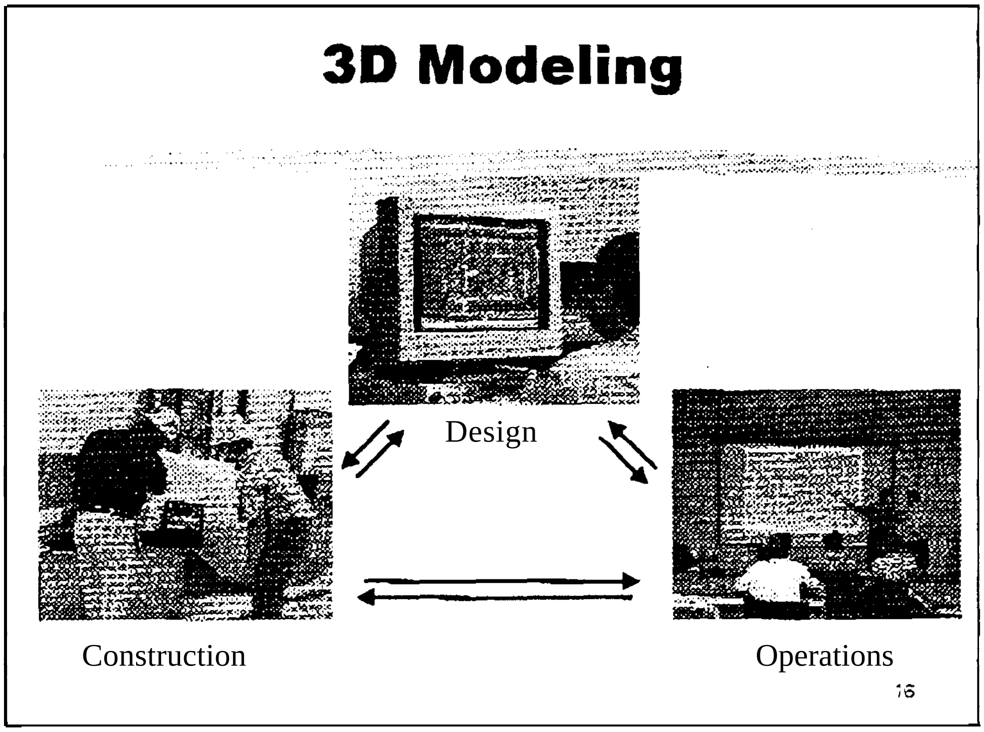
*Earlier I spoke about an ISM system that includes implementing mechanisms applicable to multiple levels of the organization - corporate, facility and task/activity.

-That same continuum of a layered approach applied to projects assures systematic integrity for design, constructability and operational enhancements.

*The above figure shows the multiple levels of Design, Construction and Startup, and the association of the ISM core safety functions to each level. While this schematic may appear to be an over complication, it is necessary to convey two important ideas. First, the importance of properly aligning the work scope through each phase of the project, and, secondly, the importance of utilizing the same management system with each phase of the project.

*Properly addressing these two concepts throughout the entire project phase should assure proper interface of operational and constructability needs with the project design, proper interface of safety analyses with the project design, and effective development of procedures and competencies. To this end, there is less likelihood for confusion, conflict and inefficiency as one progresses into operation,

•An example of multi-level interfacing in projects is demonstrated by the 3D modeling approach currently being used in the tritium facility.



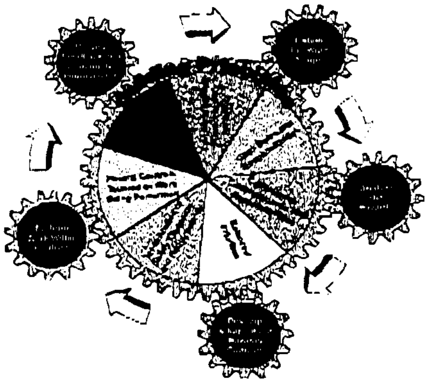
- 3D modeling has been effectively used by design, construction, and operations during some projects to improve results and it's really just a small part of the ISMS system implemented at SRS.

- In the past it has been difficult to get good input from operators and construction personnel early in the design process. It was difficult for operators to review hundreds of drawings, pick out the things that would not work or could be done better, and communicate those comments to designers. We are now designing using 3D models, This tool makes it simple for operators to actually see what the system will look like once it is built. Problems are obvious and different solutions can be easily evaluated. This tool will also be used by construction to build the glove box piping systems.

- 3D modeling is currently being used to design a complicated modification to the tritium loading facility and it is going to be used in the design and construction of the new Tritium Extraction Facility,

Achievement of a Cohesive, Holistic Integrated Safety Management System

- Establish a **coherent** set of requirements across organizations
- Codify requirements into reasonable set of implementing mechanisms
- Embody within Guiding Principles of Integrated Safety Management



•Having described the benefits of an ISMS for one part of our mission activity, I would now like to address the proposition being explored by the panel, namely, the need and timeliness of statutory reform to achieve more cohesive, holistic government-mandated protection programs and a more efficient government administration of them.

- This figure depicts the integration of ISM principles and functions, and the importance of both to the maintenance of an integrated safety management system.

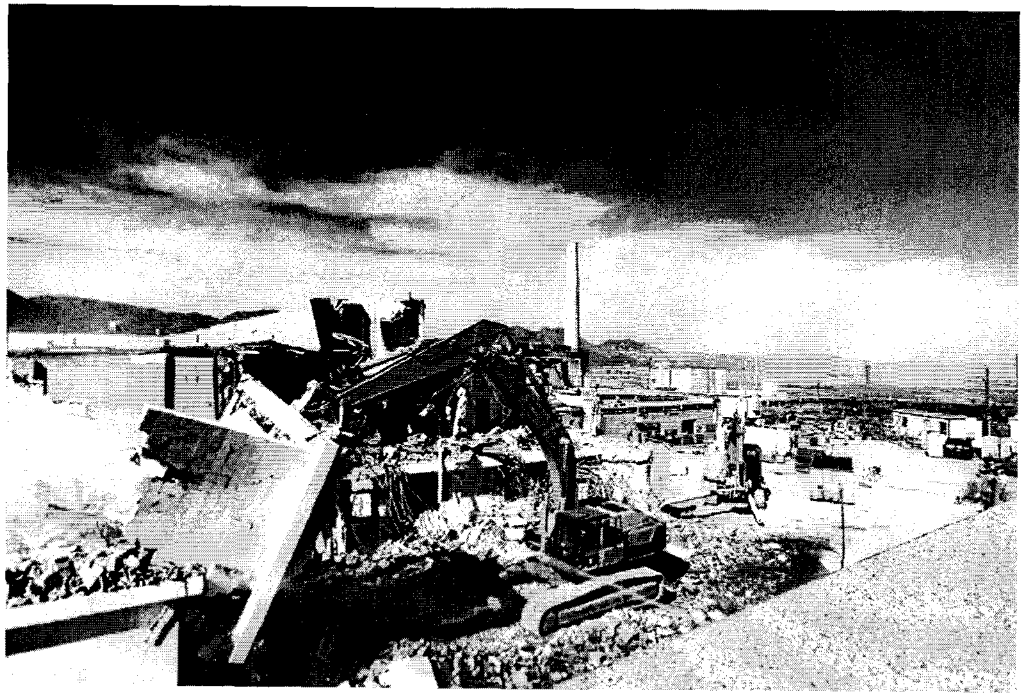
•If one can picture a site the size of the SRS with the number of different mission functions in progress, the number of different functional programs in operation, the number of different organizations in place, the number of different areas across the site, and the multiple levels of implementation in each of these examples, the overall performance becomes a very complex array of literally thousands of individual activities. This complexity could produce chaos and a potential for unsafe work without the existence of an integrated safety management system.

•This complexity is managed not only through the core safety functions, but is embodied by the widespread application of the Guiding Principles. Without these principles, we would have gaps in management authority, lack competence in our responsible personnel, lack orderliness in the work by not setting priorities, and experience conflicts due to differences and inconsistencies in standards and requirements.

•A properly implemented ISM system assures a coherent system for planning and performing work that avoids the condition just described.

•If an ISM system is good for the complex missions and activities at SRS, then why wouldn't it be suitable for a larger or higher level of government orderliness? I would offer such a proposition is worthy of examination and should be considered for a broader community of government activities.

Application of Integrated Safety Management for Nuclear Decommissioning



Presentation to the American Nuclear Society

November 16, 1999

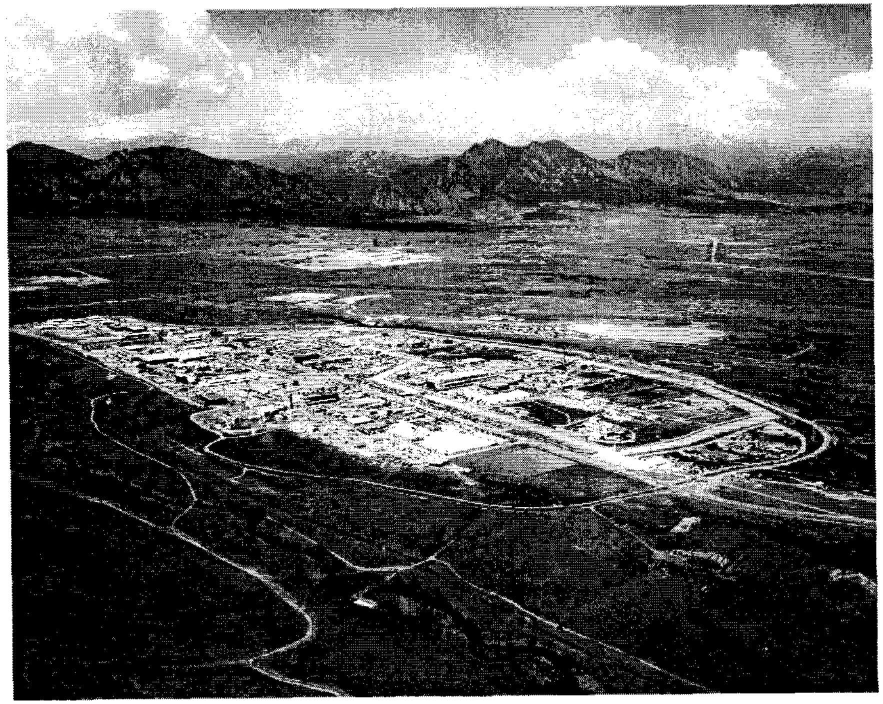
Mark Spears

Director, Environment, Engineering, Safety and Quality Assurance, Kaiser-Hill Company

CLOSURE 2006
ROCKY FLATS CLOSURE PROJECT
KAISER-HILL

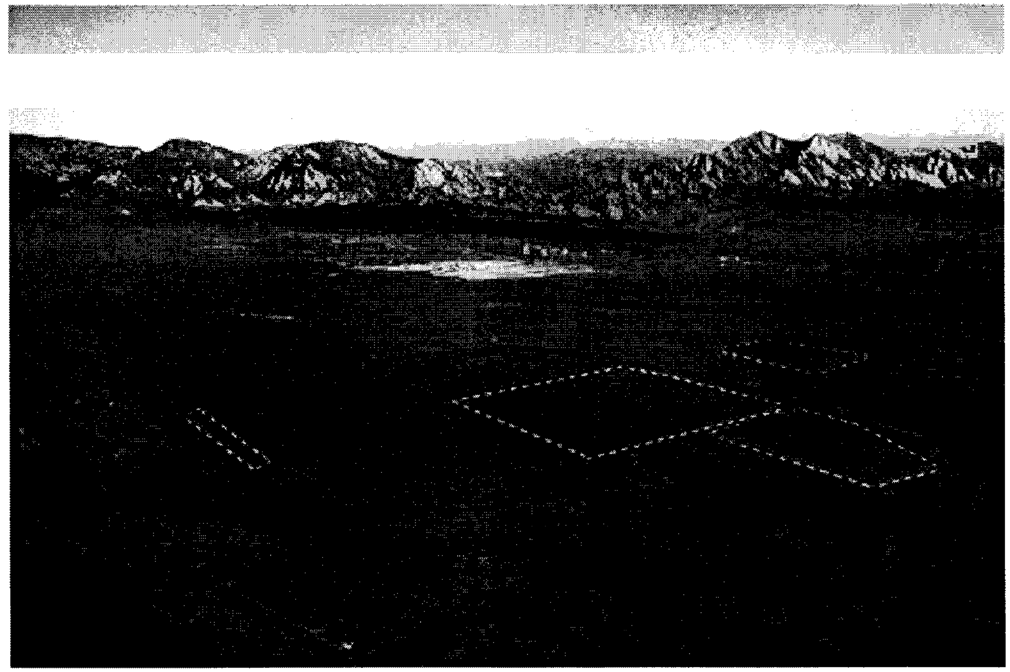
About Rocky Flats

- 1950's era DOE Weapons Complex Facility near Denver, Colorado
- Plutonium processing and machining facilities
- Significant radiological and chemical hazards remain
- Production mission ended 1993
- Site will be closed by 2006



The Rocky Flats Challenge

- While achieving best-in-class safety and compliance results close the site for $30 billion and 60 years less than the 1995 baseline
- Safety is the key to enabling this rapid closure
- ISM is the key to our safety program



CLOSURE 2006
ROCKY FLATS CLOSURE PROJECT
KAISER-HILL

Key Features Of Rocky Flats Affecting Safety Management Systems Design &Application

- Limited remaining life of the project
- Mix of ongoing heavy nuclear operations with all phases of decommissioning sometimes even in the same building
- Need to streamline ongoing maintenance and operation costs to reduce \$350M/yr of "mortgage" costs
- Significant safeguards concerns generated by large quantities of weapons ready plutonium
- Major legacy environmental issues
- Quality assurance requirements associated with the compliant off-site shipment of Special Nuclear Material and other waste forms
- Very diverse work force (over 200 different companies on-site)

ISM Approach

- ISM methodology designed to handle multiple hazards encountered in short term and non-routine nature of facilities and work
- Key ISM elements are incorporated into the site closure project baseline development and the work activity planning and control process
  - Closure project baseline anticipates and responds to emerging safety and compliance issues
  - All work activity funneled through a standard process which recognizes that up front hazard identification is a key ISM step
- ISM approach also applicable to managing requirements associated with environmental management, safeguards and quality assurance

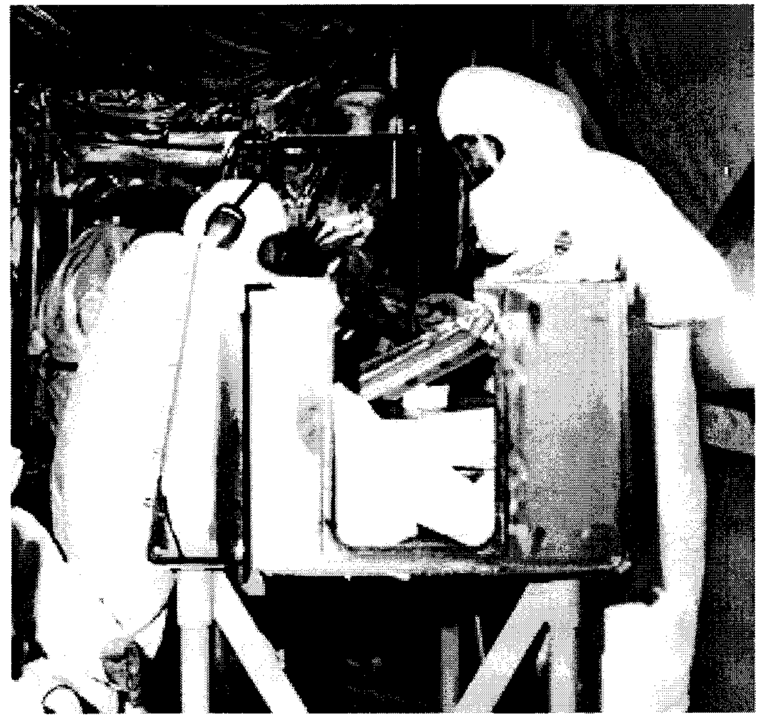
Closure Project Baseline

- ISM principles used in high-level budgeting and scheduling
- Drives macroscopic control decisions at project level
  - Robotics *vs* manual size reduction
- Up-front safety planning at project baseline pays dividends in cost and schedule at the activity level

CLOSURE 2006
ROCKY FLATS CLOSURE PROJECT
KAISER-HILL

Work Planning Challenges in a Closure Environment

- Process must be adaptable to a wide range of activities and hazards - from glovebox strip-out to snow removal
- Significant uncertainty in presence of hazards (Box of Chocolates)
- Reliance on temporary safety systems as permanent ones are removed
- Feedback extremely important to rapidly apply lessons-learned for new D&D technology
- Worker safety in D&D environment drives Site risk



CLOSURE 2006
ROCKY FLATS CLOSURE PROJECT
KAISER-HILL

Integrated Work Control Program

- Kaiser-Hill implements ISM through the Integrated Work Control Program (IWCP)
- The IWCP Manual defines process - one stop shopping
- All work performed at the Site uses IWCP for work planning
- Ensures consistent hazard screening to uniform criteria
- Ensures hazards are appropriately analyzed and controlled
- Activity Screening Process and Job Hazard Analysis are unique

IWCP (Continued)

Activity Screening Process

- Determines complexity of planning effort including detail of hazard analysis
- Identifies Subject Matter Experts early in process
- Numerical grading system
- Pre-screen provides exemption path for routine, negligible risk activities
- Determines applicability of ISM DEAR clause to subcontracted services

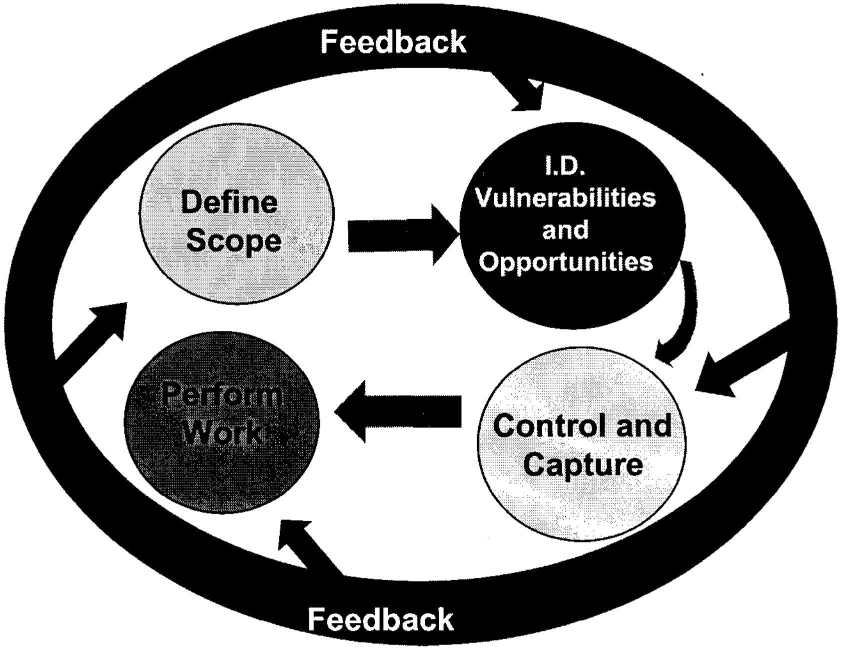
IWCP (Continued)

Job Hazards Analysis

- 82 questions identify anticipated hazards
- Involves Subject Matter Experts in work planning process
- Identifies controls for each hazard
- Tailored to address D&D

Application to Other Assurance Areas - Environmental, Safeguards, Quality Assurance

Integrated Environmental



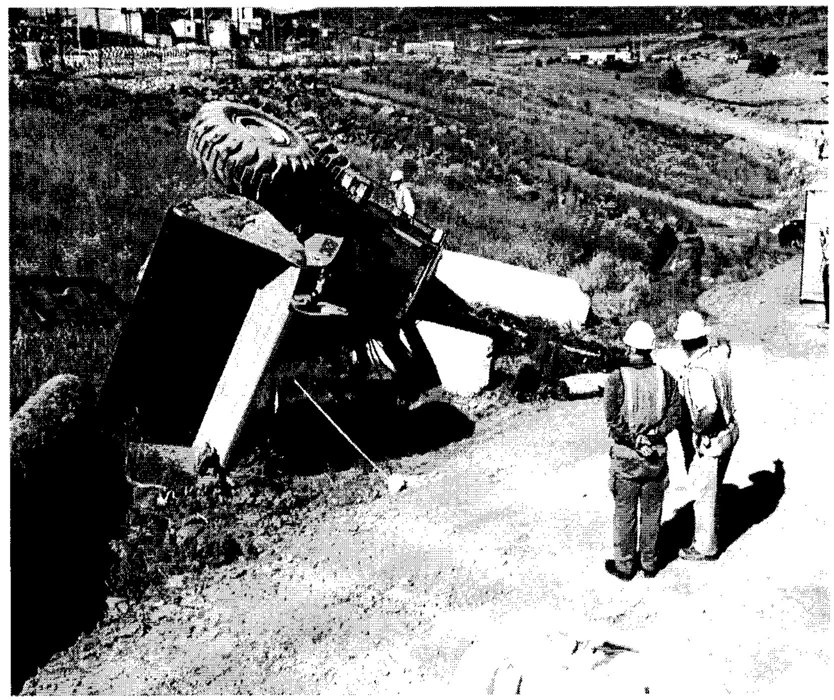
Management System

- *Define the Scope*
  - Activities
  - Compliance requirements
  - Stewardship elements
  - Consultative process
- *Identify and analyze the vulnerabilities and opportunities*
  - Potential releases
  - Waste management
  - Stewardship opportunities
- *Implement controls and capture opportunities*
- *Perform the Work*

CLOSURE 2006
ROCKY FLATS CLOSURE PROJECT
KAISER-HILL

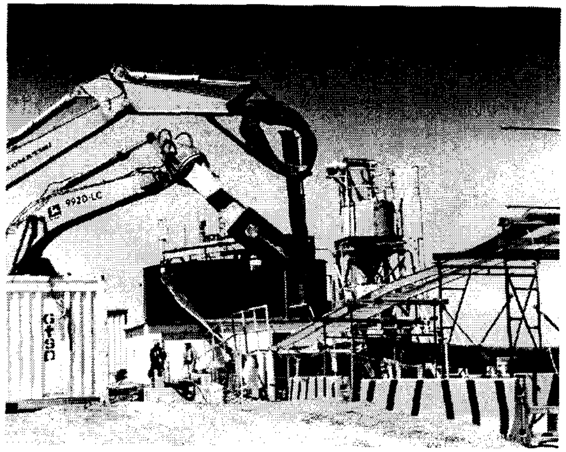
Improvements Needed At Rocky Flats

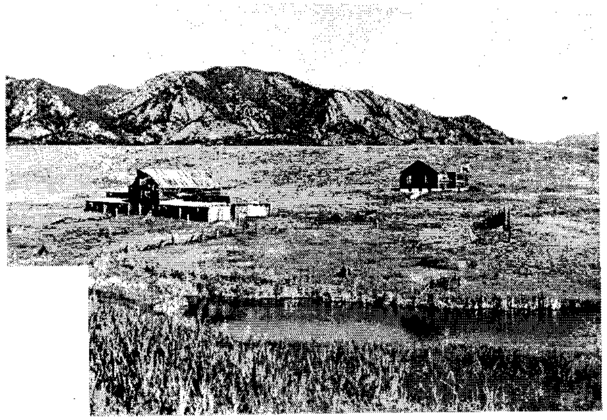
- Minor maintenance work control
- Full integration of safety disciplines with IWCP process
- Quality Assurance
- Initial project screening and engineering interface with entry into the work control process
- Compliance with process at the floor
- Oversight and control of subcontracted work, including use of temporary workers



Summary

- ISM is our core process for safety
- ISM is an integral part of how we plan, execute and control work
- Adopting the model for all programmatic areas at the Site
- Can be applied at a closure site





CLOSURE 2006
ROCKY FLATS CLOSURE PROJECT
KAISER-HILL

Integrated Safety Management at Los Alamos National Laboratory: A National Weapons Laboratory Perspective.

Bruce Matthews and Bill Zwick
1999 American Nuclear Society Meeting

Integrated Safety Management is a powerful tool for assuring constantly changing research activities are performed in accordance with regulatory requirements. Los Alamos adopted the principles of Integrated Safety Management in 1996 and since that time has implemented formal policy that applies to the entire workforce. Integrated Safety Management requires that all work be performed in accordance with the five core safety management functions, and that all workers meet safety requirements defined in Laboratory operations requirements. Those documents serve as the implementing requirements for the contractually-sanctioned Work Smart Standards set comprised of Federal rules, DOE orders, and consensus standards. Importantly, the Work Smart Standards set has been compiled based on the work performed at the Laboratory and the hazards associated with that work.

Integrated Safety Management at Los Alamos is implemented at three levels:

1. At the Institutional Level, standards, contractual requirements, and performance expectations define the highest level of requirements.
2. At the Facility Level, requirements are defined in implementing requirements and guidance documents, safety plans, and work control requirements
3. At the Activity Level authorized work is based on process hazard assessments, safe operating procedures and worker training.

Historically, the TA-55 Plutonium Facility has been held to higher standards of safety management than many other facilities within the Laboratory because of the potential hazards associated with the handling and processing of large quantities of nuclear materials. Improved safety management systems began with a facility-wide stand down in 1993 and evolved to the current system that is compatible with Laboratory Implementation Requirements.

One of the keys to safe operations in a nuclear materials R&D environment is managing change at well-defined interfaces. A deliberate hierarchical relationship enables the drill down of the Laboratory Implementing Requirements at the division management, facility management, technical line management and worker levels to assure that hazards are mitigated, work is authorized, and changes are formally managed. Ownership boundaries and work authorization processes have been established starting at the glovebox level where the hazards exist. The goal is to provide a clear set of expectations and requirements that will permit the individual worker to operate safely and compliantly in the areas he/she controls while retaining the flexibility required to work productively and to contribute to missions requiring nuclear materials research, development, and production.

Bruce Matthews
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Integrated Safety Management at Los Alamos

"A National Weapons Laboratory Perspective"

Bruce Matthews & Bill Zwick

1999 ANS Winter Meeting

Los Alamos National Laboratory: The Work

The Lab's mission is to enhance global security by:

- Ensuring the safety and reliability of the US nuclear weapons stockpile
- Reducing threats to US security with a focus on weapons of mass destruction
- Cleaning up the legacy of the cold war
- Providing technical solutions to energy, environment, infrastructure and health threat problems

Laboratory ES&H Policy

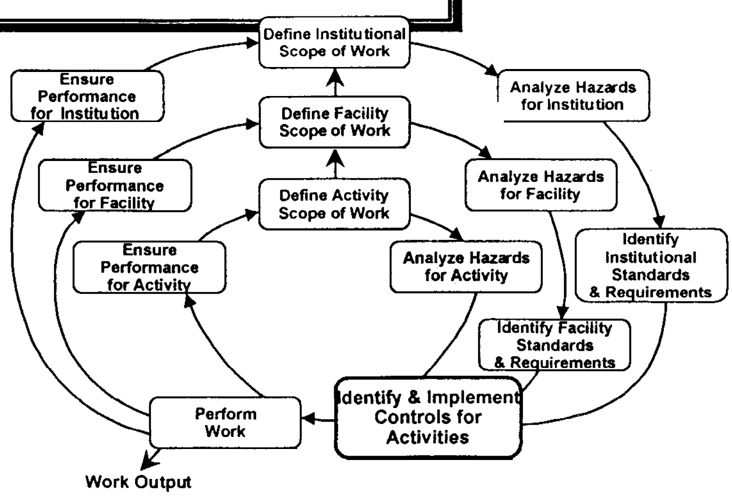
Safety is first at LANL.
We will never compromise safety for operational needs.

We are committed to achieving excellence in environment, safety and health performance. In meeting the moral imperative not to injure people or the environment while accomplishing our mission, and the business imperative to meet the environment, safety, and health requirements of the contract between the University of California and the Department of Energy, the employees, contractors and guests of the Los Alamos National Laboratory will strive to have:

- Zero injuries and illnesses on the job
- Zero injuries and illnesses off the job
- Zero environmental incidents
- Zero ethics incidents
- Zero people treatment incidents
- Zero safeguards and security violations

ESH 99-343 (7/99)

Three Levels of ISM

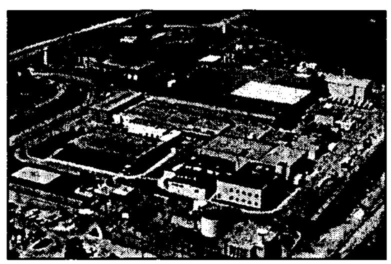


LIR Implementation

- – Facility Tenant Agreements
- – Facility Management Work Control
- – Safe Work Practices
- – Management Safety Walk-Around
- – Authorization Basis for Hazardous Facilities
- -Worker Safety Concerns Program
- – Quality - Nuclear
- – Facility Configuration Management
- – Electrical Safety
- – Radiological Protection

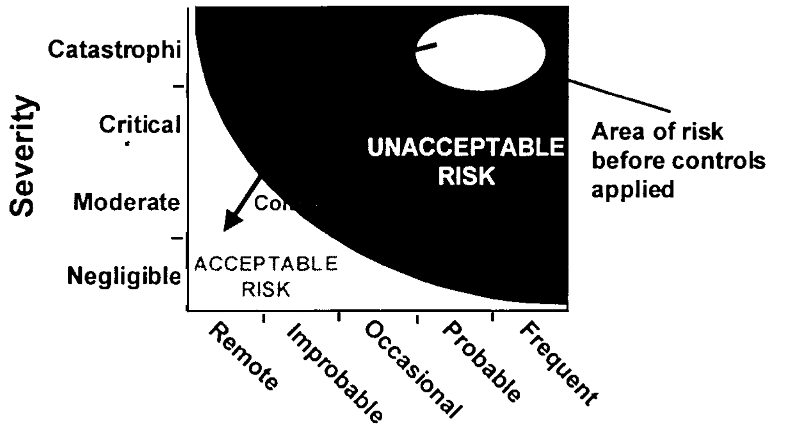
Facility Management Units

- LANL is divided into 20 FMUs
- Managed by 13 Technical Divisions
- Range from high hazard radiation facilities, to
- High hazard explosive testing operations, to
- Medium hazard chemical and biological labs to,
- Low hazard administration buildings



TA-55 Plutonium Facility

SWP: Controls must move the operation into the domain of acceptable risk



Los Alamos

Integrated Safeguards & Security Management

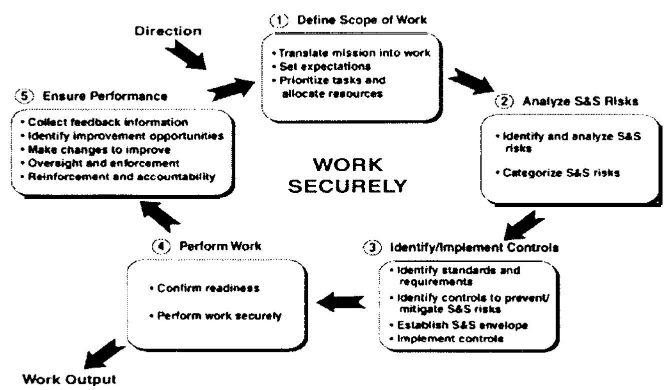
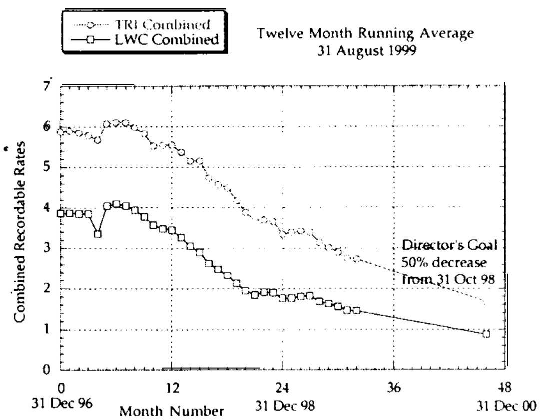


Figure 2. Integrated Safeguards & Security Management (ISSM) Core Functions

Los Alamos

PERFORMANCE



TA-55: The Work

Technical capabilities

- ***Plutonium metallurgy***
- ***Actinide chemistry***
- ***Actinide ceramics***

Surveillance
Manufacturing
Aging

Residue stabilization
Waste minimization
Metal preparation

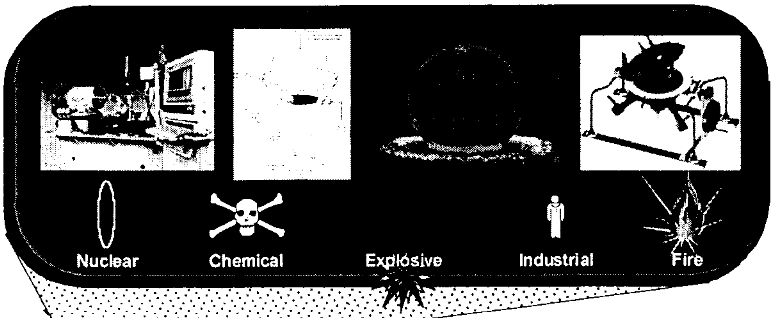
MOX fuels
^{238}Pu heat sources

Operations infrastructure

- ***Facility management***
- ***Waste management***
- ***Nuclear materials management***
- ***Fissile material handler training***
- ***Safeguards and security***
- ***Radiation protection***

TA-55 Safety Management Approach

GLOVEBOX (Staff Responsibilities)
SOP, RWP, S WP, Exp. Plans



Goal: Enable technologists to solve plutonium problems, while working in a safe and compliant facility.

Los Alamos

NMT-DO (VG)95-146b NMT-DO Overview

Three Levels of ISM, Continued

- *Institutional Level*
  - *Division Level:* **Authorization Agreement, Quality Management Plan, Safety Manual, Division Procedures**
- *Facility Level*
  - *TA-55/CMR:* **Facility Safety Plan, Facility Safety Analysis, Technical Safety Requirements, Facility Procedures**
- *Activity Level*
  - *Laboratory Level:* **Process Hazard Analyses, Change Control Manual**
  - *Glovebox Level:* **Safe Operating Procedures, Experimental Plans, Work Instructions**

Levels of Work Authorization

Los Alamos National Laboratory DOE/UC contract, Work Smart Standards, LPRs, LIRs, LIGs

NMT Division (Division Director) Authorization Agreement, QMP, Safety Manual, Division Procedures

CMR and TA-55 Facilities (Facility Manager)
Facility Safety Plan, BIO/FSAR, TSRs, USQDs, Change Control Manual, ORRs/RAs, Facility-Procedures

CMR and PF-4 Labs (Technical Managers)
PHA, Change Control, GLRVs

Activity-level Work (Staff)
SOPs, RWPs, SWPs, Exp.. Plans, Work Instructions

Start/Restart for Experimental Work

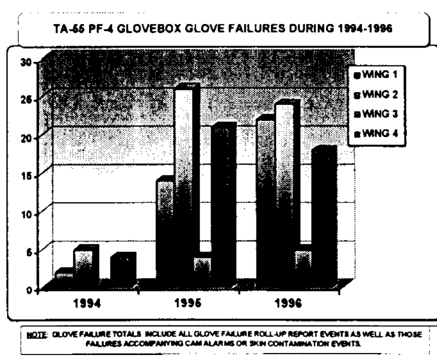
- Process change in scope of existing SOP?
  - Yes: Glovebox walk down
  - No: Review against existing HA
- Existing, adequate hazards analysis?
  - Yes: group-level readiness verification (GLRV) to authorize work
  - No: develop hazards analysis and perform USQ screen

Start/Restart for Experimental Work

- Unreviewed Safety Question Determination required?
  - Yes: perform USQD
  - No: GLRV, Readiness Assessment, or Operational Readiness Review to authorize work
- USQD outcome?
  - Negative; GLRV, RA, or ORR
  - Positive: RA or ORR if approved by DOE; work not performed if disapproved

Performance Assurance

- Input Data:
  Management Walkarounds, Occurrence Reports, Safety Inspections, Post-job Meetings, Employee Safety Suggestions, Lab Assessments, External Audits & Assessments
- Issues Management:
  Track on computer database
- Performance Assurance:
  Analyze data and trends
- Operating Experience:
  Advise managers, monthly and quarterly performance reports, Safety Bulletins, Lessons Learned



Integrated Safety Management: National Laboratory Perspective

Presented to

ANS Session on Integrated Safety Management

November 16, 1999

Dennis C. Parzyck

Oak Ridge National Laboratory

The following topics will be addressed in this presentation

- Need for integrated safety management at the national laboratories
- Integrated safety management at Oak Ridge National Laboratory
- Need for broader regulatory integration

The national laboratories require an integrated management approach in order to carry out their mission in a safe and effective manner.

- **Research activities range from desktop to reactor technology**
- **Associated hazards span those well known to those unknown**
- **Hazard controls frequently require new knowledge**
- **Research activities are often first-of-a-kind or one-of-a-kind**
- **Feedback mechanisms are extremely limited**

Only an integrated approach provides a balanced response to the complexity and diversity of a national laboratory.

- **Nature of work must provide basis for safety program**
- **All potential hazards must be considered in a balanced manner**
- **Controls must protect workers, the public, and the environment**
- **All potential impacts must be identified and addressed**

A balanced approach requires that environment, safety and health considerations are integrated into every aspect of research planning and execution.

- **Standard setting addressed, particularly if no standard exists**
- **Safety program developed as basic element of planning**
- **Hazard controls modified as research changes or evolves**
- **Performance review made against research expectations**
- **Effective feedback mechanisms developed**

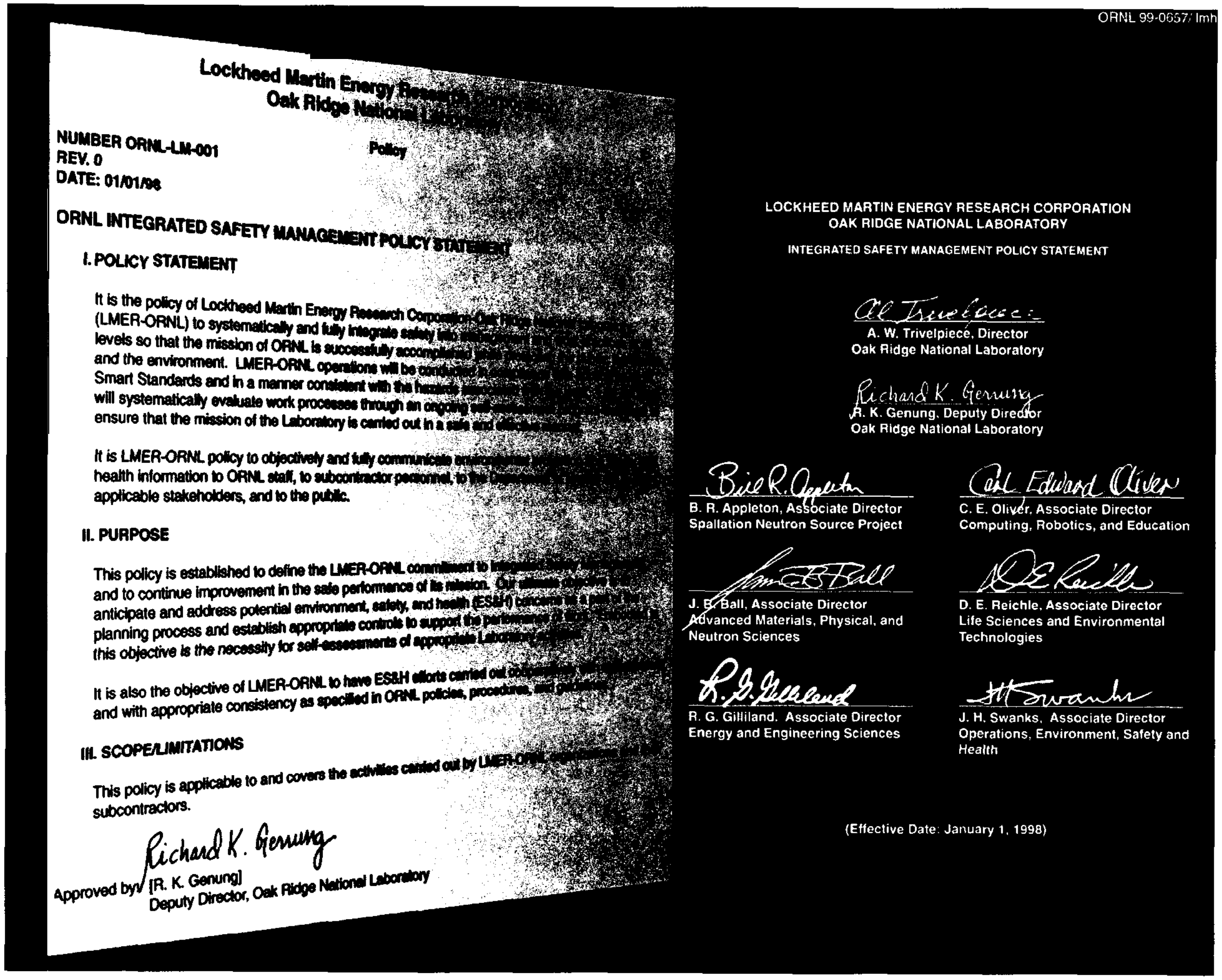
A fully integrated approach requires that those performing the research take ownership of work planning and execution.

- Line ownership of management integration process considered a necessity
- Management process tailored by those performing research
- Continuous mentoring of process by experienced parties
- Management leadership in development of process tools
- Ongoing line management role in evolution of process

The role of line management in integrated safety management has been implemented at Oak Ridge National Laboratory through the ORNL ISMS Program.

- **ORNL ISMS Program supported by line management policy**
- **WSS Sets tailored for each type of research or support activity**
- **ISMS Plans tailored to all research and support divisions**
- **ISMS Implementation Committee and support organization providing continuing guidance**
- **ISMS tools developed by ISMS Implementation Subcommittees**
- **Feedback mechanisms produced with line management leadership**

The ORNL ISMS Program was founded with the visible support of ORNL line management.



Lockheed Martin Energy [illegible]
Oak Ridge National [illegible]

NUMBER ORNL-LM-001 Policy
REV. 0
DATE: 01/01/98

ORNL INTEGRATED SAFETY MANAGEMENT POLICY STATEMENT

I. POLICY STATEMENT

It is the policy of Lockheed Martin Energy Research Corporation-Oak Ridge [illegible] (LMER-ORNL) to systematically and fully integrate safety [illegible] levels so that the mission of ORNL is successfully accomplished [illegible] and the environment. LMER-ORNL operations will be conducted [illegible] Smart Standards and in a manner consistent with the hazards [illegible] will systematically evaluate work processes through an ongoing [illegible] ensure that the mission of the Laboratory is carried out in a safe and [illegible]

It is LMER-ORNL policy to objectively and fully communicate [illegible] health information to ORNL staff, to subcontractor personnel, to [illegible] applicable stakeholders, and to the public.

II. PURPOSE

This policy is established to define the LMER-ORNL commitment to [illegible] and to continue improvement in the safe performance of its mission. [illegible] anticipate and address potential environment, safety, and health (ES&H) concerns [illegible] planning process and establish appropriate controls to support the [illegible] this objective is the necessity for self-assessments of appropriate [illegible]

It is also the objective of LMER-ORNL to have ES&H efforts carried out [illegible] and with appropriate consistency as specified in ORNL policies, procedures, and [illegible]

III. SCOPE/LIMITATIONS

This policy is applicable to and covers the activities carried out by LMER-ORNL [illegible] subcontractors.

Approved by: [R. K. Genung]
Deputy Director, Oak Ridge National Laboratory

ORNL 99-0657/ lmh

LOCKHEED MARTIN ENERGY RESEARCH CORPORATION
OAK RIDGE NATIONAL LABORATORY

INTEGRATED SAFETY MANAGEMENT POLICY STATEMENT

A. W. Trivelpiece, Director
Oak Ridge National Laboratory

R. K. Genung, Deputy Director
Oak Ridge National Laboratory

B. R. Appleton, Associate Director
Spallation Neutron Source Project

C. E. Oliver, Associate Director
Computing, Robotics, and Education

J. B. Ball, Associate Director
Advanced Materials, Physical, and Neutron Sciences

D. E. Reichle, Associate Director
Life Sciences and Environmental Technologies

R. G. Gilliland, Associate Director
Energy and Engineering Sciences

J. H. Swanks, Associate Director
Operations, Environment, Safety and Health

(Effective Date: January 1, 1998)

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A Work Smart Standards Set has been developed and implemented for each of the types of work carried out on the ORNL Site.

- General Hazard Facilities
- Radiological Research Facilities
- Accelerator Facilities
- Radiochemical Technology Facilities
- Radiochemical Engineering Development Center
- Radiochemical Development Facility
- Irradiated Materials Examination and Testing Facility and Irradiated Fuels Examination Laboratory
- Construction and Construction-Like Activities
- Engineering Design of Standard Industrial, Radiological, Non-Reactor Category 2 and 3 Nuclear, and Accelerator Facilities
- High Flux Isotope Reactor
- Building 4501 Nuclear Hot Cell Facility

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The ORNL ISMS Program is tailored to the work performed in each ORNL organization.

Office of the President

Spallation Neutron Source Project

Office of the Director

Advanced Materials, Physical, and Neutron Sciences

- Chemical and Analytical Sciences
- Metals and Ceramics
- Physics
- Research Reactors
- Solid State

Computing, Robotics, and Education

- Center for Computational Sciences
- Computational Physics and Engineering
- Computer Science and Mathematics
- Computing, Information, and Networking
- Robotics and Process Systems
- University and Science Education

Life Sciences and Environmental Technologies

- Chemical Technology
- Energy
- Environmental Sciences
- Life Sciences
- Radiochemical Development Facility (3019)

Operations, Environment, Safety and Health

- Capital Asset Programs
- Engineering
- Environmental Protection
- Health
- Laboratory Protection
- Laboratory Waste Services
- Mail Center Services
- Materials Management
- Nuclear Safety
- Packaging and Transportation
- Plant and Equipment
- Quality Services
- Radiation Protection
- Safetv and Health Protection

Energy and Engineering Sciences

- Engineering Technology
- Fusion Energy
- Instrumentation and Controls

Other

- Central Management
- Human Resources

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ORNL ISMS Implementation Committee is the cornerstone to implementation of ISMS at ORNL.

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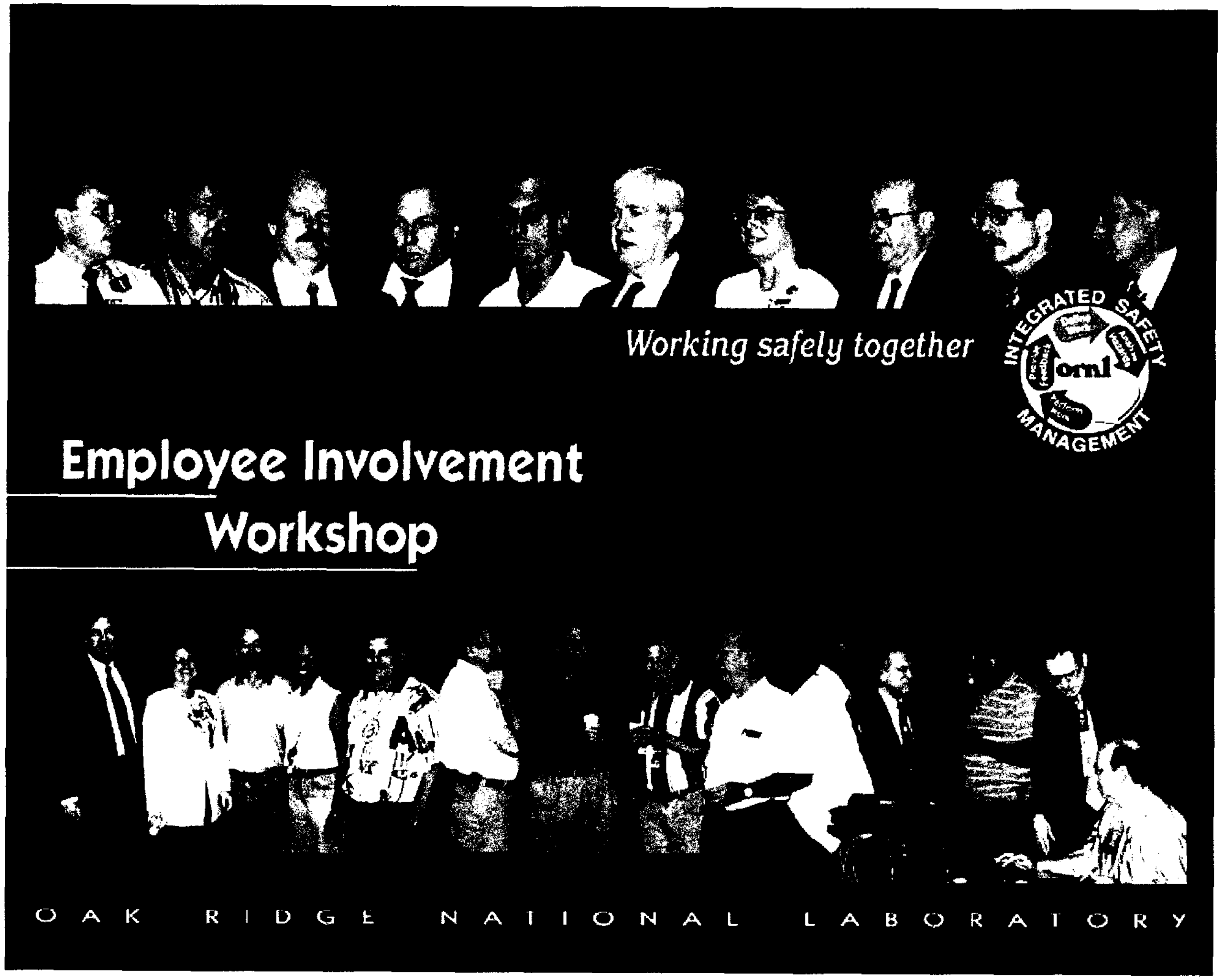
The ORNL ISMS Implementation Committee establishes line management subcommittees to address ISMS Program needs.



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DOE and ORNL management have established an innovative approach to identifying and resolving environment, safety, and health concerns.

Operational Awareness Program

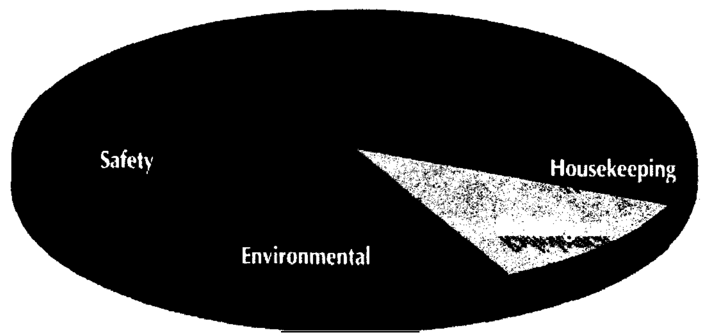
The Operational Awareness Program has been chartered to provide ORNL organizations support and assistance in the identification and resolution of environmental, safety, and health problems through a partnership among ORNL organizations, ORNL ES&H representatives, and the DOE ORNL Site Office.

Summaty of Observations

December 1997– September 1999

Safety 61%

Electrical
Signs/Labeling (non rad)
Hazardous Materials Storage/Use
Access/Egress
Compressed Gas Cylinders and Regulators
Flammable Liquids Storage/Use
Machine and Equipment Guarding
Fire Protection
PPE
Crane, Hoist, and H&R Inspection/Use
Welding cutting, or burning
Ladders
Walking and working surfaces
Ergonomis



Environmental 22%

Potential discharge to Waterways
Signs/Labeling (sink and drain only)

Signs/Labeling (rad)
Posted Areas
Surveys

Housekeeping

Safety
Environmental
Radiological

Working Safely Together

INTEGRATED SAFETY MANAGEMENT

ORNL Line Management has taken the leadership role in reviewing ISMS Program status.

RATINGS
GREEN
YELLOW
RED

	CORE FUNCTIONS					OVERALL PHASE II REVIEW
	DEFINE WORK	ANALYZE HAZARDS	DEVELOP HAZARD CONTROLS	PERFORM WORK	FEEDBACK AND ASSESSMENT	
SENIOR MANAGEMENT						
DIVISION MANAGEMENT						
MIDDLE MANAGEMENT						
FRONT LINE MANAGEMENT -SUPERVISOR-						
WORKERS						
RATING						

ORNL ISMS Program has produced substantial benefits as a result of line management involvement in an integrated safety management approach.

- **Safety concerns incorporated into work processes at all levels**
- **Line management and workers developing ownership and understanding**
- **New approaches to perform work safety being developed**
- **DOE and Contractor establishing partnership for change**

Implementation of Work Smart Standards and Integrated Safety Management have highlighted the challenges still facing the national laboratory community.

- **Laboratories confronted by sometimes contradictory standards**
- **Regulatory approaches may conflict with nature of work**
- **Standards setting done without real benefit of work experience**
- **Critical need for regulatory feedback**

Regulatory challenges facing the national laboratories emphasize the need for integration of regulatory requirements.

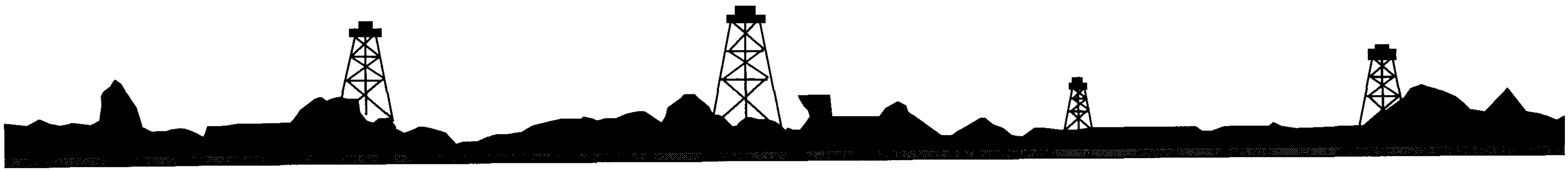
- **Regulatory approach tailored to nature of work**
- **Focus on performance-based system of regulations**
- **Integration of environment, safety, and health requirements**
- **Programs based on safety principles rather than compliance**
- **Experiences of industry utilized to develop holistic approach**

An interagency forum may be needed to bring about this integration and create a more coherent set of environment, safety, and health standards.

- **Draw upon DOE WSS/ISMS experienced organizations**
- **Involve relevant environment, safety, and health regulatory agencies**
- **Support creation of a more unified approach to regulation**
- **Develop more effective processes to influence and monitor regulatory activities**

William C. Gibson
Project Manager, SORP

A Non-Nuclear Application: Strategic Oil Reserve Program



U.S. DEPARTMENT OF ENERGY

STRATEGIC PETROLEUM RESERVE

Integrated Safety Management Systems Non Nuclear Application at the SPR

Guiding Principles

1. Line Management Responsibility for Safety

- Emphasis on supervisors and managers - Construction / Operations / Maintenance
- Management walk-arounds

2. Clear Roles and Responsibilities

- Behavioral safety
- Stop work authority
- Position descriptions
- M&O emphasis on Responsibility, Authority & Accountability (RAA)

Guiding Principles

3. Competence Commensurate with Responsibility

- Job task analysis drives training requirements
- Crane safety - inspection and training

4. Balanced Priorities

- Risk ranking for maintenance workorders
- Annual budget process (ES&H requirements prioritized - risk based)
- QA program prioritized annually (risk based)

Guiding Principles

5. Identification of Safety Standards & Requirements

- OSHA “Process Safety Management (PSM)” since 1994
- Defined and listed (Necessary and Sufficient) in contract & SPR ES&H Manual

6. Hazard Controls Tailored to Work Being Performed

- Integrated in operations and maintenance procedures and subcontracts
- Safety Issue Tracking System (SITS)
- Ergonomic survey of al personnel with 3 levels of risk identified

7. Operations Authorization

- 42 Readiness Review Boards in FYI999

Core Functions

1. Define the Scope of Work

- 32,951 workorders annually
- Fluid movement procedures issued for all oil / water / brine movements
- Levels of equipment repair established
- MRC's&ORC's

2. Analyze the Hazards

- HAZOPs since 1994 have resulted in 1164 hazard control recommendations
- 99% of the recommendations have been successfully resolved

3. Develop and Implement Hazard Controls

- Since 1985 at total of 1658 safety issues have been identified
  - 1st priority given to engineering hazard out of process
  - 2nd priority to administrative procedures
- Only 9 are currently open (less than 1% of those

Core Functions (continued)

4. Perform Work Within Controls

- Currently the SPR generates approximately 24,960 Safe Work Permits a year
- 26,740 MRC PM's and 6,211 Corrective Maintenance Workorders a year
- Conduct of Operations / Maintenance

5. Provide Feedback and Continuous Improvement

- Employee Behavioral Safety Process provided feedback 4,254 times in FY99
- Occurrence reporting system
- Monthly project reviews
- Site safety councils / Tripartite Safety Council
- Performance based contracting
- Annual ISM verification / appraisals / assessments
- Crosstalk information exchange program (27)

SPR Successes

- **ISM Fully Implemented 9/30/99**
- **Site Appraisal Process (M&O / DOE)**
- **Positive Performance**
  - **Only 200 barrels spilled out of 57,300,000 barrels of fluid pumped in 1999**
  - **Only one reportable spill in 1999, a 92 % reduction in number of spills since 1993**
  - **SPR Fire Protection Cost Rate of only 0.83 cents per $100 of value as compared to DOE average of 12.01 cents**
  - **1999 Total Recordable Case (TRC) incidence rate is 23% below the 1994-1998 DOE & Contractor rate**
  - **1999 Lost Workday Case (LWC) incidence rate is 24% below the 1994-1998 DOE & Contractor rate**
  - **1999 Lost Workday (LWD) incidence rate PMO is 9% below the 1994-1998 DOE & Contractor rate**
  - **Emergency response teams are approaching "Best in Class"**

Opportunities for Improvement

- Subcontractor Oversight
- Electrical Safety
- Safe Work Permitting

Bob Perry
Center for Chemical Process Safety

Chemical Process Safety Management: Integration of Process Safety, Environmental, Safety, Health and Quality

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INTEGRATEDSAFETY

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Long Beach, California
November 16, 1999

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

CENTER FOR CHEMICAL PROCESS SAFETY

CCPS MISSION

- ❖ Advancing state-of-the-art process safety technology and management practices
- ● erving as a premier source for information on process safety
- ❖ Fostering process safety in chemical engineering and related science and engineering education
- ❖ Promoting process safety as a key industry value

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THE NEED FOR INTEGRATION

- Increasing and overlapping regulatory demands
- Pressure to reduce cost of operation and at the same time improve performance
- Ability to continuously improve ESH performance by correcting the underlying systematic failure
- Recognition that other business activities have benefited from integration

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TECHNOLOGY ALONE IS NOT ENOUGH

- Relying on experience is insufficient
- Just because a major accident has never occurred doesn't mean it won't
- 3 Many accidents are caused by equipment failure
- Human error is rarely the key failure
- Learning from Near Misses - yours or others - is powerful
- Business managers must be involved
- A comprehensive safety management strategy is critical

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MANAGEMENT OF CHEMICAL PROCESS SAFETY

- ❖ **Accountability: Objectives and Goals**
- ❖ **Process Knowledge and Documentation**
- ❖ **Capital Project Review and Design Procedures**
- ❖ **Process Risk Management**
- ❖ **Management of Change**
- ● **3 Process and Equipment Integrity**
- ❖ **Human Factors**
- ❖ **Training and Performance**
- ❖ **Incident Investigation**
- ❖ **Standards, Codes, and Regulations**
- ● **Z+ Audits and Corrective Action**
- ● **3 Enhancement of Process Safety Knowledge**

SUCCESSFUL PROCESS SAFETY MANAGEMENT

Three things are certainly true:

- ❖ **In effective safety cultures, individuals *OWN* actions taken to improve safety rather than seeing them as imposed from the outside**
- ● **+ This requires not only senior management commitment but also a reflection of that commitment in the actions of staff at all levels**
- ❖ **Safety management programs are less than successful because they have been developed piecemeal in response to particular accidents or regulations; a comprehensive safety management strategy is critical to success**

The CCPS Chemical Process Safety Management System

Shortly after CCPS published its first books on process safety technology, it became apparent that technology alone was not enough for good safety performance. Management systems were needed.

In 1988, CCPS outlined a model of a comprehensive process safety management (PSM) system in its brochure, *Chemical Process Safety Management: A Challenge to Commitment.* The system was comprised of 12 essential and interrelated elements. Subsequent CCPS publications and conferences have provided "how to" materials for each element. A brief description of the CCPS PSM system follows:

Accountability Objectives and Goals

Establishing accountability requires that managers demonstrate to all personnel that process safety is an important management function related to other business objectives and that setting goals for safe operation is essential to business success;

Process Knowledge and Documentation

A good process safety program captures the operating experiences, engineering design, and technical expertise important to chemical production and handling facilities, so that others can easily retrieve and use the information;

Capital Project Review and Design Procedures

Capital project review ensures that hazards associated with new and existing chemical processes have been identified and that adequate resources are available to minimize risk to employees, the public, and the environment and to protect assets and continuity of operations;

Process Risk Management

Process risk management systems can identify hazards and the actions necessary to reduce the potential for major releases of dangerous toxic, flammable, explosive, and reactive materials. Other risk management efforts include risk reduction projects, release mitigation programs, and emergency management plans;

Management of Change

Proper management procedures must assure that all modifications proposed to equipment, processes, and staff are reviewed by knowledgeable personnel before installation in order to assess risk, take appropriate action to minimize risk, and establish an inspection or follow-up system;

Process and Equipment Integrity

Management systems should ensure that process equipment is fabricated, installed, and maintained in accordance with design specifications. The history of initial equipment, replacements, maintenance performed, and modifications made must be maintained to improve safety and reliability;

Human Factors

Since human factors have been a major cause of chemical process accidents, it important that the potential for human error in operating procedures and upset conditions is assessed and that operator/process and operator/equipment interfaces are properly designed;

Training and Performance

Site-specific, up-to-date, and documented employee training programs are crucial to ensure that employees understand their job in relation to the chemical process, its hazards, and the precautions necessary to prevent unwanted incidents;

Incident Investigation

Incidents that result or could result in fires, explosions, runaway reactions, or hazardous releases should be investigated to assure that all causes have been identified and that appropriate corrective and preventive actions are taken;

Company Standards, Codes, and Regulations

Management systems ensure that various internal and external published guidelines, regulations, and standards are kept up-to-date and disseminated to appropriate departments and personnel;

Audits and Corrective Action

Periodic audits, which provide a detailed inspection of a facility's process safety management systems and procedures, are needed to establish if the safety effort is complete, current, and in use and to determine if they comply with applicable regulations and company policies. Correction of deficiencies is a necessity;

Enhancement of Process Safety Knowledge

Capture of continuously emerging process safety knowledge is essential to build on experiences and technological advances.

Dr. Andrew C. Kadak
MIT (ANS President)

A Perspective from Academia
(panelist only - no prepared remarks)