

**IDEAS FOR IMPROVING
THE DEPARTMENT OF ENERGY'S
SAFETY MANAGEMENT
OF NUCLEAR FACILITIES**

A Discussion Paper*

by

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*This paper was prepared by Defense Nuclear Facility Board Member Joseph J. DiNunno. The views expressed are those of the author and do not necessarily represent the views of the Defense Nuclear Facilities Safety Board as a whole.

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1. INTRODUCTION

The current internal safety management program of the Department of Energy (DOE) has evolved over years of change in missions; organizational structure; and statutory requirements for protecting the public, workers, and the environment and for safeguarding special nuclear materials. Under the terms of the Atomic Energy Act of 1946, as amended, DOE has the authority and responsibility for regulating its nuclear activities to ensure protection of the public and workers from exposure to radioactive materials and to safeguard its special nuclear materials. For non-nuclear toxic and hazardous materials, DOE is required by the Federal Facility Compliance Act of 1992 to bring its facilities into compliance with environmental protection laws as administered by the Environmental Protection Agency (EPA) and the states.

Through departmental policies, rules, and contract terms, DOE has defined expectations relative to safety practices for its contractors. Primary responsibility for ensuring that the contractors comply with such requirements rests with those in the federal workforce assigned mission responsibilities. The Secretary of Energy has delegated to Program Secretarial Officers responsibility for safe performance of their assigned missions, with general oversight of their performance by DOE's Deputy and Under Secretaries. Ultimate responsibility for safe operations rests with the Secretary of Energy. DOE's organizational units, independent of the line organizations, perform periodic assessments of the safety performance of the mission-dedicated contractors and the oversight federal workforce, reporting observations to DOE's senior officials. In addition, DOE's Office of Inspector General and the Defense Nuclear Facilities Safety Board (Board) provide DOE senior officials with independent appraisals of the safety performance of DOE's operating units. (The Board's appraisals are limited to operational nuclear safety at defense nuclear facilities.) DOE's Office of Safeguards and Security provides federal oversight of security measures for inventory control and antidiversionary safeguards for special nuclear materials.¹ DOE's Environment, Safety and Health (ES&H) program is thus a complex, overlapping collection of resources of contractors, contract managers, mission managers, independent internal assessors, independent external assessors, and external regulators.

The current ES&H program has evolved over the years as DOE's mission and the regulations under which that mission must be performed have changed. Responsibility for the various ES&H functions is dispersed. The establishment of the new National Nuclear Security Administration as a largely autonomous entity within DOE and recent changes in assigned functions and responsibilities (Blake, 2001) add to that dispersion. Without the cohesive force of strong central leadership, the ES&H program is likely to become dysfunctional. It is therefore timely to step back and examine both DOE's mission and regulatory framework with a fresh view. The goal of such a review is more effective safety management.

Under Secretary Card, has initiated such a review and solicited ideas as to what might be done to effect improvements. The observations and suggestions herein are offered in that spirit.

¹ This paper was prepared prior to the September 11, 2001, attack on America. The safeguarding of all toxic and hazardous materials from those who might want to use them as a threat to the public well-being must be given far more attention than has heretofore been the case.

2. HISTORICAL BACKGROUND

2.1 CHRONOLOGY OF KEY EVENTS

A chronology of key events leading to the current state of DOE's ES&H program is shown in Table 1. A brief summary follows.

1942-1947

The development of nuclear weapons during the World War II years was performed in secrecy under the direction and management of the Manhattan Engineering District (MED), Corps of Engineers. Although the potential harmful effects of radiation exposure were known to the weapon developers, associated material processors, and component manufacturers, the extent of that knowledge was then quite limited. What was known was brought to bear to protect workers by means of a relatively small group of health physicists serving as advisors to project leadership. The deadly effects of massive doses of radiation, as evidenced by the consequences of the bombing of Japan, led to much-expanded studies of radiation effects on people and their environment.

1947-1960

In 1947, the Atomic Energy Commission (AEC) was established to take the weapons program over from the MED. Shortly thereafter, the AEC established a Safety and Industrial Health Advisory Board to survey health, safety, and fire protection practices throughout the complex. The Board was composed primarily of outside experts from various health and safety professions. Membership included Dr. Abel Wolman, Head of the Sanitary Engineering Department of The Johns Hopkins University. Dr. Wolman was included in response to pressure by the National Academy of Sciences, which was concerned at the time that the AEC was not giving sufficient attention to sanitary engineering issues, particularly waste disposal and management practices. In retrospect, the findings of the Advisory Board as reported in 1948 are particularly interesting for they could have been written today. These findings included such observations as the following:

- The AEC had inherited an excellent health and safety program record, although the deferred health injury was not measurable. However, there were indications of program deterioration. This deterioration was partially attributable to executives within both the AEC and contractors that either did not fully accept their responsibility for safety and health or did not know how to carry out that responsibility.
- Particularly negligent was the management of waste disposal. Continued disposal of waste in present quantities and by present methods in the long term presented the gravest of problems. Moreover, the whole problem of both toxic and radioactive wastes required immediate laboratory and field study.

- A significantly upgraded environment, safety, and health effort was a priority for the complex. The key lay in organization and management. Diffused responsibility for health matters was a major problem. Throughout the complex, for example, officials focused considerable attention on radiation hazards and ignored the release of chemically toxic wastes.

The admonitions and advice of the Safety and Industrial Health Advisory Board did not fare well. Neither the new AEC nor its General Advisory Committee was convinced of the seriousness of the health and safety issues identified. Some adjustments to the safety program were made, but no substantive effort was undertaken to address the more serious matters, such as waste disposal and an upgraded health and safety program. A Division of Biology and Medicine was established in 1948, but its activities were geared more to biology and medical research than to engineering solutions for safe disposal of hazardous, toxic, and radioactive wastes.

In 1954, Congress amended the Atomic Energy Act to encompass the peaceful uses of nuclear materials. Under the Atomic Energy Act of 1954, Section 161, the newly authorized AEC was authorized to:

Establish by rule, regulation, or order such standards and instructions to govern the possession and use of special nuclear material and by-product material as the Commission may deem necessary or desirable to promote the common defense, to protect or to minimize danger to life or property.

In 1954, the AEC's Reactor Development Division undertook a collaborative effort with Duquesne Power and Light Company, Shippingport, Pennsylvania, to adapt nuclear fission to the generation of electricity. The experiences of weapons contractors were brought to bear in the Shipping Port design. The project faltered until Congress caused the AEC to place the project under the direction of Admiral H. G. Rickover. Admiral Rickover, then head of a fledgling program for the development of naval propulsion reactors, brought design rigor, discipline, and naval emphasis on reliability of performance to bear as basic elements of an ES&H program.

This period was also marked by development and installation of a variety of university research and training reactors and several small nuclear power plants—Vallecitos, Fermi, and Yankee Rowe. Authorization for construction and operation of these facilities was granted after safety reviews by a small "regulatory staff" of the AEC. Nuclear safety was the focus of these reviews, in keeping with Section 161 of the Atomic Energy Act. These reviews of proposed peaceful uses were largely ad hoc, performed by individuals with expertise developed largely under the weapons or naval reactors programs. Consensus of experts rather than demonstrated compliance with formalized safety requirements was the basis for authorization.

For closer scrutiny of the operations of its own nuclear facilities, the AEC in 1959 consolidated its subject matter experts in applied health physics, fire protection, and industrial

health and safety standards into an Operational Safety Division. These experts, along with those in the Division of Biology and Medicine had been largely advisory to weapons production managers. The Operational Safety Division continued to serve as a core group of experts but in a somewhat different fashion. The Commission began to look to this group to assist production managers through independent reviews and critiques of safety practices at weapon production facilities. The focus was nuclear safety. Results of such reviews were also made available to the Commissioners. The establishment of the Operational Safety Division marked the first forceful federal insertion of safety expectations into the production programs of the government's weapons contractors.

In effect, the 1947–1960 period was marked by a continuation of safety practices in the weapons program that had been put in place by the Corps of Engineers during the MED days, and subsequently augmented by the safety practices of the industrial firms that were contracted by the government to run the weapons production facilities (e.g., Dupont, Union Carbide, Philips Petroleum, and Monsanto). The AEC relied greatly upon its contractors to apply the results of the Commission's very substantial research on the biological effects of radiation on people and the environment, and of basic research in such fields as chemistry, physics, and metallurgy.

1960–1970

The period 1960–1970 was marked by diverging ES&H programs for the Commission's weapons program and its regulation of the peaceful application of nuclear materials. However, both had common roots.

In 1961, the Commissioners created the post of Director of Regulation and assigned it authority relative to establishing nuclear safety requirements and the regulation of commercial uses of nuclear materials. In accordance with Section 161 of the Atomic Energy Act, the regulatory staff proceeded to develop licensing requirements. This was done through formal rulemaking processes. For the weapons program, requirements were being captured less formally in a Manual of Practices (Manual Chapters). Much of the technical basis for regulatory reviews for the commercial industry during this period consists of (1) process safety practices brought to the nuclear industry by the giants of the chemical industry that developed and operated the weapons complex in these early years, and (2) results of many research studies in biology, medicine, and basic research performed by contractors in support of AEC's weapons programs. The weapons establishment was never subject to the formal licensing procedures instituted by the Director of Regulation for the commercial sector. After 1961, however, DOE's development reactors were subject to "parallel reviews" and scrutiny by the regulatory staff, who reported their conclusions to the Commission.

With the increase in the number of commercial power reactors for which licenses were sought in the early 1960s, the biology and medicine research program of the AEC was reoriented much more toward applied research in support of the reactor research and development (R&D) program. An Environmental Science Laboratory was established in 1960 to track and analyze fallout from weapons. The AEC expanded the ES&H self-assessment program for the weapons

program. Growing public awareness of the environmental effects of weapons testing, prospects of an energy future dominated by nuclear reactors, and a strong national movement toward environmental protection in general put AEC's weapons program and its advocacy of peaceful uses for nuclear energy under heavy pressure for curtailment.

In 1969, with enactment of the National Environmental Policy Act, a dramatic shift in the AEC's ES&H programs began. In 1969, the Commission established the post of Special Assistant to the General Manager for Environmental Affairs. An Office of Environmental Affairs, under the General Manager, was established in 1970.

In 1973, AEC combined its Divisions of Operational Safety, Biology, and Medicine and Environmental Affairs under an Assistant General Manager for Environment, Safety and Health. The General Manager's biology and medicine and reactor research programs continued to provide basic safety-related data to support both the weapons program and the commercial regulatory program. New environmental protection statutes enacted during the 1970-1980s forced major changes to AEC's ES&H program. These statutes included the Occupational Safety and Health Act (1970), the Resource Conservation and Recovery Act (RCRA), the Solid Waste Disposal Act (1976), and the Comprehensive Liability Act (1980). The need for the AEC to go beyond nuclear safety considerations in regulating uses of nuclear materials was affirmed by the courts in the Calvert Cliffs case (July 1971/cite Reference) which established a precedent for enhanced environmental protective measures in the weapons program.

The ES&H program under the Assistant General Manager performed during this early period largely in a reactive rather than proactive mode relative to enhanced environmental protection. The decade of the 1970s was also marked by continued external pressures on DOE to deal more effectively with nuclear waste issues. In 1974, the AEC established a remedial action program to clean up formerly used sites (FUSRAP).

The Re-Organization Act of 1974 abolished the AEC and established the Energy Research and Development Administration (ERDA) and the independent Nuclear Regulatory Commission (NRC). ERDA assumed responsibility for the weapons program, including the legacy wastes of the early weapons production era, but its main focus was on energy independence, not weapons production. ERDA's organization included an Assistant Administrator for Environment and Safety. The functions of this Environment and Safety group, like those of its predecessors, were largely in support of the line. They included a lead role in sponsoring biomedical and environmental research, oversight of a health and safety laboratory, development of environmental control technologies, development of safety standards, compliance oversight, coordination of safety reactor research, and waste management and transportation.

In 1977, ERDA was replaced by DOE. The new DOE inherited the residual nuclear and chemical waste problems of the weapons program. The new leadership brought to bear less advocacy for nuclear programs and much more zeal for environmental protection than had heretofore been displayed by either ERDA or DOE. Administration of the new environmental

protection laws was assigned to the EPA (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA]) and the states [RCRA]). DOE leadership initially resisted compliance with these laws, claiming exemption under terms of the Atomic Energy Act.

In 1979, a major reactor accident occurred at Three Mile Island. This event rocked a nuclear industry already under public attack.

1980-1990

The decade of the 1980s was marked by intensified public interest and involvement of activists in achieving better protection of the environment. Both the nation's weapons program and commercial nuclear power program were caught up in this movement, with nuclear activities becoming a major target of activist attention. The first Secretary of Energy took over administration of an agency under heavy pressure to comply with the recently enacted RCRA (1976) and CERCLA (1980) at all of DOE's weapon production sites. In 1981, an assessment performed in the aftermath of the accident at Three Mile Island for the Secretary of Energy on the safety of DOE's production reactors (Crawford Report, 1981) revealed a considerable number of deficiencies (see Appendix C). Confidence in DOE's ES&H program further eroded. In addition, the residual radioactive wastes that had been the concern of the Advisory Board some 30 years earlier once again emerged as the major point of controversy. DOE's resistance to remedial actions under RCRA and CERCLA was met with lawsuits and court actions, leading to the courts' opening of DOE defense nuclear sites to access and scrutiny by the EPA and state authorities. Public concerns about the legacy wastes at DOE sites led to additional attention of the Administration and Congress. Senator John Glenn brought the matter to national prominence through congressional hearings held in 1985.

In 1985, John Herrington, Secretary of Energy at the beginning of President Reagan's second term, created a new position of Assistant Secretary for Environment, Safety and Health (EH) with enhanced responsibilities and more authority than its predecessors for restraining mission-oriented nuclear activities of the weapons programs. The new Assistant Secretary was to "have more oversight tools and be integrally involved in the operations of DOE at all levels" (Herrington, 1985). Congress, in turn, made clear in the Superfund Amendment and Reauthorization Act of 1986 that sites owned by the government were to be subject to consideration for inclusion on the National Priorities List, with remedial action under the jurisdiction of the states and/or EPA. During this same period, DOE and EPA came to an understanding with respect to mixed wastes. Disposal of these wastes would be subject to regulatory oversight by EPA.

In early 1988, in the aftermath of the Chernobyl accident, DOE (Secretary of Energy, Admiral James D. Watkins, U.S. Navy [Retired]) established an independent external oversight committee (Advisory Committee on Nuclear Facility Safety) to advise the Secretary on the safety of operations of DOE's production reactors. Congress, in turn, established the Defense Nuclear Facilities Safety Board (Board) to provide independent external oversight of the weapons establishment, with the obligation to recommend such improvements to DOE's safety

management program as deemed advisable. The Board became active in 1989. That same year, Secretary Watkins undertook a major restructuring of DOE's approach to safety management. Line managers were once again made primarily responsible for safety management of the work required to satisfy their assigned missions and programs. A new Office of Nuclear Facility Safety was established, reporting directly to the Secretary. This new office was to advise the Secretary on how well the line performed and to assist in effecting continued improvements in that performance (U.S. Department of Energy, 1993).

1990–2000

During the 1990s, DOE's ES&H program continued to experience shifting directions as both Congress and the Administration wrestled anew with the waste problems of old and faced new problems arising from the shutdown of weapon production lines. In 1992, Congress passed the Federal Facility Compliance Act, requiring federal agencies to bring their facilities into compliance with federal environmental protection requirements.

In 1993, a new Secretary of Energy (Hazel O'Leary) kept the same basic safety management structure as that of her predecessor, but placed the Office of Nuclear Facilities Safety under EH. The Assistant Secretary was given facility shutdown authority should nonsafe conditions justify such action.

In 1996, with the advice of the Board, DOE (Secretary O'Leary) adopted the concept of Integrated Safety Management (ISM) as its reference approach to safety management. ISM is dedicated to providing protection of the public, workers, and the environment in an integrated way. The system is based upon the principle that line management has primary responsibility for doing work safely. The corporate Assistant Secretary for ES&H was expected to provide an independent assessment of the operational safety practices of line management and other regulatory support for the Office of the Secretary. This reference ISM System was retained during the post-O'Leary period (1996–2001). Because DOE is organized into major mission-oriented programs administered by independent Program Secretarial Officers, Secretary Richardson in 2000 designated his Deputy Secretary as DOE's Chief Operating Officer (COO). As such, the COO also acted as DOE's Chief Safety Officer. The Deputy Secretary organized a Field Management Council, a group made up of Program Secretarial Officers and Field Managers, to assist and advise the Office of the Secretary on cross-cutting safety issues.

In 2000, Congress established the National Nuclear Security Administration (NNSA) as a semiautonomous agency within DOE to continue the nuclear weapons mission. A new administrator for NNSA was appointed. Secretary Spencer Abraham, the new Secretary of Energy, designated his Deputy Secretary as DOE's overall COO. The former independent oversight functions under EH were combined with safeguards and security oversight and assigned to a new unit, Office of Independent Oversight and Performance Assurance (OA), reporting to the COO. The remaining functions of EH were placed under the Under Secretary (Abraham, 2001).

Table 1
Evolution of Department of Energy's ES&H Programs: Chronology of Key Events

Date	Action	Action Summary
1947	Atomic Energy Commission (AEC) established Safety and Industrial Health Advisory Board established Advisory Committee of Biology and Medicine established	AEC took over the weapons program from the Manhattan Engineering District. AEC asked the National Academy of Sciences (NAS) to help set up a board to review and advise the Commission on ES&H matters. That board recommended creation of an Advisory Committee for Biology and Medicine. Advisory Committee appointed to coordinate medical, biological, and health physics research. Served as subject matter experts for program managers, in addition to administering research contracts on biology and medicine.
1948	Advisory Committee report released	Safety and Industrial Health Advisory Board report issued. Recommended a "significantly ungraded environment, safety and health effort."
1948-1954	Division of Biology and Medicine (DBM) Established	Assisted and supported the line organization in establishment of health and safety, industrial hygiene, health physics, and environmental science programs and conducted the research programs.
1954	Atomic Energy Act amended	Peaceful uses of nuclear materials were authorized and encouraged. AEC authorized to establish standards and instructions to govern such possession and use so as to protect or to minimize danger to life and property.
1954-1957		DBM continued to serve line managers as subject matter experts on ES&H.
1957	Health and Safety Branch and Regulatory Group created by DBM	Expertise expanded to include occupational medicine, industrial hygiene, and applied health physics. Radiation standards issued as "Manual Chapters."
1959	Division of Operational Safety established	Absorbed responsibility for development of health and safety and regulatory standards functions.
1960	Enforcement Unit established	Established under the Inspector General to take enforcement action in the health and safety area.
1962	Independent assessments initiated	Initiated by the Operational Safety Division.
1963	Clean Water Act enacted	
1969	National Environmental Policy Act enacted	Required federal agencies to consider environmental impacts in all major activities affecting the environment.
1970	Occupational Safety and Health Act enacted	Major legislation dealing with hazards of the industrial workplace..
1973	Endangered Species Act enacted	Restricted developments endangering habitats.

Table 1 (continued)
Evolution of Department of Energy's ES&H Programs: Chronology of Key Events

Date	Action	Action Summary
1976	Resource Conservation and Recovery Act enacted Solid Waste Disposal Act enacted Toxic Substance Control Act enacted	Established a cradle-to-grave responsibility for hazardous materials. Restrained disposal of hazardous materials. Restricted release of toxic materials to the environment.
1979	Accident at Three Mile Island	Caused renewed national attention to reactor safety.
1980	Comprehensive Environmental, Response, Compensation and Liability Act enacted	Required cleanup of contaminated sites.
1981	Safety Assessment of DOE nuclear reactors (Crawford Report) issued	Provided an independent evaluation of the safety management of DOE's production reactors.
1982	High-Level Waste Policy Act enacted	Set forth a national approach for dealing with high-level waste.
1984	Bhopal accident	An overseas chemical plant accident of major proportions.
1985	James Kane Report	A major critique of DOE's ES&H program with recommendations for changes. Led to the creation by DOE of the new Office of Assistant Secretary for ES&H.
1986	Emergency Planning and Community Right to Know Act enacted Chernobyl accident	Congressional action in the aftermath of Bhopal. Required major chemical plants to analyze and make public the potential hazardous aspects of operations. A major nuclear reactor accident involving widespread off-site release of radioactive materials.
1987	National Research Council's Committee on Safety of DOE Production Reactors appointed DOE commitment to compliance with Resource Conservation and Recovery Act	Conducted independent study of safety of DOE production reactors. Court actions forced DOE compliance.
1988	Defense Nuclear Facilities Safety Board established	Established for independent, external nuclear safety oversight of defense nuclear facilities.
1989	New initiatives by Secretary of Energy	ES&H function realigned; DOE-Headquarters involvement strengthened.
1990	Pollution Prevention Act enacted	
1992	Federal Facility Compliance Act enacted	Congressional action requiring federal facilities to comply with environmental protection statutes.

Table 1 (continued)
Evolution of Department of Energy's ES&H Programs: Chronology of Key Events

Date	Action	Action Summary
1996	Integrated Safety Management (ISM) established as policy by DOE	An integrated safety program for protection of workers, the public, and the environment.
2000	ISM implementation	ISM implemented at all high-hazard nuclear facilities. Terms and conditions for safety operation made contractually binding on contractors.

2.2 HISTORICAL LESSONS LEARNED

Given the above history, what might one reasonably extract in the way of observations to assist new departmental administrators in improving DOE's ES&H program? The following are believed to be some key points:

- The history of ES&H activities relative to the weapons program has been marked by a series of assessments that took place during the years 1948–2000 as the new leadership of DOE and its predecessor agencies attempted to address safety issues. Excerpts from three of these assessments are included as Appendices A–C. In retrospect, it is remarkable how consistent the observations were and how different were the responses.
- Statutory admonitions notwithstanding, those faced with the urgency of responding to the threat to national security during the early period of the weapons program placed priority on the success of the mission. Environmental impacts were a secondary consideration (e.g., long-lived radioactive waste was allowed to accumulate in storage tanks, with no end-disposal plans).
- The public, under the stress of war and the grave threat to national security, accepted operations less open to public scrutiny than is the case during peacetime.
- As the external threat diminished (as marked by the end of the cold war), public demand increased for a nuclear weapons program more constrained by environmental, health, and safety considerations, i.e., protection programs comparable to those being imposed by statutes on the commercial industrial sector.
- The ES&H programs of DOE and its predecessor agencies have been scrutinized repeatedly during the years 1948–2000 (see appendices). It has been much easier to identify inadequacies than to effect solutions.
- A variety of ES&H programs, differing mainly in the degree of oversight and control of mission-related activities by DOE Headquarters organizations, have

been tried over the years. What has evolved as a well-recognized management principle is that safety responsibility must rest primarily with those planning and performing hazardous work—line managers. Equally important, it is clear that it is no longer acceptable to either the public or Congress that those in DOE given mission responsibilities be allowed to proceed without some independent oversight of their safety (ES&H) practices.

- The establishment of EH as an Assistant Secretarial Office resulted historically from the need for DOE to address the clamor for a weapons production program much more sensitive to the environmental protection mood of the nation as evidenced by the environmental protection legislation of the 1970s–1980s. Those assigned mission responsibilities were not to be trusted—because of the historical record of environmental abuses—to achieve the proper balance of weapons production and environmental protection. To a large extent, this mistrust still exists. The Board, established by Congress in 1988, is evidence of this perspective. While DOE and the Program Secretarial Officers have rightfully placed on their line managers—those responsible for missions—the primary responsibility for ensuring compliance with statutory requirements relative to ES&H, this approach is not sufficient to placate a distrusting public. Further, it has been shown to be highly beneficial, even in the commercial sector, for managers of facilities involved in hazardous materials and operations to use independent internal examiners of the safety practices of their line organizations. Evidence that DOE has in place a top-driven, effective ES&H protection program is essential. Working to develop trust but continuing to verify should be DOE's basic approach.
- In 1996 DOE embarked upon a program called Integrated Safety Management. This program addresses many of the deficiencies of the past. Protection of workers, the public, and the environment is being treated as an integrated whole. New facilities are being designed to satisfy not only nuclear safety but also environmental protection requirements. Older facilities are being subjected to the Federal Facilities Compliance Agreement, directed at phasing in compliance programs. However, as with the efforts of previous AEC/DOE administrators, the dedication to and implementation of effective ES&H programs such as ISM are vulnerable to discontinuities as DOE's senior leadership changes, and responsibility for the essential elements of the program becomes diffused.

3. CURRENT DOE SAFETY MANAGEMENT ORGANIZATION

3.1 BASIC ENVIRONMENT, SAFETY AND HEALTH (ES&H) FRAMEWORK

DOE's ES&H program is required to provide for protection of the public, workers, and the environment from the potential harmful effects of materials that are chemically toxic or hazardous. DOE's basic framework of requirements for management of its nuclear and other toxic and hazardous materials is basically sound. It is a standards-based framework that embodies Departmental directives (rules, guides) that are responsive to statutory requirements for protection of the public, workers, and the environment. The program is directed at achieving not only nuclear safety, but also chemical safety. The framework allows for adaptation to the wide range of operations and hazards involved in DOE's programs. For highly hazardous operations, terms and conditions for ensuring nuclear safety are set forth in Authorization Agreements, with noncompliances being subject to enforcement actions. Contractors performing work for DOE are required to maintain effective internal self-assessment programs. DOE's line organizations are charged with monitoring contractor performance closely and regularly.

The safety management organization within DOE is much like that of a multiproduct industrial firm, wherein corporate-level management is provided from a head office, with responsibility for each main product line delegated to a corporate line officer. All product lines are expected to operate under corporate-wide policies and practices to the extent applicable, and with the clearly established understanding that line corporate offices have the primary responsibility for ensuring safety in the performance of their assigned missions. (The term "safety" is used herein in the context of protection of the public, workers, and the environment.) Commonly, a corporate office, independent of the line, is used by corporate senior management to assess periodically the safety programs instituted by the line organizations and to recommend upgrade actions.

The major difference between this model and DOE is that virtually all of DOE's hazardous work is done by contractors. The model still holds if contractor line management is regarded as an extension of the DOE corporate line, with safety responsibilities delegated through contract terms and conditions.

3.2 ES&H FUNCTIONS AND RESPONSIBILITIES

Key functions and responsibilities of DOE's current organizational entities are shown in Tables 2 and 3. As these tables show, DOE's internal ES&H organization is not any single well-defined entity, but rather an amorphous one. Broadly speaking, it is an entity made up of (1) individualized ES&H units at DOE Headquarters and in the field that support DOE's disparate program offices, (2) a corporate ES&H group (EH) that performs an eclectic set of functions, (3) an independent corporate safety and safeguards assessment group (OA), and (4) an Office of Inspector General. Until DOE's adoption of ISM, there was no clearly defined, common framework upon which the various program offices could build their activity-specific safety management programs, nor was there any central driver of safety management upgrade

programs complex-wide. The latter function was performed by the Deputy Secretary, who served as DOE's COO during the previous administration (1998–2000). A technical team—the Safety Management Integration Team (SMIT)—and a Safety Council (SC) were established ad hoc to assist the Deputy Secretary in guiding and driving the safety management efforts.

Reassignments of some ES&H responsibilities were announced by Secretary Abraham (Abraham, 2001) and Deputy Secretary Blake (Blake, 2001). Under these realignments Deputy Secretary Blake was designated to serve as DOE's COO. The Office of the Assistant Secretary for ES&H (EH) was assigned to the Under Secretary Card. The function of corporate-level safety program assessments formerly performed by EH was combined with safeguards and security assessments and incorporated in OA, reporting to the COO. Further realignments may result from organizational changes soon to be announced by the Administrator of NNSA and from new initiatives by Under Secretary Card.

Table 2
Key ES&H Functions and Responsibilities

Functions	Lead Responsibility	Reviews and/or Concurrence/Approvals/Follow-up
Establish, maintain, and update safety (ES&H) policies, rules, directives and standards	EH NNSA (nuclear explosives) NR (Naval Reactors)	Program Secretarial Officers MA Office of the Secretary Field Managers
Coordinate with other federal agencies on national health and safety policy and regulatory structure	EH	Office of the Secretary Program Secretarial Officers Field Managers
Establish training and qualification for environment, safety, and health personnel		
Establish contractual safety requirements	Field Managers/Contract Officers	Program Secretarial Officers/Headquarters (ES&H) staff EH
Develop authorization basis, documents, safety analysis reports, hazards analysis reports, Justifications for Continued Operation, Environmental Impact Statements, Environmental Permits	Contractors	Field Managers EH
Establish safety-related Manuals of Practice	Contractors	
Establish terms of authorization agreements (nuclear safety— public and worker protection requirements)	Contractors	Field Managers

Table 2 (continued)
Key ES&H Functions and Responsibilities

Functions	Lead Responsibility	Reviews and/or Concurrence/Approvals/Follow-up
Safe conduct of operations	Contractors	Field Managers Program Secretarial Officers/Headquarters Line and ES&H Headquarters staff EH (Readiness Reviews) Safety Oversight (OA) Inspector General
Perform accident investigations	EH	Field Managers Program Secretarial Officers Office of the Secretary Under Secretary NNSA Field Managers
Enforcement Actions <ul style="list-style-type: none"> ● Nuclear Safety/Price-Anderson ● Contract safety requirements 	EH Field Managers	Program Secretarial Officers Chief Operations Officer Program Secretarial Officers Chief Operations Officer Chief Financial Officer
Environmental Compliance	EPA	Office of the General Counsel Field Managers Contractors
Feedback and Improvement <ul style="list-style-type: none"> ● Self assessments/corrective actions ● Conduct of independent corporate-level assessments ● Tracking of corrective actions 	Contractors Contractor Field Managers OA EH	Field Managers Program Secretarial Officers/Headquarters line and ES&H staffs Office of Secretary Program Secretarial Officers Under Secretary NNSA

**Table 3
Departmental Hierarchy for ES&H Functions**

Department Secretarial Offices	Office of the Secretary	Complex-wide functions	Establish Requirements and Guidance Monitor Compliance Actions	<ul style="list-style-type: none"> • Statutory compliance • Funding and resources • Safety policies, directives (rules) • Federal compliance agreements • Safeguards and security • Resolution of cross-cutting issues • Chief Operations Officer • Technical excellence leadership
	Offices of Under Secretaries	Mission-oriented functions		<ul style="list-style-type: none"> • Funding and resources (manpower, facilities) • Safeguards and security • Recruitment and staffing (technical excellence) • Operational oversight*
	Assistant Secretaries (Program Secretarial Officers)	Program-oriented functions		<ul style="list-style-type: none"> • Funding and resources (manpower, facilities) • Recruitment, staff development • Operational oversight
	Assistant Secretary, ES&H	Complex-wide functions		<ul style="list-style-type: none"> • Drafting and maintaining currency of complex-wide ES&H directives (rules, orders, guides) • Maintaining a pool of ES&H subject matter experts (available for consultation/use of Program Secretarial Officers) • Leading special ES&H complex-wide initiatives, e.g., Voluntary Protection Program, use of industry standards, worker compensation • Providing input to national health policy and regulatory structure • Providing analysis of health, safety, and environmental data and making appropriate recommendations.
	Field Managers	Program-specific functions	Establish Terms and Conditions Perform Accordingly	<ul style="list-style-type: none"> • Review and acceptance of authorization basis documents (Safety Analysis Reports, Environmental Impact Statements, Justifications for Continued Operations) • Authorization Agreements • Contract safety terms and conditions (Standards Requirements/Identification Documents) • Operational safety • Recruitment and development of staff expertise
	Contractors	Project/activity-specific action		<ul style="list-style-type: none"> • Operational safety • Safety and environmental impact analysis • Establishment of site-specific Standards Requirements/Identification Documents • Establishment of Manuals of Practice • Establishment of project-specific safety program • Implementation of Integrated Safety Management • Protection of workers, the public, and the environment

* Operational oversight refers to regularized monitoring of the performance of those lower in the hierarchy and redirection as required.

4. OBSERVATIONS AND SUGGESTIONS FOR IMPROVEMENT

The following observations and suggestions are offered as timely input to DOE's current initiatives to enhance its internal safety management program. In preparing them, the principles of ISM were used as the frame of reference. As set forth in DOE Policy 450.4, these principles are as follows:

- Line management is primarily responsible for safety.
- Clear roles and responsibilities must be articulated.
- Competence must be commensurate with responsibilities assigned.

These suggestions are offered with full recognition that there is no unique way to manage a complex as diversified as that of DOE. Alternatives other than those suggested may be required to best fit the needs of DOE and the talent pool available or attractable to government service. The matter, as always, is open to dialogue with those within DOE seeking to enhance the management of safety.

While organized and structured much like a multiproduct commercial industrial firm, the safety management program of DOE is not as effectively and efficiently delivered. The question is: Why not? The following observations are made relative to a number of aspects of DOE's ES&H program and are accompanied by suggestions for improvement.

4.1 CORPORATE-LEVEL INVOLVEMENT

Observations. If DOE's basic safety management structure is not unlike commercial counterparts, why does DOE appear to be much less successful in its administration and execution? The following observations are offered:

- The frequent changeover of senior administrators, a common phenomenon in government, has little parallel in the private sector. With all due respect to our political system, rapid turnover of top-level DOE administrators, some of whom assume their duties with little or no familiarity with the work of DOE and remain for relatively short terms of service, hardly makes for stability or consistency in direction. Administrators in the private sector have much more authority to institute change. In government, even the most able of administrators on short tours find it difficult to effect substantive change in organizations and safety cultures that have evolved over many years.
- Effective safety management programs for organizations with multiple product lines must be driven from the top through common goals and objectives, upper management's personal involvement, and upper management's holding line managers accountable commensurate with their delegated responsibilities.
- The effectiveness of the independent internal auditing and appraisal function within DOE has been quite limited because historically there has never

consistently been a strong decision-making, action-forcing authority within DOE to see that such appraisals are given their just due, and the line is directed to take actions deemed prudent given the facts presented. The Board's Recommendation 98-1 resulted in commitment by the Secretary of Energy to implement a corrective actions program with mandatory tracking to completion of actions to be responsive to the internal auditing functions of the independent oversight group. This function is now being extended to the line's own self assessments.

- Tensions inevitably result when one group is chartered to appraise and critique the performance of another. A system that holds the line primarily responsible for safety but uses an internal unit to assess and report to top management on the performance of that line must have in place a management arrangement for resolving differences when they arise and for structuring a path forward. Moreover, the path forward must be appropriately resource loaded if line managers are to be held accountable for the execution of corrective action plans.
- The DOE complex is mainly an aged one. The need for safety upgrades as revealed by both the Board and DOE/EH is often perceived by the line as a money absorber that has not been budgeted and hence diverts from planned programmatic expenditures. Resistance to improvements recommended for safety reasons appears to be proportional to the perceived diversion from funds already programmed for other purposes. This situation is particularly evident for any major cross-cutting issue when multiple program offices are involved. (Examples include stabilization and safe storage of hazardous materials—the subjects of the Board's Recommendations 94-1 and 97-1 respectively). The recent policy pronouncement that work planning and safety planning must proceed as integral functions is a major step forward. However, this policy has yet to be made a universal reality within DOE
- DOE operates under a highly compartmentalized organizational structure and an approach in which it is stressed that safety is a responsibility all operational units must ensure in carrying out their individual missions. All operational units are constrained to operate within bounds defined by statutes, corporate policies, requirements, and practices, and are subject to independent oversight on behalf of corporate management. This classic arrangement works well if the two main organizational elements—line ES&H and corporate ES&H—work closely together. Too often, however, this has not happened.

Suggestion: Chief Safety Officer. The Deputy Secretary has been designated as the Chief Operating Officer of DOE. Given the heavy, diverse responsibilities of this office, its administrator may personally be unable to perform both as COO and Chief Safety Officer (CSO). (History has shown this to be so) In any case, the importance of maintaining a steady course relative to ES&H programs and practices argues for a "career slot," reporting to the COO, to serve as DOE's CSO. Surely the importance of this function merits a slot comparable

to that of the Chief Information Officer or the Chief Financial Officer or even the Office of General Counsel. The CSO would serve as the principal safety technical advisor to the COO. The Office of the CSO would in effect serve the COO, for example, as the clearinghouse for all staff activities leading to safety policies and directives advanced for Secretarial approval. It would also have responsibilities in the resolution of cross-program issues in dispute, in the resolution of differences in views on the need for corrective actions, in review of proposed enforcement actions, and in technical support for DOE's ES&H litigation actions.

Alternatively, an Assistant Secretary of Energy could serve such a function if the requisite expertise were ensured and a career slot for a similarly qualified individual at the Deputy Assistant Secretary level were established for assured continuity. (See the observations in Section 4.2).

4.2 QUALIFICATION REQUIREMENTS FOR KEY SAFETY OFFICERS

Observations. Maintaining a highly visible, key safety position, such as a Chief Safety Officer or an Assistant Secretary of ES&H, to assist the Office of the Secretary in "corporate-level" safety functions such as interpreting statutes, establishing safety requirements, and monitoring implementation signals a commitment to achieving protection of the public, workers, and the environment as DOE satisfies its mission requirements. However, filling such slots with individuals not well versed in the hazardous nature of the work involved or the statutory protection requirements that must be satisfied does much to nullify the public confidence these positions are intended to instill.

Suggestion: Qualification Prerequisites. In establishing the Board, Congress included in its enabling legislation that Board Members be required for appointment to be "recognized by their peers as nuclear safety experts." Both the DOE's CSO and the Assistant Secretary of ES&H and their deputies should equally be "recognized by their peers as experts in statutes and programs for protection of the public, workers, and the environment as they pertain to DOE's missions." DOE and the Administration would derive added public and congressional confidence in the DOE's safety management programs by staffing these critical safety positions, including the deputies, with individuals so qualified. DOE might well use the Deputy positions as career-enhancing assignments for future Field Managers and/or the CSO.

4.3 INFRASTRUCTURE UPGRADES

Observations. Lack of funding for maintenance and infrastructure upgrades has been a major contributor to ineffective corrective actions. Operating crews have been encouraged to work around equipment and controls that have become nonfunctional because funds for fixing them are scarce or nonexistent. As noted earlier, the need for safety upgrades as revealed by both the Board and DOE's independent assessors is often perceived by the line as a money absorber that has not been budgeted and diverts from planned programmatic expenditures. The DOE policy pronouncement that work planning and safety planning must proceed as integral

functions is a major step forward. However, this policy has yet to be made a universal reality within DOE despite the existence of requirements or rules and orders.

Suggestion: Resource Allocations. Many facilities of the DOE complex are old and require upgrades and/or extra maintenance. This kind of attention is particularly important for equipment that provide vital safety functions. The Board in its Recommendation 2000-2 urged DOE to determine the operational status of vital safety systems in all its high hazards nuclear facilities. This included an assessment of near term dependability and "end of life" expectancy. Results of these efforts should be converted to risk-informed action proposals to Congress for funding for infrastructure upgrades.

Suggestion: Contingency Planning. Planning in advance for what can be reasonably foreseen is a necessary action but not sufficient. Ensuring safety requires contingency planning, particularly for aged facilities in the DOE research and production complex. Some discretionary funding to deal with the unforeseen is merited. The history of having to deal with the unexpected makes for such a case, e.g., fires, explosions, extreme natural phenomena, increased security threats, an inadvertent release. Given the strong preference of budgeteers for task-specific funding requests, the case for a safety discretionary fund may be difficult to make but should be advanced, nonetheless. The management of such funds to ensure use for the intended purposes would undoubtedly be a condition for Congressional consideration. Some fraction—perhaps as much as 15 per cent—should be added to all budgeted, high hazard, facility operational costs for contingency response. The need for expeditious actions in response to safety findings of external reviewers (e.g., the Board or the Inspector General) is a case in point.

4.4 CHANGING ROLE OF OFFICE OF ASSISTANT SECRETARY OF ENERGY

Observations. The DOE Headquarters role in ensuring the ES&H performance of DOE's mission-dedicated contractors has varied considerably over the years as different DOE administrators have imposed their own management styles on the program. As described in Section 2, there has been considerable variation in the use made of the Office of the Assistant Secretary for ES&H by the Office of the Secretary with regard to establishing policies and requirements and monitoring and enforcing compliance with them. This, of course, is the prerogative of the Secretary. Secretary of Energy Abraham and Deputy Secretary Blake recently announced organizational changes affecting DOE's safety management program. The residual role of EH is substantively affected.

EH has for some time been an organization seeking more utility. It now encompasses an eclectic set of functions, some of which are more a vestige of history than a reflection of current utility to its customers—the principal of these being the Program Secretarial Officers, the Field Managers, and the Office of the Secretary. With the recent transfer of independent, internal ES&H assessments to the new Office of Safety Oversight, Under Secretary of Energy Card has initiated a review of EH's residual functions. In this context the following suggestions are offered.

Suggestion: Roles of EH. A review of the functions performed in EH should be performed. This review should address the question: "What does each unit of EH do, and who are the customers for the resultant products and services?" The objective should be to distinguish between functions that are "corporate" versus those that are programmatic (line). Targets for such inquiry should include the following:

- *Responsibility for review and approval of authorization basis documents has been delegated to the Field Managers. The role of EH in the review of Safety Analysis Reports and Environmental Impact Statements should be evaluated for value added. The priority on ES&H resources of DOE should be on building quality into these documents by those generating them, not those performing quality checks.*
- *Whether the long-term basic research on the biological effects of radiation, such as the Russian Studies, the Radiation Effect Research Foundation studies and non-DOE related studies, would better be assigned to Science, should be evaluated.*
- *Development and issuance of new safety directives, including rules, are not exclusive to EH. The practice of assigning an Office of Principal Interest allows placement of drafting assignments where both expertise and interest lie. In any case, for rules, a type of "negotiated rulemaking" process should be considered. The objective would be to institutionalize a regularized process of input from those responsible for planning and performing hazardous work to those assigned the lead for developing and issuing safety directives. The Occupational Safety and Health Administration's Participant Program for its Voluntary Protection Program for industrial safety is a good example. Where substantive differences develop in provisions of directives, the COO or designee (e.g., the CSO) should lead the conflict resolution effort.*
- *There should be broader deployment and use of a considerable number of EH's subject matter experts (see the observations in Section 4.5). The practice of sequestering ES&H expertise in multiple DOE Headquarters organizational units, rather than pooling such talent for common use should be reexamined.*
- *Price-Anderson enforcement actions should be a function supportive of the COO or CSO. Enforcement actions through fee adjustments and Price-Anderson civil penalties should be complementary. They are now administered as uncoupled actions (see 4.9).*

4.5 DEPLOYMENT OF ES&H RESOURCES

Observations. DOE's hierarchal structure, operating under the well-accepted concept that line management has primary responsibility for safety, has led to a proliferation of ES&H groups within DOE Headquarters. Although a few years ago, most ES&H functions were delegated to the Field Managers, a substantial number of DOE Headquarters ES&H staff has

been retained. Further, the use by program offices of ES&H subject matter expertise that traditionally has been a part of the corporate independent oversight organization (EH) has decreased substantially over the years as the program offices and the field have been able to acquire their own expertise. The result is that today, there appear to be too many ES&H staff at DOE Headquarters and too few in the field. In fact, there are too few either at DOE Headquarters or in the field that can truly be classed as subject matter experts. Those at DOE Headquarters seem to be underutilized because the mainline safety functions are assigned and preformed in the field. DOE's ES&H human resources need to be realigned and in some cases upgraded to better perform the functions required of the federal workforce.

***Suggestion: ES&H Staff Realignment.** DOE's ES&H staffing should be reassessed as a whole and realigned to correspond to the functions and responsibilities currently delegated to DOE Headquarters and field units. Program Secretarial Officers administering multiple programs should consider consolidating DOE Headquarters subject matter experts and deploying them as support to Program Managers and/or Field Managers. In all cases, field and DOE Headquarters line ES&H personnel should be performing complementary, not duplicate functions.*

***Suggestion: ES&H Needs Assessments.** A Technical Capability Panel was established a number of years ago as a result of the Board's Recommendation 93-3, with the objective of raising the technical expertise of DOE. After the loss of its champion—then Under Secretary T. Grumbley—the effectiveness of the panel diminished substantially. The Technical Capability Panel should be reinvigorated, with leadership assigned to the CSO and strong Program Secretarial Officer (COO) support and participation. The identification of capabilities; the kinds of ES&H expertise needed and where; the inventory of talent on board; the training, recruitment, and retention programs required—these should be made urgent tasks for the Panel and the Program Secretarial Officers.*

Suggestion: Reassignment for more effective deployment of a considerable number of EH's subject matter experts now duplicating line functions is merited. For example, a pool of ES&H subject matter experts in authorization basis documents (Safety Analysis Reports [SARs]/Effluent Information Systems [EISs]), in operational safety, in satisfying environmental protection requirements might be established within the program managed by Under Secretary Card to serve his programs (Science, Environmental Management [EM], EH) the way NNSA has done for the weapons program. Where this grouping of subject matter experts is located does not seem critical but how they are used will be. Their primary function should be to support line management.

4.6 WORKER PARTICIPATION IN ACTIVITY WORK PLANNING

Observations: Instilling better work practices at the first line management level has been one of the most difficult upgrades to achieve. Considerable progress has been made by opening up the work planning processes to contractor employees who will perform the work.

***Suggestions: Enhanced Worker Participation.** Successful ISM requires both a top-down and bottom-up approach. One without the other will not succeed. It is important to*

continue to include and recognize worker contributions to safety in the workplace. Some workers have enthusiastically taken advantage of the opportunity. DOE's senior management should solicit stronger participation of union leadership in the enhanced worker protection programs.

4.7 INDEPENDENT OVERSIGHT OF FIELD OPERATIONS

Observations: By Policy P 450.5, DOE made contractor self-assessment the fundamental base of its safety oversight program. This base program is monitored by federal staff in the Field Offices and DOE Headquarters on behalf of the Program Secretarial Officers (or NNSA Administrator). The Field Managers place staff in high hazardous facilities to monitor operations and assign system engineers to monitor status and operability of vital safety system in such facilities. Field Managers ensure that their contractors maintain effective safety management programs through annual fee award and ISM assessments. Senior DOE Headquarters management also deploys, periodically, an Office of Independent Oversight and Performance Assurance to assess effectiveness of the line managed programs and an Office of Price-Anderson Enforcement (EH-10) to enforce safety requirements established by Rules. DOE's Inspector General (IG) does independent reviews. Taken as a whole, this represents a very substantial amount of resources devoted to ensuring work is performed safely. Yet, with the organizational structure of DOE, there is too little management of these resources as a whole. Each unit operates to a charter of its own.

DOE's safety program is also subject to substantial amount of external review by those having no mission responsibilities. These include the Government Accounting Office, the Defense Nuclear Facilities Safety Board, the Department of Transportation, the Environmental Protection Agency, and the States.

For those straining to fulfill mission requirements the multiplicity of groups constantly looking over their activities can at times seem excessive. A certain tension is inevitable between those planning on performing hazardous work and those independently monitoring and critiquing such efforts. Such tension is healthy so long as the interplay is managed constructively. Involvement is required of senior contractor and DOE management in the deployment of those independent, internal resources acting on their behalf, and in the review of results and corrective actions, when required. Similarly, DOE and contractor senior management should each work to establish smooth interactions with their external reviewers, such as the Board, as well.

Suggestion: Coordination of DOE Internal Safety Program Assessments. *Senior DOE Management (i.e., the Chief Operating Officer, Director NNSA, Under Secretary) should maintain control over the timing and periodicity of comprehensive reviews performed on their behalf as safety assurance checks. While serious safety infractions or accidents causing harm to individuals justifiably trigger immediate investigations, the periodic reviews such as contractor self-assessments, ISM annual updates, Price-Anderson reviews, and Office of Independent Oversight reviews merit longer term planning with the various reviews sequenced and coordinated to foster order and cost effectiveness. If DOE Policy P 450.5 is to be effected, the contractors should be given the opportunity to perform their assessments and field and*

headquarters line management assess contractor performance before DOE senior management sends in their independent reviewers (OA).

Suggestion: Contractor Facility Evaluation Boards. *The most effective contractor self-assessment programs are marked by effective use of Facility Evaluation Boards (FEBs). DOE should move aggressively to promote the use by contractors of such Boards at all sites and regularly review the effectiveness of contractor management's use of them. Where an Energy Facility Contractor is active at multiple DOE sites, the common use of corporate expertise on FEBs should be encouraged.*

Suggestion: An Institute of Nuclear Facilities Operations. *DOE should consider encouraging the nuclear industry serving its missions to develop a self-assessment/self-improvement program comparable to that of the Center for Chemical Process Safety. The common use by DOE's contractors of such a center of excellence to promote programs and practices for protection of workers, the public, and the environment could go a long way toward achieving uniformly high standards of excellence in carrying out DOE's diverse missions. A major step forward in this direction was made by DOE contractors in setting up the Energy Facilities Contractors Group (EFCOG). This positive initiative merits more active recognition, support, and involvement of senior safety officials in line management of DOE. The potential benefits to the government could well justify some subsidization of costs for such a center's establishment.*

4.8 LACK OF ACTION FORCING

Observations: DOE's ES&H program has historically been strong on assessments and weak on effective corrective actions. The feedback and improvement loop has consistently been identified as one of the least effectively performed functions. The effectiveness of DOE's independent internal auditing and appraisal function has been quite limited because DOE has never had a strong decision-making, action-forcing authority to see that such appraisals are given their just due, and the line is directed to take action deemed prudent, given the facts presented. A better system is needed to translate the results of critiques/assessments of operations indicating areas meriting improvement into consensus action plans for achieving improvements. An example is the tank farm operations at the Hanford site. These operations are performed under contract to the federal government by Chem2Hill Hanford Group (CHG). DOE's Office of River Protection is contract manager with line management responsibility. In February 2001, CHG performed a comprehensive self-assessment of its operations. The assessment found operations to be safe, but also revealed a considerable number of cases in which risk reduction improvements were merited (Beamis, 2001). The self-assessment was followed in April 2001 by an independent DOE assessment (EH-2 report, July 2001). In September the Board (Conway, 2001) provided DOE with additional observations on CHG's operations. While some immediate steps were taken by CHG to modify its operations, neither CHG nor the Office of River Protection moved expeditiously to establish a longer-term corrective action program. Such a sluggish response to assessment results is not unusual.

As noted earlier, tensions inevitably result when one group is charged to appraise and critique the performance of another. If the line has primary responsibility for safety but an

internal unit is used to assess and report to top management on the performance of the line, there must exist a management arrangement to review the results and structure a path forward. Moreover, the necessary resources must be provided if line managers are to be held accountable for the execution of corrective action plans.

Suggestion: Establishment of Priorities and Resource Allocation. The lead for developing expeditious corrective action plans has been assigned to the Field Managers. Such plans should reflect risk reduction priorities and resource needs. The role of DOE Headquarters in corrective action planning needs to be more clearly defined. For example, decisions by Field Managers not to take corrective actions for funding or other reasons should be reviewed by the responsible Program Secretarial Office and/or the CSO.

4.9 RESPONSIBILITY/ACCOUNTABILITY

Observations: Admiral H. G. Rickover once observed:

Responsibility is a unique concept. It can reside and inhere in a single individual. You may share it with others, but your portion is not diminished. You may disclaim it, but you cannot divest yourself of it.

Responsibility and accountability are frequently treated as companion functions and rightfully so, but only if responsibility is accompanied by the requisite authority and resources. Where responsibilities and authorities are poorly defined and requisite resources are not provided to fulfill responsibilities, accountability is difficult to establish. Where responsibility is assigned to all, no one feels uniquely responsible.

Responsibilities for which federal employees are accountable are defined primarily in position descriptions and terms accepted as conditions of employment. For contractors, responsibilities are established by the terms and conditions of contracts and statutes. The major functions of the DOE workforce are seeing that (1) terms and conditions of contracts, including the availability of requisite funding, are sufficiently encompassing to ensure that DOE's mission will be accomplished safely and effectively; (2) such terms and conditions are satisfied; and (3) deviations from agreed-upon terms and conditions are subject to enforcement provisions, including penalties when appropriate.

Requirements established by DOE for the safety of its nuclear activities are quite extensive. They are a mix of nuclear safety requirements established by rules and requirements established through contract terms and conditions. The former are generally applicable to all sites and nuclear activities, and the latter are selected to best fit a site's specific activities. The latter also include requirements for protection of workers and the environment that flow down from statutes and regulatory requirements of other federal regulatory agencies. Nuclear safety requirements for protecting the public and workers are subject to enforcement proceedings under provisions of the Price-Anderson Act.

The formulation by DOE and its contractors of *specific* terms and conditions mutually agreed upon as a safety basis for the conduct of hazardous work is a prerequisite for establishing accountability. The Board has been so advising DOE, and a number of its recommendations have been aimed at establishing agreement on activity-specific control measures and programs to which the contractors commit and for which they are to be held accountable. Such agreements, resulting from careful tailoring of control measures to the hazards of the work involved, have been one of the major outcomes of ISM.

While progress is being made in better defining specific terms and conditions (ISM), there is less evidence that measures to hold those thus committed accountable for compliance are keeping pace. Enforcement measures are fairly well established for situations that reflect willful neglect or inept implementation of good safety practices defined in regulations, i.e., the EH-10 Price-Anderson enforcement program. However, most safety requirements are established through contract terms and conditions, and the practices for achieving accountability through contract provisions are not as well established or executed.

Contracting and contract administration have been done largely in the field, with no apparent uniformity in specified measures for linking the achievement of safety objectives and contract performance ratings and awards. Contract administration has historically given greater emphasis to tracking dollars (costs and schedules) than to ensuring that safety-related terms and conditions are satisfied. While a major step forward was taken through the addition of a contract provision in DOE's Acquisition Regulations (DEAR) (Clause DEAR 970.5223-1, *Integration of Environment, Safety, and Health into Work Planning and Execution*) requiring an ISM Description by every major Management and Operation (M&O) contractor setting forth its proposed Integrated Safety Management Plan, this means of defining expectations and establishing a basis for accountability is new. Its effectiveness will depend greatly on how well DOE's site contracting officers enforce these safety-related provisions. The role of the Contracting Officer's Technical Representative is especially critical.

Suggestion. The above observations would be addressed by the following measures:

- *Reinvigorate efforts to (1) establish and maintain the currency of a Functions, Responsibilities and Authorities Manual for the federal workforce, and (2) ensure that position descriptions and associated annual performance appraisals of senior personnel with substantive responsibilities for safety functions reflect those responsibilities.*
- *Establish the specific terms and conditions that result from implementation of the ISM concept as the primary frame of reference for contractor accountability determinations (relative to safety).*
- *Designate and assign a Contract Technical Officer to support the Contract Administrative Officer for every M&O contract or equivalent (e.g., Maintenance and Integration contract). This individual would assess on an ongoing basis contractor satisfaction of safety management commitments, and recommend to the Contracting Officer such administrative action as may be appropriate, such*

as rewards for acceptable or exceptional services, diminishment of award fees for cause, or referrals to enforcement authorities other than the Contracting Officer (e.g., EH Enforcement Office).

- *Include in Price-Anderson Act investigations of unusual occurrences or general appraisals of safety performance examination of the "accountability network," including both contractor and federal workforces. Where contractor penalties result from such inquiries, consideration should also be given to whether the responsible federal office should also be subject to disciplinary actions. A poor performing contractor is indicative of a poor performing federal oversight office. The emphasis in all cases should be on determination of the root causes of unacceptable performance to enable the development of corrective actions and thereby avoid repetition.*
- *Establish an enforcement program that is perceived and executed as a cohesive whole, even though its enforcement authorities stem from different sources, and enforcement actions are executed by different DOE entities.*

APPENDIX A

REPORT AND RECOMMENDATIONS ON THE DEPARTMENT OF ENERGY'S MANAGEMENT ACTIVITIES IN ENVIRONMENT, SAFETY AND HEALTH

Report Prepared by: Dr. James S. Kane, April 1985

MOTIVATION FOR PREPARING THIS REPORT

This report was prepared at the request of Secretary Harrington, who asked that the status of this important part of DOE's responsibility be appraised. It was not prompted by a crisis, an accident, or extra-Department pressures. There is no indication that the Department's operations are unsafe, or are endangering the public health. Nevertheless, there is little doubt that the motivation came, at least in part, from the perception that the health of the Department's safety and environmental oversight function is not sound.

The conclusions given in this report were drawn from information obtained from three sources: 1) a careful reading of several previous reports on safety oversight by individuals both inside and outside the Department*, 2) discussions with several Department officials having expertise in matters related to questions of environment, safety and health, and 3) my personal experience as a member of the DOE's "Crawford" Committees, which conducted an extensive investigation of the Department's nuclear reactor operations shortly after the Three Mile Island accident. Although the conclusions I made are solely my responsibility, I believe there is a general agreement with my recommendations. The written reports were virtually unanimous in their recommendations, and most are similar to those on safety oversight that will be given later in this report.

The philosophy of this report is to restrict its recommendations to those of a general, managerial nature. Its format is first to recommend actions, discuss briefly the reasons behind them, and, in a few cases, to suggest options that are thought to be most appropriate for responding to the recommendations.

*Selected References

1. DOE/US-005, "A Safety Assessment of Department of Energy Nuclear Reactors," Executive Summary, March 1981.
2. GAO Report, "Better Oversight Needed for Safety and Health Activities at DOE's Nuclear Facilities," Chapter 6, EMD-81-108, July 27, 1981.
3. GAO Report, "DOE's Safety and Health Oversight Program at Nuclear Facilities Could Be Strengthened," Chapter 4, GAO/RCED-84-50, November 30, 1983.
4. Letter - J. Hunter Chiles, III to W. Kenneth Davis, Deputy Secretary, "Safety Oversight: The Customer's point of View."

As will emerge subsequently, the problems I perceive cannot be solved simply; they are a product of failure by many participants in managing the Department over a period of perhaps a decade. The Department has proclaimed its dedication to the principle of safety and environmental oversight, while at the same time it has allowed the organization responsible for this oversight, the Office of Environment Safety and Health (ES&H), to atrophy.

BACKGROUND

The Department of Energy conducts a very large and complex high technology operation. The Department's projects involve working with a variety of processes substances and devices, some of them unique to DOE operations, that are potentially hazardous both occupationally and environmentally. It is clearly the responsibility of the DOE to accomplish its missions without undue risk to its workers, the general population, or the environment.

Most of the Department's programmatic work is done at contractor laboratories. The basic responsibility and authority for conducting the work safely and with proper regard for the environment is theirs; this is the DOE's fundamental operational tenet. The responsibility for assuring that the laboratories are in fact doing the work properly goes up the programmatic chain of authority to the Assistant Secretaries, who are in charge of each program, and ultimately to the Secretary.

Yet there is a fundamental, inevitable tension between the two goals of programmatic accomplishment and a safe, environmentally sound operation. In recognition of this tension, it has been the practice of DOE and its predecessor agencies to counterbalance the programmatic viewpoint with one of independent oversight, in the form of an organization that acts as an advocate for safety and environmental acceptability. Those conducting the programs are not relieved of their basic responsibility for this aspect of their programs, but an additional perspective, free from the influence of programmatic pressure, is brought to bear. The success of this dual approach has been amply demonstrated by the excellent record of the DOE facilities.

If it is to work properly, this program-oversight dualism must have equal dynamism, knowledge and technical expertise on both sides. It must also have an arbiter, an official at the highest level of the organization, who is responsible for all aspects of the Department's operations. In the rare instances when there is an unresolved disagreement between the programmatic and the oversight viewpoints, this official must be prepared to weigh the opposing opinions, and to make decisions. This resolution of these safety and environmental issues is one of the heaviest responsibilities of managing potentially hazardous operations, especially when the postulated accidents have a low probability of occurring, yet extreme consequences if they do. The tragedy of Bhopal and the accident at Three-Mile Island are reminders that safety and environmental issues must have regular and serious attention at the highest levels of management. This is where the ultimate responsibility lies.

There is no reason to believe that this operational philosophy, as briefly described, is not sound. Quite the opposite is true. The merits of separating programmatic responsibility and

environment and safety oversight are time proven. The recommendations offered subsequently, are not directed toward changing this philosophy; it is judged to be valid. The recommendations are intended instead to ensure that this philosophy is followed.

RECOMMENDATIONS

I am making eight recommendations. The first two are by far the most important.

Recommendation 1—Revitalize the Environment Safety and Health Office

The current state of ES&H is a disgrace. It is widely perceived as having “no clout,” and of being ignored by senior management unless a crisis develops. Morale is low, and as successive reports recommending action are followed by no action, it sinks further. It is not an office that would be attractive to aggressive young people on the way up. In spite of dedicated efforts by many of its staff it has become a toothless watchdog guarding the safety and environmental integrity of one of the potentially most hazardous undertakings in the world.

The organization must become more aggressive in establishing safety and environmental policy for the Department. Environmental policy development will require far greater initiative in dealing with the EPA.

If we are to pay more than lip service to the concept of an independent safety and environmental oversight function at Headquarters, there must be a vigorous effort to revitalize the ES&H Office.

Options

This recommendation is really not amenable to a listing of options. What I have done is to list some of the steps that should be taken. The list is most certainly not complete.

- (1) Place the ES&H office at a more prominent organizational level.
- (2) Designate a Departmental Safety Officer, with access to high management on a regular basis, similar to the Inspector General.
- (3) Encourage an attitude of hands-on safety oversight, not one of monitoring the monitors.

These first three items are given subsequently as individual recommendations.

- (4) Include reviews of ES&H in the Departmental Management Review Process.

- (5) Rotate personnel from other offices, including the Field Offices, into ES&H. This should include other than professional safety personnel. Make this rotation an attractive step on a career ladder.
- (6) Give the Office an active role in the Department's environmental compliance program.
- (7) Encourage Intergovernmental Personnel exchanges with government and state agencies and universities.
- (8) Improve professionalism. Don't transfer in unqualified people.
- (9) Sponsor an appropriate program of research on selected topics related to the ES&H mission.

Recommendation 2—Establish Organizational Responsibility and Budget Strategy for Environmental Site Cleanup

The Department has a number of sites where hazardous substances have been discharged to the environment. Many of these sites will require remedial action to be in compliance with current legislation, especially RCRA* and CERCLA*. Already several hundred potential CERCLA sites have been identified, and the characterization efforts are not yet complete. Several hundred additional sites could be identified in the future. Although only a fraction of the sites will require cleanup, remedial action costs could be in the range of billions of dollars.

The responsibility for obtaining funds and correcting the deficiencies is clear where single program operations have occurred. Responsibility is not clear or accepted at multi program sites. The situation has resulted from operations of several programs, some of them long ago. There is also reluctance by all to include the large remedial costs in the normal budget process, because of the fear that the costs will have to be absorbed by the program. A Departmental strategy for this situation has not yet been developed.

As a further complication, some Field Offices are significantly farther along than others in identifying the extent of their problems and requesting remedial action funds.

This uneven approach to environmental cleanup makes it virtually impossible to assign priorities on a DOE-wide basis. The Department must get its act together. It needs a comprehensive, well-planned approach to handling the cleanup of sites to meet environmental requirements. Without it, the Department will continue to lose credibility and could face significant interruption in its programs,

* RCRA stands for Resource Conservation and Recovery Act. CERCLA stands for Comprehensive Environmental Response, Compensation and Liability Act. RCRA deals with ongoing activities involving hazardous wastes, while CERCLA deals with abandoned or inactive sites where hazardous wastes are present.

Options for Responsibility

1. Assign full responsibility to a single program office.
2. Make Defense Programs responsible for sites under its jurisdiction and assign another program office to be responsible for all other sites.
3. Completely decentralize to each Program Assistant Secretary.

Corresponding Options for Budget Strategy

1. All DOE cleanup efforts would be budgeted in a prioritized, single line item budget request.
2. Because of Congressional interfaces, the DOE cleanup efforts would be budgeted in two individually prioritized line item budget requests.
3. Each Assistant Secretary would budget cleanup efforts at that program's sites.

Recommendation 3—Enhance the Organizational Stature of Environment, Safety and Health

Both of the GAO reports referenced in the introduction and DOE/US-0005, the “Crawford” Committee Report, gave a high priority to elevating the organizational stature of the ES&H Office. The reasoning was that such an important function should have ready access to the highest levels of Departmental administration, and should not be buried too deeply within the organization. Their recommendations were not followed.

Why this preoccupation with organizational status? In a perfect bureaucracy an important message would get through, independent of the organizational depth of its origin.

Real organizations are not perfect. In real organizations the location of an office, either physically or on the organization chart, can convey a far more important message than the title on the door. Optics are important.

The ES&H oversight function should be organizationally located commensurate with the importance attributed to it by management. I cannot refrain from making the observation that in the past, it has been.

The ES&H oversight function is critically important to the Department, and should be properly recognized. ES&H should have a voice in Departmental issues where its opinion is relevant. Its opinions should count in office appraisals, Departmental budget submissions, contract extend-compete decisions, and other similar matters. The important role assigned to this Office warrants high organizational status.

Options

1. The ES&H function should be placed at an organizational level comparable to that of other programs. The Assistant Secretary in charge should not have other disparate duties. The office should include a senior highly placed career official who would provide stability and continuity during the inevitable transitions.
2. The Office should be staff to the Under Secretary, perhaps as the Deputy Under Secretary for ES&H, reporting directly. The office should include a senior, highly placed career official who would provide stability and continuity during the inevitable transitions.

Recommendation 4—Choose and Adopt a New Organization for Environment, Safety and Health

The current organization for ES&H was approved in April 1982. While the structure was thought appropriate at that time, it has not been fully implemented even to this date. For example, permanent Directors were not established for several key executive positions, nor were position descriptions updated.*

Since 1982 a number of changes have taken place. (1) Several functions have been transferred to other offices in the Department, (2) manpower ceilings have been reduced, and (3) environmental compliance has emerged as a high priority effort.

In view of these changes a serious effort was initiated in 1984 to modify the organization and correct deficiencies. A structure was identified and concurred in by Management and Administration (MA), and all position descriptions were revised and have been reclassified by MA. Action on this effort has not been completed pending further Secretarial Office reviews.

Without specifying any particular organization, it is apparent that a satisfactory structure should be established that puts additional emphasis on today's requirements, including environment, nuclear safety, and health physics.

Because of the chaos in the current organization, proper revisions will undoubtedly involve some downgrades and a reduction in force. Until this is accomplished, however, ES&H will not have a firm organizational and administrative structure to fulfill its obligations.

Recommendation 5—Issue the Recently Revised Environment, Safety and Health Nuclear Safety Orders

These orders codify the responsibilities of the various offices with respect to nuclear safety matters. The orders currently in existence should be replaced. A new version was worked

*Approximately 50% of the existing position descriptions were prepared for an organization that existed prior to 1982.

out in a coordinated effort between Field and Headquarters offices over the period from June 1984 to March 1985. The new orders are in the Office of the Assistant Secretary for Management and Administration, ready for signature and issue.

The new orders were written in response to a general recognition that the current orders give far too little responsibility and authority to the ES&H oversight function. The history of this de-fanging of ES&H is not worth recounting here, other than to observe that it was probably an understandable over-reaction to the "Crawford" Committee Report.

The issuance of the new orders is necessary, but not sufficient. It should be accompanied by a revised organization of the ES&H office as recommended in the previous recommendation. The new organization will be necessary to carry out the responsibilities that the revised orders assign to ES&H.

Although I recommend the issuance of these new orders without reservation, I find the emphasis on a written definition of what ES&H can and cannot do somewhat disturbing. It is an indication of the sorry state to which ES&H has fallen. I do not believe that a technically competent safety and environment office, armed with the facts and having ready access to high Departmental officials who respect their opinions, should have to rely so heavily on authority derived from written orders. If they are good, and are right, they will be listened to, orders or not.

Recommendation 6—Designate a Departmental Safety Officer

The Deputy Assistant Secretary for Environment, Safety and Health should be designated as the Departmental Environment and Safety Officer. The Environment, Safety and Health activities of the Department need a high level spokesman. This individual should have a personal knowledge of what the Department is doing and how it works, and would provide continuity during the transitions that inevitably occur. Many managers in the DOE, especially those at the Presidential Appointee level, occupy their positions for relatively short terms. It cannot be assumed that these managers will have the requisite background, nor the time, to understand personally the various ingredients of an environment and safety program. To the degree practicable, the DOE safety functions must possess an institutional stability. The Environment and Safety Officer would provide this.

Designation of a Departmental Environment and Safety Officer also has the benefit of enhancing the perception of the function by others in the DOE organization. The Officer would be viewed as an extension of the Secretary's Office whose primary functions would be to provide independent safety assurance. The status of the Officer should be established by the Secretary's Office and occasionally reinforced. Short periodic meetings (perhaps 15 minutes on a weekly basis) with the Under Secretary would provide for necessary communications and indicate management support for the Office.

This arrangement might be thought of by some as a means to bypass the responsibilities of the Assistant Secretary responsible for ES&H. This is indeed a problem. I believe, however, that the short average tenure of Presidential Appointees makes the problem unique to government. Would the Nuclear Regulatory Commission tolerate a utility that had such rapid turnover in its Chief Safety Officers? This recommendation should be carefully considered.

Recommendation 7—Re-orient the Headquarters Environment, Safety and Health Appraisals to Put Greater Emphasis on the Adequacy of Operations

The Field Office managers have the primary responsibility to ensure adequate consideration of ES&H matters by their contractors. The Headquarters ES&H group is responsible for independently verifying that the Field Offices are carrying out this function. In the recent past, the Headquarters assessments have tended to focus on the “paper trail” developed by the Field Office staff, rather than on the operations themselves. While important, this is only a secondary measure of the effectiveness of the overall program. Experience has shown that actually observing the operations and conditions at the plants is an important and necessary step in verifying that an adequate ES&H program is indeed functioning satisfactorily.

To do this field evaluation properly requires extra effort and appropriate expertise. The Headquarters ES&H staff will need assistance. Support from service contractors, Field Office and Headquarters program personnel, consultants, DOE contractors and experts from other Agencies, such as the Nuclear Regulatory Commission or the Environmental Protection Agency, could be used. At a lower level of detail, but nevertheless essential, travel funds must be available. Use of personnel within one portion of the DOE complex to help in the review of others also has a side benefit in furthering an exchange of ideas and practices.

Recommendation 8—Consolidate Headquarters Environment, Safety and Health Functions

The deterioration of the ES&H organization has led to the proliferation of independent safety groups in Headquarters. Energy Research and Defense Programs have created or bolstered their staff organizations, while Nuclear Energy has historically maintained an active safety oversight organization. Multiple oversight organizations cause problems. They lead to a confusion of responsibility, and to duplicative and occasionally contradictory directions to the field.

This question of consolidation should be pursued. It is my impression that the Field Offices will support it enthusiastically. Energy Research and Defense Programs will agree, if they can rely on a rejuvenated ES&H, while Nuclear Energy will wish to continue an active program of its own.

Even if the reasons for maintaining separate, programmatic oversight offices are found to be persuasive, there should be a requirement that only ES&H is allowed to issue directives to the field involving matters of environment, safety or health.

CONCLUSION

For over thirty years the DOE and its predecessor agencies have been the recognized technical authorities on the safety and environmental aspects of their programs. Reactor safety, weapons safety, and radiation safety are all three examples of fields that were originated and developed by the Department. In effect, the activities of the Department, many of them unique, have been regulated by internal technical expertise of the highest order. This internal regulation is far superior to the adversarial process. It has worked and worked well but it is now in serious need of attention.

The most pressing problem I have found in the Department's treatment of safety and environmental matters is that they have been almost completely neglected by top management. It is not coincidence that the decline in the Safety Oversight office began when the mission of the Department was expanded to include such time consuming and politically contentious activities such as energy regulation, natural gas pricing, etc. These tend to overwhelm management. Safety and environmental issues other than those of a crisis nature are driven out by the bureaucratic equivalent of Gresham's law.

Safety is in many ways analogous to quality control. It is more a state of mind than it is a neatly defined set of operations. It has been said that the best measure of an organization's dedication to safety is not the number of safety inspectors, but the number of hours per week the Chief Executive Officer devotes to safety issues. The same is true for environment. It is easy to ignore, until a crisis occurs.

I believe that following the recommendations in my report is a necessary first step in the reversal of the long term decline in the Department's treatment of environment and safety. But that won't solve the problem. As I see it, the only long range solution is an overall raising of the Department's consciousness on these vital subjects. This means attention by top management, the restoration of an aggressive, technically competent ES&H office, and an increasing awareness that environmental issues must be given greater emphasis at all levels.

APPENDIX B

NEW DIRECTIONS IN NUCLEAR SAFETY MANAGEMENT AND ORGANIZATION Report Prepared by the Office of Nuclear Safety, April 2, 1993

A Discussion of Nuclear Safety Problems in DOE¹

DOE facilities continue to be plagued by dangerous or potentially dangerous incidents involving poor radiological work practices, inadequate safety analyses, unanalyzed conditions, preventable releases to the environment, and criminal acts. The frequency and significance of these events raises serious concerns about the management of nuclear safety in DOE. These incidents are primarily the result of failures within the contractor organizations, but they are also signs of institutional failures within DOE.

This chapter [Appendix] describes incidents and unsafe conditions that either exist at DOE facilities today or have occurred in the last few years. The descriptions are taken from official DOE occurrence reports, investigation reports prepared by DOE line and oversight organizations, and reports prepared by external advisory groups. These incidents and conditions are just a sample of those the Office of Nuclear Safety (NS) is aware of, but they are significant from the perspective of risks to the workers, the public, and the environment. The descriptions indicate that nuclear safety problems are not restricted to any particular facility, site, field office, or program office. They exist everywhere in DOE facilities. We believe there are at least four important reasons for this.

First, DOE has many low-priority facilities that have not received (and are not receiving) adequate management attention. Management attention has been focused on Secretarial priorities (such as K-Reactor or Rocky Flats building 559) and new projects (such as the Advanced Neutron Source, the Defense Waste Processing Facility, and the Hanford Waste Vitrification Project).

Second, in designing and siting facilities, the Department has historically emphasized protecting the public who live nearby the facilities. This approach has had its consequences for facility workers and the local environment.² In order to classify a facility system as a "safety system," the DOE approach required a determination that, if an accident were to occur at the facility, there was a real danger that a person at the site boundary would receive radiation doses in excess of 25 rem. Most DOE sites are large, and the facilities are many miles from public areas. The large distances between facilities and site boundaries made it very unlikely that accidents would lead to such doses for the public. Therefore, very few facility systems were classified as safety systems, even though failures in these systems posed a potential danger to

¹ This appendix is not intended to be a comprehensive analysis of DOE's recent accident history

² It should be noted that AEC, ERDA, and DOE accident analyses were done poorly for any scenarios, including those with offsite effects.

workers on site or to the immediate environment. Because only safety-class systems received significant maintenance, many important systems have prematurely degraded and failed.

Third, facilities have been and are being operated beyond their design life. If increasing maintenance is not applied to them, they inevitably degrade at a high rate.

Fourth, few DOE contractors have brought modern management techniques, processes and systems to the management of DOE facilities. A modern safety culture cannot be built and sustained in a nuclear facility without the application of strong and effective management systems.

ANALYSIS OF CAUSES AND IMPLICATION FOR DOE

The events discussed in this Appendix and in Chapter 2 involve breakdowns in management programs that are vital to nuclear facility safety, specifically (1) radiological protection, (2) facility safety analysis and process hazards analysis, (3) control of facility configuration over the life of a facility, (4) environmental protection, and (5) prevention of criminal acts.

Many of the events discussed in this report involve inadequate radiological protection of the workers. The underlying causes of these events are breakdowns in DOE contractor processes for planning work in radiological areas, controlling contaminated equipment and sealed sources, implementing effective radiological survey programs, ensuring that personnel monitoring practices are proper, and implementing ALARA (As Low As Reasonably Achievable) policies and practices as required by DOE orders. The frequency of these kinds of events reflects an absence of the requisite attention to detail³ for radiological work across the DOE complex. This is of particular concern because DOE's radiological workload is expected to increase as increasing emphasis is placed on environmental remediation and decontamination and decommissioning of facilities. NS has recently implemented a focused assessment program to stimulate improvements in the radiological protection programs of DOE's contractors. Aggressive implementation of improvements to these programs is warranted given the current state of radiological controls within DOE.

DOE safety analyses do not adequately assess accidents with radiological consequences⁴ for the workers. NS has identified this deficiency at many sites across the country, and it is highlighted again in some of the events described in this Appendix. At the Rocky Flats Plant, DOE conducted a systematic re-evaluation of the safety analyses for Building 559 and 707 and

³ Attention to detail (or the lack of it) in connection with nuclear work is a significant indicator of the "safety culture" present at DOE facilities.

⁴ Consequences resulting from the accidental release of radioactivity or radiation. This differs from occupational doses where ALARA applies. Accidental releases may be from nuclear criticality, fire, earthquake, abnormal transients in facility containment of power systems, etc. Through accident analysis facilities improve design, testing, and maintenance programs for systems that can protect workers.

found several accident scenarios that were not addressed in the existing safety documentation. These scenarios required through evaluation in order to provide additional protection for the workers, such as new administrative controls for the testing and maintenance of equipment. Most facilities in DOE have not conducted re-evaluations of this kind.

Emergency preparedness activities in DOE are also inferior, particularly when compared to the preparedness of the commercial nuclear industry. The ability to respond promptly to emergencies has not been demonstrated at most DOE facilities.

Recent incidents have also brought to light deficiencies in process hazard analysis. The safe operation of DOE nuclear facilities requires a thorough understanding of nuclear and chemical process safety, yet many DOE facilities do not know the design basis for the equipment and production processes they employ.

Poor maintenance programs (including inadequate chemistry control), coupled with the practice of operating facilities beyond their design life, are causing incidents at DOE facilities. A recent NS assessment at the Idaho National Engineering Laboratory that focused on potential criticality problems identified this concern. Phenomena such as corrosion and erosion, exacerbated by poor maintenance, are leaving some DOE facilities in an unanalyzed state, establishing preconditions for accidents.

Decontamination and decommissioning activities are a special case and involve special hazards. For decontamination and decommissioning activities, failures in management programs can literally create booby traps for unsuspecting workers, who often come along many years after the trap has been set. The most important of these failures involve planning for long term containment of radioactive material; safety analysis; design; operations; maintenance; and control of plant changes.

Safety barriers can and are being willfully defeated at some DOE facilities. The number of these cases appears to us to be on the rise. The risks of this activity are high, particularly when they involve the defeat of a final barrier in a series designed to protect against release of radioactivity.

Human error and equipment failure can never be totally prevented. But safety management can be improved to provide institutional barriers that minimize the effects of individual errors and prevent them from leading to disaster. To NS, the recurring problem of contamination incidents at DOE facilities is the result of management paying too little attention to safety barriers essential to radiological control. We believe these incidents are manifestations of serious institutional failures within the DOE and contractor organizations.

This appendix first describes a class of incidents that has affected workers, the public, or the environment or that were near misses.⁵ The discussion is grouped according to consequences: radiological contamination of the public or the off-site environment; radiation exposures of workers; and radiological contamination of workers, facilities, or the on-site environment.

The first class of incidents is followed by discussion of a second class of incidents involving seriously degraded safety conditions. The second class of incidents lead to reduced margins of safety in the affected facilities, setting the stage for subsequent near misses or actual harm to people or the environment. The second class of incidents may, in fact, be more significant from a safety perspective than the first because of the potential to adversely affect a larger number of people.

⁵ We are not trying to argue that all of these incidents were significant from the perspective of human health; we are arguing that they are significant as indications of the performance of management systems.

APPENDIX C

I. EXECUTIVE SUMMARY

A SAFETY ASSESSMENT OF DEPARTMENT OF ENERGY, NUCLEAR REACTORS DOE Report, DOE/US-0005, 1981 (Crawford Report)

FINDINGS AND RECOMMENDATIONS

Based on the assessments conducted, the Committee findings can be summarized as follows.

1. No evidence was found that any of the DOE-owned reactors are being operated in an unsafe manner or that any of these reactors should be shut down.
2. A number of significant deficiencies exist in DOE's reactor safety management activities, as revealed by the Committee's on-site reviews and by the findings of the Committee's Support Team in assessments of site Headquarters documents.
3. There is a need to strengthen substantially the technical and managerial capabilities of DOE Headquarters and field organizations which have reactor safety responsibilities.



The conclusion that DOE reactors should be allowed to continue operation is not unlike that made by the Nuclear Regulatory Commission (NRC) with respect to licensed reactors after the accident at TMI [Three Mile Island]. In that case, a number of significant items requiring industry-wide improvement were identified. Additionally, the majority view among the members of the President's Commission which investigated the accident was that continued operation of licensed reactors was warranted as long as corrective measures were undertaken expeditiously.

The Committee has been particularly sensitive to the role played by DOE Headquarters management in carrying out its responsibility for nuclear safety, particularly in light of the major departmental changes that have occurred over the past five years. It attempted to compare not only DOE and NRC in their respective nuclear safety overview roles, but also DOE's present overall management role with that of its predecessor organizations. These comparisons have contributed to the Committee's understanding of the organizational changes in nuclear management that have occurred in the successive reorganizations from the Atomic Energy Commission (AEC) to the Energy Research and Development Administration (ERDA) to DOE.

The impact of these changes raises questions about the adequacy of the current organizational structure, relative to nuclear programs, to satisfy DOE's legally established

obligations to protect the public health and safety. One important result of these organizational changes is that many organizations and individuals who manage nuclear reactors have had their responsibilities widened to include an increasing portion of non-nuclear management responsibilities. Nuclear activities have been increasingly dispersed among non-nuclear programs as ERDA succeeded AEC, and DOE in turn succeeded ERDA. Headquarters' guidance and direction to the field units have become diffused and weakened due to the decentralization of the programs, and the organizational gap has widened between top management (presently, the Secretary of Energy) and the reactor safety overview organization. All these factors in combination operate to deprive the Secretary of the ability to assure that he is effectively carrying out his legal responsibilities for the protection of the public.



The responsible conduct of all nuclear reactor programs is currently a prominent public, political and medial issue. It is the Committee's opinion that a visible, unified DOE nuclear mission, closely coupled to the highest levels of DOE management, would demonstrate that nuclear safety is receiving high-priority attention. To accomplish this, the Committee recommends three basic organizational changes.

1. Establish some means to ensure that matters relating to DOE nuclear safety receive continuous attention at a management level above the Assistant Secretaries.
2. Establish an independent overview group within DOE to serve as the main independent safety surveillance channel from the reactor programs and sites to top management.
3. Establish a group of experts external to DOE, but reporting to and advising the Secretary of Energy on the Department's overall nuclear safety performance.

Based on the results of the Committee's reviews of DOE reactors, it is recommended that steps be taken to conduct similar in-depth reviews of DOE non-reactor nuclear facilities. Those too should be conducted by an independent group established by the Under Secretary and composed of thoroughly knowledgeable and professionally competent individuals not responsible for the operation of the facility reviewed.

ASSESSMENT OVERVIEW – MAJOR FINDINGS

The following seven items constitute the major findings of the Committee:

1. The number of significant deficiencies that exist in safety management within DOE nuclear reactor programs indicates a need for DOE management to reassess its capabilities and priorities.

2. The Committee found little evidence within DOE of a renewed effort to strengthen its “corporate” capability or to assure that its performance in operating its reactors safely is commensurate with its policy position on the importance of this matter.
3. DOE Headquarters policies, instructions, and other information relating to nuclear matters issued to the sites are not definitive and lack uniformity among the various nuclear programs. They have not been upgraded to take into account the standards and requirements reissued by NRC.
4. A coordinated DOE-wide program relative to TMI Lessons learned has not been established, and only isolated corrective measures are evident at reactor sites.
5. DOE lags behind the commercial nuclear industry in issuing uniform unambiguous requirements for the selection, training, and qualification of reactor operating personnel.
6. Effectiveness of quality assurance within DOE nuclear programs varies widely, and a comprehensive overhaul is warranted from Headquarters downward. Lack of Headquarters guidance is considered to be a contributing factor.
7. DOE has no Headquarters directives that promulgate requirements on emergency planning or public information in accident situations.

As a result of the above findings, the Committee concludes that the following needs are of utmost importance:

- For an external high-quality, advisory backup to DOE’s independent reactor safety overview management function;
- To define clearly and unambiguously the responsibilities and authorities for reactor safety at all levels in DOE’s organizational hierarchy;
- For uniform and higher-quality technical standards throughout all phases of DOE’s nuclear programs;
- For selection and approval of these standards by the top level reactor safety overview group at DOE headquarters;
- To upgrade nuclear technical competence both in management and support personnel who are involved in DOE’s nuclear programs;
- To upgrade technical competence of reactor operating personnel through improving training; and

- To establish a single focal point within DOE for collecting, analyzing, and distributing data, which would be useful in improving nuclear operations and preventing accidents.

All of these needs are stated in terms applicable to DOE's reactor facilities. The Committee is convinced, however, that most of them have an equivalent counterpart in the non-reactor facilities where nuclear materials are handled in DOE's nuclear activities. For that reason, a recommendation is made to extend the basic reactor-related recommendations into this other area, when applicable.

Findings and Recommendations of the Committee for each of the seven assessment categories listed below with the numbers in parentheses being the number of findings in the indicated area and each finding has related recommendations.

- DOE Safety Overview Function (6)
- DOE Programmatic Function (12)
- Training of Operating Personnel (9)
- Technical Assessment (6)
- Radiological Controls and Worker and Public Health and Safety (6)
- Emergency Planning and Response (4)
- Public's Right to Information (4)

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GLOSSARY OF ACRONYMS

AEC	Atomic Energy Commission
ALARA	As Low As Reasonably Achievable
Board	Defense Nuclear Facilities Safety Board
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFO	Chief Financial Officer
CHG	Chem2Hill Hanford Group
COO	Chief Operating Officer
CSO	Chief Safety Officer
DBM	Division of Biology and Medicine
DEAR	DOE Acquisition Regulation
DOE	Department of Energy
EFCOG	Energy Facilities Contractors Group
EH	Assistant Secretary for Environment, Safety and Health
EIS	Effluent Information System
EM	Environmental Management
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
ES&H	DOE's Environment, Safety and Health program
FEBs	Facility Evaluation Boards
GAO	US General Accounting Office
IG	Inspector General
ISM	Integrated Safety Management
M&O	Management and Operation
MA	Management and Administration
MED	Manhattan Engineering District
NAS	National Academy of Sciences
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
NS	Nuclear Safety
OA	independent corporate safety and safeguards assessment group
R&D	research and development
RCRA	Resource Conservation and Recovery Act
SAR	Safety Analysis Report
SC	Safety Council
SMIT	Safety Management Integration Team
TMI	Three Mile Island