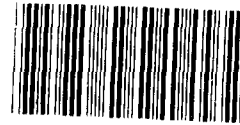


GAO

June 1986

NUCLEAR ENERGY

A Compendium of Relevant GAO Products on Regulation, Health, and Safety



130069

**Comptroller General
of the United States****B-223176**

June 6, 1986

To the President of the Senate and
the Speaker of the House of Representatives

On or about April 25, 1986, a nuclear reactor at Chernobyl, the Ukraine, Soviet Union, malfunctioned. As a result, the immediate area around the reactor was highly contaminated, causing deaths and injuries, radioactive contamination of surrounding countries, and residual fallout worldwide. The Chernobyl reactor is used for generating electrical power and is believed by some to be a facility for producing plutonium for nuclear weapons. The reactor is one of four units at Chernobyl, all of which are water-cooled and moderated by graphite.

As a result of the Chernobyl accident, there has been heightened interest over relevant environment, health, and safety issues pertaining to nuclear power in this country, including the adequacy of the Nuclear Regulatory Commission's (NRC's) regulation of domestic commercial nuclear facilities and the self-regulation of the Department of Energy's (DOE's) nuclear installations. A major concern in the United States today is the possibility of an accident similar to Chernobyl occurring at one of DOE's production reactors, of which there are four at its Savannah River Plant near Aiken, South Carolina, and one at its Hanford Reservation near Richland, Washington. All five of these facilities produce plutonium for nuclear weapons, and none have containment structures of the type required for commercial nuclear power plants.

We have received requests from a congressional committee, a subcommittee, and a Member of Congress to pursue several areas relating to domestic commercial nuclear facilities and those operated by DOE. These include (1) a review which compares and contrasts various safety and other features of DOE's reactor at Hanford with those of the troubled unit at Chernobyl, (2) a review focusing on the safety features and requirements of DOE's production reactors at Savannah River, (3) a broad-based study of the safety of domestic nuclear power, including both federally and commercially-owned facilities.

In addition, at the time of the accident, we had several reviews in process, including (1) a review of the adequacy of health and safety procedures at selected DOE defense facilities, including the Hanford reactor, (2) an assessment of DOE's implementation of the Nuclear Waste Policy Act of 1982, (3) an analysis of the limits on insurance provided under the Price-Anderson Act dealing with severe nuclear accidents, and (4)

an evaluation of the possible relocation of the Rocky Flats plutonium processing operations.

This report provides the Congress with a compendium of our past work in the nuclear energy area. The compendium includes reports and testimonies relating to nuclear energy since January 1, 1979, shortly before the accident at the Three Mile Island nuclear power plant, near Harrisburg, Pennsylvania. It will be useful to the Congress, pertinent agencies, and other interested parties during deliberations on nuclear activities over the next several months concerning the safety of nuclear power in this country and other related issues.

The compendium is presented in two appendixes. Appendix I briefly discusses 27 reports and testimonies directly relating to nuclear regulation and 12 directly relating to nuclear environment, health, and safety issues which we believe are of concern given the Chernobyl accident. The narratives included in the appendix are based on information presented in the reports or testimonies and may not reflect current circumstances.

Our work in the area of nuclear regulation has focused on NRC's implementation of the lessons learned from the accident at the Three Mile Island plant. For example, we have recommended management improvements related to (1) resolving safety issues common to nuclear plants, such as issues identified from that accident, (2) preparing for emergencies, and (3) inspecting operating nuclear plants.

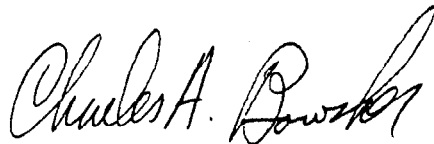
Most of our prior work relating to environment, health, and safety issues focused on DOE's various nuclear facilities. These included DOE's uranium enrichment plants, multiprogram laboratories, plutonium production reactors, plutonium processing plants, and uranium and plutonium fabrication facilities. Our reports presented in the appendix, which date back to 1980, contain findings, conclusions and recommendations in the areas of (1) protecting worker health and safety, (2) planning for nuclear emergencies and coordinating response mechanisms in the event of a serious nuclear accident, (3) ensuring the safe design of facilities, and (4) monitoring the environment.

While we reported that deficiencies in these areas were correctable through improved management techniques and a greater awareness of safety and health oversight, we pointed out that impaired organizational independence of the oversight function, a lack of headquarters authority, and the decentralized nature of the oversight activities may

constitute more serious problems over the long term. To correct these potential problems, we identified several alternatives for improving oversight of DOE's nuclear facilities, ranging from elevating the health and safety function to a higher organizational level in DOE to having outside agencies provide this function. Although DOE has since elevated the oversight function and has made several other improvements to correct noted deficiencies, our more recent work indicates that organizational independence of the oversight function may still be a problem area and is likely to receive increased scrutiny in the aftermath of the Chernobyl accident.

Appendix II is a list of other GAO products and provides a more complete overview of our past work in the nuclear area. This list includes reports and testimonies relating to nuclear waste management and disposal activities at commercial and federal facilities, as well as other products dealing with nuclear regulation, environment, health, and safety and other areas which have a less direct relationship to issues generated by the Chernobyl accident.

We are sending copies of this report to the House Committee on Government Operations, Senate Committee on Governmental Affairs, Senate and House Appropriations Committees, and the respective House and Senate committees having oversight responsibilities for nuclear energy matters. We are also making copies available to the Secretary of Energy and the Chairman, NRC.



Charles A. Bowsher
Comptroller General
of the United States

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Abbreviations

DOD	Department of Defense
DOE	Department of Energy
EMD	Energy and Minerals Division, GAO
EPA	Environmental Protection Agency
ES&H	Environment, Safety, and Health
FEMA	Federal Emergency Management Agency
GAO	General Accounting Office
ID	International Division, GAO
INPO	Institute of Nuclear Power Operations
IAEA	International Atomic Energy Agency
NRC	Nuclear Regulatory Commission
NSIAD	National Security and International Affairs Division, GAO
OGC	Office of General Counsel, GAO
PRA	probabilistic risk assessment
R&D	research and development
RCED	Resources, Community and Economic Development Division, GAO
TMI	Three Mile Island

Synopses of Reports and Testimonies Directly Related to Nuclear Regulation, Environment, Health, and Safety Issues

The material presented in this appendix was derived from issued GAO reports and testimonies. The narrative portions may not reflect current situations since they were prepared based on circumstances existing at the time these GAO products were issued. Such products are as follows:

Nuclear Regulation: Page References

Oversight of Quality Assurance at Nuclear Power Plants Needs Improvement (p. 8.)

Process for Backfitting Changes in Nuclear Plants Has Improved (p. 9.)

International Response to Nuclear Power Reactor Safety Concerns (p. 10.)

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Probabilistic Risk Assessment: An Emerging Aid to Nuclear Power Plant Safety Regulation (p. 12.)

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Three Mile Island: The Most Studied Nuclear Accident in History (p. 19.)

Analysis of the Price-Anderson Act (p. 20.)

Do Nuclear Regulatory Commission Plans Adequately Address Regulatory Deficiencies Highlighted by the Three Mile Island Accident? (p. 21.)

Reorganization Plan No. 1 of 1980 (Testimony) (p. 22.)

The Nuclear Regulatory Commission: More Aggressive Leadership Needed (p. 22.)

Placing Resident Inspectors At Nuclear Power Plant Sites: Is It Working?
(p. 24.)

Emergency Preparedness Around the Rancho Seco Nuclear Power Plant: A Case Study (p. 25.)

Emergency Preparedness Around Nuclear Facilities (Testimony) (p. 25.)

NRC's Program for Licensing Nuclear Power Plant Operators (p. 26.)

Areas Around Nuclear Facilities Should Be Better Prepared for Radiological Emergencies (p. 26.)

Higher Penalties Could Deter Violations of Nuclear Regulations (p. 28.)

Reporting Unscheduled Events at Commercial Nuclear Facilities: Opportunities To Improve Nuclear Regulatory Commission Oversight (p. 28.)

Nuclear Environment, Health, and Safety: Page References

Environment and Workers Could Be Better Protected at Ohio Defense Plants (p. 29.)

DOE's Safety and Health Oversight Program At Nuclear Facilities Could Be Strengthened (p. 30.)

Decommissioning Retired Nuclear Reactors at Hanford Reservation (p. 31.)

Actions Being Taken to Help Reduce Occupational Radiation Exposure at Commercial Nuclear Power Plants (p. 32.)

Cleaning Up Nuclear Facilities: An Aggressive and Unified Federal Program Is Needed (p. 32.)

Better Oversight Needed for Safety and Health Activities at DOE's Nuclear Facilities (p. 33.)

GAO's Response to DOE's Comments on EMD-81-108, "Better Oversight Needed for Safety and Health Activities at DOE's Nuclear Facilities" (p. 34.)

Congress Should Increase Financial Protection to the Public From Accidents at DOE Nuclear Operations (p. 35.)

Better Oversight Needed for Safety and Health Activities at DOE's Nuclear Facilities (p. 36.)

Problems in Assessing the Cancer Risks of Low-Level Ionizing Radiation Exposure (p. 37.)

The Department of Energy's Safety and Health Program for Enrichment Plant Workers Is Not Adequately Implemented (p. 38.)

Decommissioning and Dismantling of the 100-F Reactor (p. 39.)

Nuclear Regulation

Oversight of Quality Assurance at Nuclear Power Plants Needs Improvement (GAO/RCED-86-41) (01/23/86)

GAO reviewed the NRC's efforts to (1) identify declining performance trends in the operation of nuclear power plants that indicate the need

for corrective action by utilities; and (2) require utilities to upgrade quality assurance programs when deficiencies are observed.

GAO found that NRC assessments have provided the agency and utilities with a useful perspective on the total operational effectiveness of nuclear power plants; however, they are limited in scope and could be more useful in promoting early detection of utility management weaknesses if the agency expanded the analyses and the way the assessment reports are used. In addition, GAO found that (1) NRC decisions to require 12 utilities to upgrade their management capabilities and performance generally followed either numerous inspection violations or equipment failures; (2) these decisions were not made on a consistent basis because of the discretionary authority granted to regional offices and lack of criteria to mandate improvement programs or document why they are not warranted; (3) NRC could improve the use of the individual assessment reports which identify utility management weaknesses by analyzing the results of the assessments over a number of years; and (4) NRC could gain a more accurate picture of how well a utility operates its nuclear plants by including plant operating data and reports of safety or operating incidents in its periodic assessments.

GAO recommended that the Chairman, NRC (1) establish assessment-related criteria that, when met, would require the agency to either mandate a utility management improvement program or document the reasons why such a program is not warranted; (2) routinely analyze historical assessment results and discuss marginal and declining performance trends in individual assessment reports; (3) expand the information considered in periodic assessments to include readily available data on trends in nuclear power plant operating performance; and (4) include in the agency's overall assessment of a utility's quality program and administrative controls performance the results of its assessments in the other nine technical areas.

Process for Backfitting Changes in Nuclear Plants Has Improved (GAO/RCED-86-27) (12/24/85)

GAO commented on (1) a backfitting process NRC uses to require modifications at operating nuclear power plants; (2) the effect of those actions on selected facilities; and (3) improvements that should be made.

GAO found that individual units of NRC's decentralized staff had raised safety concerns that utilities believed must be met as a condition for

obtaining approval to operate their plants; however, NRC did not perform detailed analyses of the resulting benefits and costs or determine whether the changes would provide substantial additional protection. GAO found that, in 1981, NRC took steps to better manage backfitting by (1) creating a senior management committee to review those backfits that apply to several or all plants; (2) developing another management system for backfits that apply to features unique to one plant; and (3) requiring documented analyses of the estimated safety benefits and costs of proposed backfits. Although the NRC staff followed the new processes in imposing some new requirements, other backfits occurred outside of the established systems. GAO found that, in order to: (1) eliminate the disagreement over what constitutes backfitting, NRC needs to define more precisely what it means by backfitting; (2) ensure that backfits receive appropriate senior management review, NRC should not require utilities to comply with new or modified regulations or staff positions unless they are imposed by a designated NRC official on the basis of documented analyses demonstrating that they provide a substantial increase in protection; and (3) have effective management of backfits, NRC should periodically assess the performance of its managers and staff in adhering to the new backfit rule and management systems.

GAO recommended that the NRC Chairman revise the agency's plant-specific backfitting procedures to explicitly state that (1) the NRC staff are responsible for identifying and processing, in accordance with the plant-specific backfitting procedures, all new or amended plant-specific positions taken by the staff, and (2) to qualify as a plant-specific backfit, the technical basis for a new or revised staff position taken must be unique to a specific plant or plant location.

International Response to Nuclear Power Reactor Safety Concerns (GAO/NSIAD-85-128) (09/30/85)

GAO assessed the information that is available as to the extent and seriousness of nuclear safety problems in other countries and what is being done internationally to help countries address these problems.

According to IAEA a multilateral organization with a current membership of 112 countries, the overall nuclear safety record during the years has generally been good. However, there have been significant and potentially significant incidents involving the safety of nuclear power reactors in other countries. Many countries, under some future circumstances, may not be able to respond adequately to an accident at their nuclear facilities.

Through the IAEA and/or the Nuclear Energy Agency, an organization composed of 24 industrialized countries, efforts have been initiated to develop safety standards or guidelines, exchange information, conduct research, and provide training and expert assistance to help improve nuclear safety. The NRC also has negotiated bilateral nuclear safety arrangements with 21 countries.

The United States has been participating in multilateral and bilateral efforts to strengthen international nuclear safety. The Soviet Union has agreed to participate in the IAEA incident reporting system. However, the United States has reservations about joining. Before the United States agrees to join, U.S. officials want assurance that these countries will fully share information. These officials believe it would not be equitable for the United States to provide results of costly analytical work to the Soviet Union without getting something in return. Also, U.S. officials want to avoid potential duplication between the IAEA and the Nuclear Energy Agency systems.

The international community has been reluctant to agree in advance on a legal framework for providing assistance to one another in the event of a serious nuclear accident, contenting themselves with the development of non-binding guidelines.

The Nuclear Regulatory Commission Should Report on Progress in Implementing Lessons Learned From the Three Mile Island Accident
(GAO/RCED-85-72) (07/19/85)

GAO reviewed the NRC implementation of the TMI Action Plan to improve the operation and regulation of commercial nuclear facilities and the progress made by utility companies that operate nuclear power plants.

GAO found that (1) most of the work on the Action Plan has been completed; (2) NRC assigned a higher priority to items considered to have the greatest potential for improving safety in the shortest time and at the lowest cost; and (3) utilities have completed 84 percent of the Action Plan tasks at the 51 plants where information was obtained. GAO noted that (1) NRC does not plan to complete 20 of the 31 tasks because it considered the tasks to be low in priority; and (2) NRC merged the incomplete Action Plan tasks with generic issues into one management system which replaced the Action Plan as a current statement of the actions necessary to improve nuclear power plant operations and regulation.

GAO also found that (1) the consolidation of all safety issues was reasonable because it allowed NRC to focus its work on the issues most important to safety regardless of how the issues were identified; (2) NRC has moved away from tracking the Action Plan; and (3) NRC should publicly report on the accomplishments of the plan and show how incomplete tasks will be pursued and reported on under the new management system.

GAO recommended that, to inform Congress on utilities' and NRC progress in implementing the TMI Action Plan, the Chairman, NRC, should report to Congress a one-time, item-by-item accounting of the 176 items listed in the Action Plan.

Probabilistic Risk Assessment: An Emerging Aid to Nuclear Power Plant Safety Regulation (GAO/RCED-85-11) (06/19/85)

In response to a congressional request, GAO reported on (1) the state of the art of PRA (2) whether NRC's use of PRA appears reasonable considering its staff's experience and training; and (3) whether NRC adequately considers the potential problems and disadvantages of this method of analysis.

GAO has found that many improvements have been made in PRA methodology since it was first used in 1975; however, uncertainties remain because a PRA identifies and assigns probabilities to nuclear accident events that rarely occur. The uncertainties also reflect the incomplete knowledge about plant systems, human behavior, accident processes, the off-site consequences of accidents, and how external events can cause accidents. Therefore, due to insufficient and unreliable data, analysts may make poor assumptions, and computer models may not be realistic.

NRC uses PRA to analyze (1) nuclear power plants and plant systems; (2) related regulations and safety issues; and (3) the estimated costs and benefits of alternative regulatory actions. Although the use of PRA is costly and time-consuming, increased staff and contractor training and experience have made its use timely and reasonable. However, NRC should not use the numerical risk estimates as the sole or primary basis for regulatory decisions and should use PRA to supplement its more traditional analytical and engineering methods.

Better Inspection Management Would Improve Oversight of Operating Nuclear Plants (GAO/RCED-85-5) (04/24/85)

GAO reviewed the NRC management of its operating nuclear power plant inspection program, including (1) the NRC response to investigative findings concerning the TMI accident in 1979; (2) documentation for inspection program policies and procedures; and (3) the design and management of the inspection program. To oversee nuclear power plant operations, NRC maintains resident inspectors at each plant to observe daily operations and uses regional inspectors to perform specialized inspection functions.

GAO found that (1) many of the NRC inspection personnel and utility officials surveyed believe that the inspection program has improved since the TMI accident; and (2) most of the individuals surveyed believe that utilities comply with federal regulations and that the inspection program ensures safe nuclear plant operations. However, GAO also found that (1) despite increasing inspection requirements, the average annual inspection time per plant decreased in 1983; (2) about 40 percent of the inspectors surveyed believe that they do not have enough time to ensure compliance with regulations; and (3) most survey respondents believe that NRC should increase its inspection resources.

In addition, GAO found that the effectiveness of the inspection program is not as high as it should be because NRC does not (1) use utility industry reports of plant operating experiences to refine inspection procedures or identify needs to readjust inspection priorities; (2) correlate inspection procedures with functional areas identified in annual power plant performance assessments; or (3) use evaluations prepared by utilities and INPO in inspection program planning. Finally, GAO found that (1) some NRC inspection procedures are nebulous and need revision; (2) many inspectors believe that they have not received certain mandatory training designed to increase their familiarity with industry standards; and (3) inspectors do not always receive required training because of heavy workloads and inadequate resources.

GAO made 11 recommendations aimed at improving the NRC operating nuclear reactor inspection program.

Management Weaknesses Affect Nuclear Regulatory Commission Efforts to Address Safety Issues Common to Nuclear Power Plants (GAO/RCED-84-149) (09/19/84)

GAO examined NRC's efforts to address safety issues common to nuclear power plants and determined if NRC has corrected earlier management

weaknesses highlighted in investigation reports of the March 1979 accident at TMI prepared by a Presidential Commission, NRC, and others.

GAO found that NRC has increased the rate at which it develops regulatory solutions for safety issues. This more vigorous pace, however, has been overshadowed by the identification of new issues from the TMI accident and other sources. As a result, a larger backlog of unresolved issues exists now than before the accident. GAO also found that NRC has improved its methods for identifying safety issues and determining their importance to safety. NRC does not, however, have sufficient management controls in place to ensure resolution of issues and implementation of appropriate changes to affected nuclear plants and to NRC's regulatory procedures in a timely manner.

GAO recommended that the Congress may wish to amend the Energy Reorganization Act of 1974 to (1) expand current reporting requirements to include all safety-related generic issues assigned a high-priority ranking, and (2) require that the NRC annual report summarize the total number of generic issues identified, resolved, implemented, and fixed. GAO also made 12 recommendations to the Chairman, NRC, aimed at strengthening NRC's efforts to address safety issues common to nuclear power plants.

Further Actions Needed to Improve Emergency Preparedness Around Nuclear Power Plants (GAO/RCED-84-43) (08/01/84)

GAO reported on the adequacy of federal, state, and local offsite emergency planning and preparedness for mitigating the consequences of a nuclear power plant accident.

GAO concluded that, although progress has been made since the TMI accident in 1979, more can and should be done. GAO found that state and local emergency preparedness plans have been developed and tested for all 54 operating nuclear power plant sites, and 24 of these have met the federal criteria and have been approved by FEMA. The reasons that the remaining plans have not been approved relate to their not meeting federal criteria, some local communities not fully participating in the emergency planning process, and the difficulty some state and local governments have experienced in obtaining funding for emergency planning and preparedness. In addition, GAO found that improvements are needed in the exercises conducted to test the adequacy of state and local planning and preparedness. FEMA and the NRC rely on states and utilities to plan preparedness tests, but FEMA does not verify the compliance of

preparedness plans with federal criteria, and it does not have an agencywide tracking system for ensuring that deficiencies are identified. Finally, GAO found that agencies need to provide better guidance to state and local governments for developing state and local emergency preparedness plans, and that the federal response plan for nuclear power plant emergencies can be improved by providing for more centralized federal agency control and coordination.

GAO recommended that the Congress may wish to consider whether stronger central control of the federal response to a nuclear power plant emergency is needed to improve federal coordination in such an emergency. GAO pointed out that if such central control is to be established, any proposed legislation would need to designate a federal agency to exercise the control. GAO also stated that the proposed legislation should also provide the controlling agency the authority to require periodic exercises of the federal response plan in each region in conjunction with state and local exercises. GAO also made 12 recommendations aimed at improving emergency preparedness around nuclear power plants.

Nuclear Safety Research Responsiveness to Regulatory Needs and Coordination (GAO/RCED-84-15) (11/15/83)

Pursuant to a congressional request, GAO evaluated the relationship of the NRC's nuclear safety research program to its regulatory process and how NRC and DOE delineate and coordinate their respective research responsibilities to preclude unnecessary duplication.

NRC and DOE have overlapping research and development responsibilities for light-water reactor safety research, advanced reactors, and nuclear waste management and, although their respective research has different purposes, it involves the same technologies. GAO found that coordination between the agencies has occurred. In its program plan for light-water reactor safety research and development, DOE included NRC staff members in the 10 working groups it established to define research needs, and DOE and NRC have implemented an interagency agreement with specific coordinating techniques to be used in nuclear waste management. These techniques have helped keep DOE, NRC, and their contractors aware of the two agencies' research efforts. Nevertheless, some intentional duplication of research efforts has occurred. GAO believes that NRC needs to conduct some research which duplicates the DOE efforts to ensure that its independence is not compromised.

NRC Needs Alternative to Mandatory Relocation for Maintaining Objectivity of Resident Inspectors (GAO/RCED-84-37) (11/02/83)

GAO evaluated the NRC's policy of relocating its resident inspectors at least every 5 years.

Because NRC has estimated that resident inspectors will incur financial losses due to relocation, it has requested legislative authority to pay them higher relocation allowances than federal employees are generally provided. Since some residents are approaching the end of their 5-year duty tours, NRC has authorized the heads of five regional offices to recommend extensions of duty tours beyond 5 years pending resolution of the financial hardship issue. GAO believes that periodic movement of the inspectors enhances their objectivity; however, mandatory relocation may impair the overall quality of the NRC inspection program by causing experienced residents to resign rather than relocate. Moreover, since residents require from 1 to 2 years to fully acquaint themselves with a nuclear power plant, relocation every 5 years means that, in the short run, residents will spend a significant portion of their assignments at less than full proficiency. Although NRC presently has only limited means to measure the objectivity of resident inspectors, it has concluded that loss of objectivity has generally not occurred. GAO believes that there is a better way than mandatory relocation for NRC to help ensure objectivity in view of the uncertainty that NRC will obtain legislative authority to pay higher relocation allowances and the risk that many residents may resign.

GAO recommended that the Chairman, NRC (1) encourage, but not mandate, periodic relocations while retaining NRC management's prerogative of relocating individual residents when management determines that it is in the best interests of NRC; and (2) use alternative measures to assess inspector objectivity.

Emergency Preparedness Around Nuclear Power Plants (Testimony) (08/02/83)

GAO discussed federal, state, and local emergency planning and preparedness for nuclear power plant accidents. GAO believes that, since the 1979 TMI accident, a good deal of progress has been made by federal, state, and local authorities as well as utility companies in planning for offsite responses to power plant emergencies. However, GAO found that (1) while substantial progress has been made in developing offsite preparedness plans around operating sites, concern remains as to

whether the resources and public awareness are adequate to properly execute these plans; (2) additional federal guidance is needed to improve state and local response capabilities; and (3) much remains to be done to achieve a coordinated federal response strategy to deal with power plant accidents. FEMA formally approved planning and preparedness at 18 of the 53 operating sites, but it concluded that planning and preparedness are still insufficient to warrant its approval at the 35 remaining sites. The FEMA process for evaluating and approving state and local planning and preparedness involves reviewing plans for compliance with federal criteria and testing plans in annual exercises. However, this process has not always provided consistent and reliable results, and FEMA is initiating action to correct the process' deficiencies.

Additional Improvements Needed in Physical Security at Nuclear Power Plants (GAO/RCED-83-141) (07/13/83)

GAO reviewed the NRC performance of its regulatory responsibilities for ensuring the adequacy of physical security at commercial nuclear power plants. The review focused on recommendations made in a 1977 report (GAO/EMD-77-32), with an overall objective of evaluating the vulnerability of nuclear power plants to attempted acts of sabotage.

GAO found that many of the weaknesses noted in the earlier report have been corrected and that physical security systems at commercial nuclear power plants have been substantially improved. However, there are areas where further improvements in security can be made. First, while NRC regulations require all power plants to protect against the threat of sabotage from internal sources, NRC has not established criteria for ensuring the integrity of nuclear power plant employees. Second, some licensees and NRC officials believe that certain physical security requirements are in conflict with the safety of nuclear power plants. NRC is considering actions aimed at addressing both of these areas: (1) NRC staff is working on a proposed personnel screening requirements rule which is designed to establish a standard on the reliability and trustworthiness of plant employees; and (2) NRC established a safety review committee to address that issue.

Emergency Preparedness Around Nuclear Power Plants (Testimony) 06/08/83)

GAO discussed the status of federal, state, and local emergency planning and preparedness to deal with nuclear power plant accidents. In a 1979 report (GAO/EMD-78-110), GAO recommended that the NRC allow nuclear

power plants to begin operation only where state and local emergency response plans contain all of these essential planning elements. GAO also recommended that NRC require license applicants to make agreements with state and local agencies requiring their full participation in annual emergency exercises over the life of the facility. NRC disagreed with the GAO recommendations, but public and congressional debate continues over whether NRC should have such a policy. Although progress has been made in emergency planning and preparedness since the TMI accident, many states and communities with nuclear power plants are still not adequately prepared to respond to an emergency. FEMA formally approved planning and preparedness at 18 of the 53 operating sites, but it concluded that planning and preparedness are still insufficient to warrant its approval at the 35 remaining sites. In addition, the FEMA process for evaluating state and local preparedness planning has not always produced consistent and reliable results. Therefore, added pressure is placed on NRC to promptly consider, balance, and resolve the relevant health and safety, economic, and political issues.

Response to Specific Questions on the Indian Point Probabilistic Safety Study (GAO/RCED-83-158) (05/24/83)

Pursuant to a congressional request, GAO reviewed the reliance placed on PRA techniques by the NRC. Particular emphasis was placed on the safety assessments performed at the Indian Point nuclear power plants located close to New York City.

GAO stated that the Indian Point PRA is a comprehensive assessment which evaluates plant systems performance, the ability of the plant to contain radioactivity, and the consequences of potential accidents. While many analysts consider the Indian Point PRA to be the state-of-the-art in risk assessment, it suffers from the same fundamental problems as all PRA's: uncertainty and incomparability of results. Also, GAO concluded that, although the study identified the dominant contributors to risk, it did not identify the precise level of risk from operating the Indian Point nuclear power plants.

Problems and Delays Overshadow NRC's Initial Success in Improving Reactor Operators' Capabilities (GAO/RCED-83-4) (12/15/82)

GAO discussed NRC actions to improve reactor capabilities which were found deficient by numerous investigations following the TMI accident.

GAO found that, within 2 years of the TMI accident, NRC required and utilities implemented several interim actions to improve and strengthen the training and qualifications of reactor operators and other key control room personnel. GAO believes that in the short term these actions resulted in improved safety at nuclear power plants. After initial actions were taken, NRC efforts in this area began to lose momentum and implementation problems and delays started to occur. The impact of the NRC implementation problems may have been lessened by INPO, which assumed a leadership role in assuring that the capabilities of control room personnel were improved in accordance with the NRC TMI Action Plan. INPO is currently performing the first step of the long-term NRC program, a generic position task analysis for key personnel, and eventually plans to complete many programs similar to long-term NRC actions which are currently behind schedule. NRC is monitoring INPO work and is revising its schedule for completion of tasks to correspond with INPO timeframes.

GAO recommended that the Chairman, NRC, develop a specific agreement for coordinating NRC and INPO activities related to operator training and qualification and review all revised training programs developed by the utilities, correct any deficiencies before approving the programs for implementation, and audit the implementation of these programs within 1 year from the date of implementation.

Three Mile Island: The Most Studied Nuclear Accident in History (GAO/EMD-80-109) (09/09/80)

GAO reviewed eight investigative reports prepared by a Presidential Commission, NRC, and others on the nuclear accident at TMI. Most investigators agreed that the accident was caused by a combination of factors, including equipment malfunctions, inadequate operator training, poor designs, and inadequate operating and emergency procedures. Many of these deficiencies had been known by the NRC for some time, but most were not considered important in view of the NRC strategy for reactor licensing and design. The practices, procedures, and attitudes of NRC were challenged to such an extent that a major reorganization and restructuring of the agency was recommended.

The investigations varied in depth and comprehensiveness but were generally consistent. GAO endorses the President's reorganization plan, which would greatly expand the management role and authority of the Chairman but leave the Commissioners responsible for setting policy and providing the operational framework. NRC has taken or planned

action on the recommendations which included establishing safety goals, making power plant standardization mandatory, improving the role of the Advisory Committee on Reactor Safeguards, and providing funding and legal counsel to public groups or individuals intervening in licensing proceedings. However, little progress has been made on establishing goals and criteria which describe what level of safety and nuclear regulation is enough. GAO endorses a provision in the 1981 authorizing legislation, which directs NRC to develop a proposed safety goal for nuclear reactor regulation.

NRC needs to develop some systematic way to increase its participation in important licensing and regulatory decisions. GAO favors options that increase the Commissioners' role in the licensing and adjudication process, while retaining the Atomic Safety and Licensing Appeal Board and its basic agency responsibilities. Many long-term and important actions to improve specific design and operating problems are yet to be completed by NRC. GAO endorses the proposed creation of a special Nuclear Safety Oversight Committee and believes that NRC should submit annual reports to Congress on its progress in implementing action plans.

Analysis of the Price-Anderson Act (GAO/EMD-80-80) (08/18/80)

GAO conducted an analysis of the Price-Anderson Act (42 U.S.C. 2210), which governs offsite nuclear accident liability. The Act was designed to encourage private industry to participate in the nuclear industry by assisting it with the costs of liability anticipated in the case of a nuclear accident. Recovery to accident victims is available through common law liability, coverage by private insurance, and government indemnification (reimbursement). Licensees must maintain financial security against offsite liability for a nuclear accident in an amount equal to that available through private insurance. Liability beyond this amount would be assumed by the federal government up to a limit of \$560 million per incident.

The Act is fulfilling its intended purpose of providing financial protection to the public and the nuclear industry in the event of a nuclear accident. The Act should be retained in its basic form, but certain provisions should be revised. The limit on liability should be realistically defined, and the layers of financial coverage that compose the limit on liability should be reassessed. The premiums charged utilities in the event of a nuclear accident and the federal government indemnity could be revised upward.

GAO recommended that the Chairman, NRC, define a more realistic limit on public liability, reassess the premium charged utilities in the event of a nuclear accident, and reassess the federal government indemnity. If it is determined that some revisions to the Act are in order, the Chairman should also submit a legislative proposal to the Congress outlining these revisions.

Do Nuclear Regulatory Commission Plans Adequately Address Regulatory Deficiencies Highlighted by the Three Mile Island Accident? (GAO/EMD-80-76) (05/27/80)

As a result of the numerous studies concerning the accident at TMI, NRC drafted the TMI Action Plan. Through the plan, NRC is implementing a massive program to upgrade safety at nuclear power plants. The planned actions seem appropriate for this purpose. However, because the program is in its infancy, success or failure cannot be determined at this time. It appeared that NRC is stretching its resources very thinly and placing major dependency on industry and other organizations. Budget rescissions, another major accident, or future NRC-mandated responsibilities could have a major impact on the successful completion of the program.

GAO sanctioned the creation of the Nuclear Safety Oversight Committee to oversee the NRC activities and assess the progress being made to implement the recommendations of the President's Commission on the Accident at Three Mile Island. The Committee will have five members from outside the federal government and its own technical staff and appropriations. Such independence is needed to insure compliance with important TMI recommendations and to guarantee that progress is made toward improving reactor safety. Because NRC has depended greatly on the nuclear industry, the Nuclear Safety Oversight Committee should pay particular attention to how well the industry responds. If, in the Committee's opinion, the response is not adequate, NRC should be required to reevaluate its role in seeing that the Action Plan tasks are properly implemented.

GAO recommended that NRC periodically report to the Congress on its progress in implementing the Action Plan, specifically providing the status of each action compared to the original plan. If NRC does not agree with the recommendation, congressional oversight committees should consider formally requesting periodic reports pursuant to the recommendation.

Reorganization Plan No. 1 of 1980 (Testimony) (04/29/80)

The GAO views on the President's plan for reorganizing the NRC and the pertinent findings, conclusions, and recommendations of a January 1980 GAO report (GAO/EMD-80-17) as they relate to the reorganization plan were discussed. GAO believed that the overall NRC regulatory performance during its first 5 years has been complacent because NRC has failed to provide leadership and direction to the NRC staff, the nuclear industry, and the public. The Commissioners did not (1) establish measurable regulatory goals, objectives, and systems for measuring performance; (2) control regulatory policymaking; and (3) clearly define either their own role in nuclear regulation or the role of the Executive Director for Operations. From its analysis, GAO concluded that, if the Commission organization were to be retained, the Chairman's role should be strengthened to improve the efficiency of the daily NRC regulatory operations and that the commission form is superior for deciding nuclear regulatory policy issues.

GAO believed the Reorganization Plan under consideration addressed the concerns expressed in its report in that it allows NRC to concentrate on developing meaningful and measurable regulatory goals and objectives to guide the Chairman and the NRC staff. However, individual Commissioners have expressed concerns about the plan with regard to the authority given to the Chairman, their continued access to information, and their ability to hold the Chairman accountable for his actions. While GAO recognized that the administration's Reorganization Plan could not be changed unless the administration chose to amend it, we believed that the plan could be further improved by amending it to take into consideration concerns of the NRC Commissioners in the areas of nominations and appointments of key staff officials.

The Nuclear Regulatory Commission: More Aggressive Leadership Needed (GAO/EMD-80-17) (01/15/80)

In response to congressional directive, GAO reviewed and audited NRC's performance regulating nuclear activities during the first 5 years of its existence. The NRC regulates the nation's commercial nuclear power program and other nuclear activities. Concern over the future of nuclear power has reached crisis proportions, and the NRC will need to establish a foundation of public and industry confidence in its regulatory ability if nuclear power is to survive the crisis. GAO believes that NRC Commissioners need to provide leadership and direction, set measurable goals,

evaluate progress and performance, take control of regulatory policymaking, and make the Commission Chairman the agency's principal executive officer in fact as well as in name.

GAO believes that the NRC Commissioners have failed to take control of the Commission. They were not providing leadership and direction to the Commission staff, the regulated industry, or the public. They had not established measurable goals, objectives, or systems for measuring performance. With a few exceptions, the Commissioners had allowed the Commission staff to decide when new policies were needed and how they should be written. Finally, the Commissioners had not clearly defined their roles or that of their executive officer. The lack of leadership was seen as the major factor contributing to the Commission's slow, indecisive, and cautious performance. It relied too heavily on the policies and procedures of its predecessor, the Atomic Energy Commission.

GAO also considered alternatives to the current organizational form of the NRC. GAO found that (1) the single administrator form would eliminate leadership problems but could lead to abrupt changes in policy with changes in administrators; (2) strengthening the current Commission would offer the advantage of bringing to bear much deliberation on regulatory issues; and (3) separating the Commission into a regulatory policymaking commission and a regulatory agency headed by a single administrator would take advantage of the strengths of both systems.

GAO believes the Congress should continue to take an active oversight role in monitoring the Commissioners' progress in implementing GAO recommendations. Because of the diversity of opinion among the Commissioners on the need to clarify and strengthen the roles of the Commission Chairman and the Executive Director for Operations, and whether or not legislation is needed to accomplish this, Congress should pay particular attention to this important aspect of strengthening the Commission.

GAO also recommended that the Commissioners develop measurable Commission goals, objectives, and systems for evaluating performance in meeting the goals and objectives; elevate policymaking activities to the Commissioner level; and define the Commission Chairman's authority and duties as the Commission's principal executive officer; and place the Executive Director for Operations in charge of staff-level day-to-day operations. If necessary to implement this recommendation, the Commissioners should seek appropriate legislation from Congress.

Placing Resident Inspectors at Nuclear Power Plant Sites: Is It Working?
(GAO/EMD-80-28) (11/15/79)

The nuclear industry and the NRC have complementary responsibilities in assuring the safe operation of commercial nuclear power plants. In the past, regional NRC inspectors traveled from five offices to inspect nuclear reactor sites and other facilities. About 25 percent of the regional inspector's time was spent on-site, and the balance of the time was spent in regional offices preparing for and evaluating inspections. In June 1974, a 2-year trial program was begun in which inspectors were assigned to locations at or near nuclear power reactor sites.

After a study of the program was made in 1977, the Commissioners approved the use of resident inspectors and began assigning resident inspectors to 20 reactor sites. NRC now believes that there is a need to assign more than one resident inspector to some power plant sites. Under this concept, NRC plans to increase the number of residents to 174 by the end of fiscal year 1981. This new system will enable NRC to compare different reactors and utilities and adjust its inspection methods accordingly. The regions can also maintain overall unified management and direction. In essence, NRC's regional and resident inspection approaches working together will lead to an overall inspection effort that will be more effective in ensuring nuclear reactor safety.

GAO recommended that the Chairman of NRC resolve present weaknesses by taking the following steps during implementation of the revised inspection program: (1) require that resident inspectors perform more direct observations than review of records and provide resident inspectors with more administrative support; (2) define the role of the resident inspectors and establish what qualifications and training they need, specifically requiring them to have plant-specific training, and a level of training comparable with a reactor operator; (3) assign resident inspectors to those reactor sites that are most in need of regulatory attention; (4) coordinate the interface between the existing regional inspection approach and the evolving resident inspection approach; and (5) reevaluate and restructure the performance appraisal team and develop appropriate goals and measures of effectiveness for its nuclear power plant inspection program.

Emergency Preparedness Around the Rancho Seco Nuclear Power Plant:
A Case Study (GAO/EMD-79-103) (10/02/79)

GAO was requested to review the emergency preparedness of the localities surrounding the Rancho Seco nuclear power plant near Sacramento, California. The nuclear emergency preparedness actions of the California Office of Emergency Services, Sacramento and San Joaquin Counties, and the Sacramento Municipal Utility District were reviewed. Nuclear emergency preparedness was discussed with the emergency coordinator of Amador and Calaveras Counties. GAO reviewed NRC emergency preparedness requirements and evaluated federal agency capabilities and preparedness to assist in the event of a nuclear accident at Rancho Seco.

GAO found that although state and county emergency-response plans have been developed for Rancho Seco based on NRC criteria, the plans have been tested only on a limited basis. State and local authorities appear to have adequate coordination with respect to handling nuclear emergencies, but local authorities would need state and federal assistance to handle a major nuclear emergency. While local residents have not been routinely informed of evacuation procedures in the event of an emergency, several public meetings were held following the TMI incident. GAO also found that given the worst possible accident under the worst meteorological conditions, not all potentially affected areas would have adequate plans. For this type of accident the planning area would include 44 counties in California and several in Nevada with an affected population of over 8 million people.

Emergency Preparedness Around Nuclear Facilities (Testimony)
(05/16/79)

The accident at the TMI nuclear power plant underscores the need for sound nuclear emergency preparedness at all government levels. GAO testified that since 1973, three federal agencies have had primary planning and coordination responsibility for general civil emergency preparedness and response: the Federal Preparedness Agency, the Defense Civil Preparedness Agency, and the Federal Disaster Assistance Administration. Under a planned executive order, these three agencies will be incorporated into the new FEMA. FEMA brings together the federal responsibilities for peacetime and wartime emergency planning. However, the NRC will retain its responsibility for assisting state and local governments develop plans for responding to emergencies around

nuclear facilities unless FEMA assumes this responsibility through administrative action. As the focal point for federal emergency planning and preparedness activities, FEMA, not NRC, should make policy and coordinate radiological emergency response planning as a part of its overall emergency planning and preparedness activities.

NRC's Program for Licensing Nuclear Power Plant Operators (GAO/EMD-79-67) (05/15/79)

An analysis was made of the NRC's program for licensing nuclear power plant operators. While the principal causes of the nuclear accident are tentative, documentation shows that human/operator error has occurred at other commercial nuclear power plants. Human error could involve errors caused by nuclear facilities' management, maintenance, and other technical personnel who are not required to be licensed by NRC. Operator error relates only to those personnel who are licensed to operate a nuclear reactor. Personnel with various levels of qualifications form the organization that operates a commercial nuclear power plant. NRC has no minimum eligibility requirements for either type of operator. Instead, NRC endorses a standard established by the American Nuclear Society pertaining to the selection and training of nuclear power plant personnel. In addition to recommendations concerning education and experience, the standard states that minimum health requirements shall be established for operating personnel. Federal regulations state that an applicable operator's license will be approved if NRC finds among other things, the applicant has passed a written examination and operating test as prescribed by NRC. NRC recently has acknowledged that its power plant operating licensing program needs considerable improvement.

GAO recommended that NRC and the recently appointed Presidential Commission give attention to the specific questions raised in this review. Their investigations should take special precautions to assure that the potential for design and other generic weaknesses is not eclipsed by the emphasis on human error.

Areas Around Nuclear Facilities Should Be Better Prepared for Radiological Emergencies (GAO/EMD-78-110) (03/30/79)

There are 43 states with sizable nuclear facilities but there is only limited assurance of adequate protection for workers and nearby residents in case of a serious accident. Although most facilities are prepared for radiological releases within their boundaries, known deficiencies cast doubt on whether the public would be protected should a nuclear release

extend to the outside. NRC, DOD, and DOE own or regulate all such facilities in the United States. NRC has the primary responsibility for assisting state and local governments in developing emergency response plans and requiring the review of state plans to determine the inclusion of essential preparedness elements. Although only 10 states have fully adequate plans, licensing of nuclear facilities is continuing in the other states as well because federal law does not require states to adopt peacetime nuclear emergency plans.

GAO reported that of the 41 states with some sort of plan, 9 have conducted full-scale tests, 16 have held partial drills, and the remaining 16 have not tested their plans. GAO concluded that judging from problems found with the plans tested, untested plans would probably be ineffective in an emergency situation. In addition, GAO found that around DOD and DOE facilities, emergency preparedness is practically nonexistent because of no sense of risk to the community or from fear of violating security policies. FEMA has been established to combine the major responsibilities for emergency planning and focus state and local emergency preparedness efforts.

GAO recommended that the FEMA Director assume responsibility for making policy for coordination of local radiological emergency response planning and broaden planning assistance to state and local governments near DOD and DOE facilities. The NRC Chairman and the Secretaries of Defense and Energy should require that residents in the vicinity of nuclear facilities be fully informed of potential hazards and emergency actions, without jeopardizing national security. The NRC Chairman should receive state and local emergency plans before approving nuclear power plant operations, ensure full participation in annual emergency drills, and establish 10-mile emergency zones with modified emergency plans when necessary. The Secretaries of Defense and Energy should require facility commanders and operators to develop agreements with state and local governments delineating each party's role in case of emergencies involving the area outside the facility, and provide for joint annual drills. Also, the Secretary of Defense should collaborate with states in peacetime emergency planning. Finally, the Secretary of Energy should require DOE major facilities to perform comprehensive emergency drills at least once per year, test plans in realistically simulated conditions, and require periodic headquarters review of each facility's emergency plans.

Higher Penalties Could Deter Violations of Nuclear Regulations (GAO/EMD-79-9) (02/16/79)

The NRC uses civil penalties to enforce its regulations governing the construction and operation of commercial nuclear facilities and the possession, use, and disposal of nuclear materials. NRC requested Congress to authorize a raise in penalties for each violation and for all violations occurring in a period of 30 consecutive days. Penalty limits are low compared to amounts authorized for other federal regulatory agencies, considering the potential consequences of major violations.

The present limits on NRC's authority to impose civil penalties are too low for effective use on licensees with large and potentially hazardous nuclear operations. NRC civil penalties do not provide these licensees with the economic incentives to improve the safety of their operations, nor do they promote NRC's desired image of a tough but fair regulator. GAO supports NRC's request for authority to impose larger civil penalties, but does not agree with the proposal to limit the penalty for all violations in a 30-day period.

GAO recommended that Congress increase the civil penalty amount NRC can impose for a single violation and eliminate the limitation on the amount that can be imposed for all violations in a 30-day period; and that the NRC should consolidate into a single policy statement its criteria, policies, and procedures for selecting enforcement actions. To aid NRC in imposing penalties and projecting its desired image, the Chairman should (1) treat each occurrence of a violation of the same requirement as a separate violation for the purpose of computing a civil penalty; (2) establish procedures to insure that misinterpretations of regulatory requirements by licensees are clarified promptly; and (3) establish all enforcement criteria, policies, and procedures by rulemaking.

Reporting Unscheduled Events at Commercial Nuclear Facilities: Opportunities to Improve Nuclear Regulatory Commission Oversight (GAO/EMD-79-16) (01/26/79)

The NRC regulates the construction and operation of nuclear power plants and other facilities and the possession, use, and disposal of nuclear materials to protect the public from radiation hazards. To oversee these activities, NRC relies on information obtained in reports from licensees. It uses these reports to (1) identify safety-related incidents and problems; (2) assist in making safety-related decisions; and

(3) disseminate information to the public on the nuclear industry's operating experiences. GAO reviewed NRC's program for collecting and evaluating these reports.

NRC needs to improve its licensee report assessment procedures to better assure that it is identifying and acting on all safety-related problems. For example, NRC's review of reported events following its discovery of a safety related problem at two operating nuclear power plants revealed that the problem had been widespread for sometime. Better assessment procedures may have enabled NRC to identify this problem earlier.

To provide NRC with reasonable assurance that it promptly identifies all safety-related problems from licensee event and/or incident reports, GAO recommended that the NRC Chairman (1) define the scope and frequency of required analyses, and documentation and disposition procedures, for staff use in assessing licensee event reports; and (2) establish a system for controlling and evaluating incident reports with clearly defined objectives, responsibilities, requirements for analyses, and administrative procedures. In addition, event and incident reporting requirements should be extended to require (1) uniform surveillance and reporting requirements on safety systems and components common to all nuclear power plants; (2) nuclear materials licensees using equipment containing hazardous radioactive materials to report equipment design deficiencies and malfunctions; and (3) medical licensees to report all misadministrations of patient radiation treatments and radioactive drugs. GAO also believes that rulemaking procedures should be used to decide the issue of mandating full nuclear industry participation in the industry's voluntary reliability report system.

Nuclear Environment, Health, and Safety

Environment and Workers Could Be Better Protected at Ohio Defense Plants (GAO/RCED-86-61) (12/13/85)

Pursuant to a congressional request, GAO reviewed the DOE's effectiveness in protecting its workers, the community, and the environment at three of its defense production facilities.

GAO noted that (1) in two previous reports (GAO/EMD-81-108 and GAO/RCED-84-50), it recommended that DOE develop a system to independently verify environmental monitoring data reported by contractors; and (2) DOE did not adopt the recommendation because it believed the contractors' quality assurance programs provided an effective method

for ensuring the reliability of data. GAO found that (1) each Ohio contractor collects, evaluates, and reports its own radioactive air and water releases; (2) quality assurance programs help ensure that water and air samples are accurately analyzed but do not verify that data collected are adequate; (3) each plant had environmental problems which resulted in groundwater, soil, or drinking water contamination; (4) two of the plants were not in compliance with hazardous waste laws; and (5) one of the plants was not in compliance with state permits because it had not completed two of four pollution control projects. GAO also found that (1) the contractors did not always follow the DOE radiological monitoring guide which recommends that they monitor on- and off-site wells to assess environmental impacts of plant operations; (2) DOE did not adopt the recommendation that radiological monitoring guides be mandatory for all DOE facilities because it believed contractors would lose flexibility in designing their monitoring programs; (3) contractors received sizeable fees even though ES&H problems existed; and (4) DOE appraisal programs were not identifying major ES&H problems.

GAO recommended that the Secretary of Energy (1) require that radiological monitoring guides be mandatory for all DOE facilities, and (2) develop a coordinated DOE/state/contractor system to verify contractor-reported data.

DOE's Safety and Health Oversight Program at Nuclear Facilities Could Be Strengthened (GAO/RCED-84-50) (11/30/83)

Pursuant to a congressional request, GAO reexamined the DOE oversight of nuclear facilities. Specifically, GAO discussed (1) the extent to which findings in a DOE task force report corresponded or conflicted with findings in a previous GAO report (GAO/RCED-81-108); (2) whether recommendations in a DOE action plan will rectify problems outlined in the GAO report; (3) the extent to which the action plan is being implemented; and (4) the extent to which recommendations in the prior GAO report have been implemented by DOE.

GAO found that DOE has implemented many specific improvements in its nuclear health and safety program since the prior report. However, deficiencies still exist, and the organizational placement of the DOE nuclear health and safety function has not been addressed. GAO also found that its report and the DOE task force report had similar findings on issues that were included in both reviews, and no conflicts were apparent. In addition, GAO found that the DOE action plan (1) did not address the problems identified by GAO with respect to worker protection, nuclear

facility safety analyses, and environmental monitoring; (2) recommended some changes similar to GAO recommendations, including developing new radiological emergency preparedness requirements; and (3) concluded that the nuclear safety and health function should be placed high enough in the DOE organization to ensure adequate management attention.

While the plan agreed in concept with elevating the safety and health function in the DOE organization, GAO believes that, in effect, the reorganization was not responsive to either the DOE task force or GAO recommendations in that regard. GAO found that, while DOE has made some improvements in almost all the areas previously reported on, it has not fully implemented the GAO recommendations, particularly the recommendation that the nuclear safety and health function be elevated within the DOE organization to either a staff function reporting to the Under Secretary or the sole responsibility of an Assistant Secretary.

Decommissioning Retired Nuclear Reactors at Hanford Reservation
(GAO/RCED-83-104) (04/15/83)

GAO reported on its concerns about DOE's ongoing effort to develop a strategy for decommissioning eight retired plutonium production reactors at its Hanford Reservation.

GAO is concerned that DOE is not considering two issues which are important to selecting the most appropriate and least costly decommissioning strategy. GAO believes that DOE needs to decide (1) the long-term future of the Hanford Reservation; and (2) whether Hanford is suitable as a permanent disposal site for some of the radioactive wastes which will be produced if one or more of the reactors are dismantled. In a prior report (GAO/RCED-79-20), GAO recommended that DOE postpone the dismantling of a reactor until such decisions had been reached. GAO recognizes that some of the retired reactors may have deteriorated to the point where DOE needs to select and implement a decommissioning strategy. If DOE intends to eventually permit access to the facility or to release it to general public use, then it appears appropriate for DOE to dismantle the retired reactors and clean up the reactor sites. However, if DOE intends that the facility remain in long-term federal control, a less costly decommissioning strategy may be more appropriate. If Hanford is not an acceptable waste disposal site, DOE might incur unnecessary costs of temporary waste storage, followed by relocation. Delay in assessing the facility's suitability as a permanent disposal site increases the likelihood of more costly storage approaches.

Actions Being Taken to Help Reduce Occupational Radiation Exposure at Commercial Nuclear Power Plants (GAO/EMD-82-91) (08/24/82)

In response to a congressional request, GAO provided information on increases in occupational radiation exposures that are occurring at commercial nuclear power plants. The report focused on the extent of the occupational exposure increase, its causes, and what is being done to reduce these exposures.

Workers who operate and maintain commercial nuclear power plants are exposed to low doses of radiation. The NRC requires power plant operators to monitor occupational radiation exposures and to ensure that exposures are within regulatory limits. NRC regulations also state that licensees should maintain exposures as low as reasonably achievable. While individual exposures have been kept well below the regulatory limit, the collective dose has increased. Three factors have clearly contributed to increases in occupational exposures: (1) increased radiation levels and maintenance due to plant age; (2) modifications required by NRC to correct safety problems; and (3) premature failure of major plant components. Additionally, the utility practice of spreading exposures over more workers results in a higher collective dose than would occur otherwise. Based on an NRC analysis, the greatest single cause for weaknesses identified in the area of radiation protection organization and management was the generally poor attitude toward radiological safety which resulted in utilities providing inadequate staff resources and management support. NRC actions to reduce exposure hazards are aimed at strengthening radiation protection at the facility level. DOE is developing a program to develop practical improvements in the generic safety of nuclear power plants. In addition, private industry is looking into the causes of and methods to reduce occupational exposures. However, it is too early to determine how effective these actions will be.

Cleaning Up Nuclear Facilities: An Aggressive and Unified Federal Program Is Needed (GAO/EMD-82-40) (05/25/82)

GAO conducted a review to determine the status of federal efforts and activities to correct decommissioning problems identified in a prior report (GAO/EMD-77-46). In addition to following up on the implementation of the recommendations for correcting these problems, GAO also evaluated how effectively NRC's, DOE's, DOD's, and EPA's decommissioning and standard-setting programs were functioning.

Nuclear facilities and sites which require or eventually will require cleanup or other disposition can be tracked, evaluated, and recorded for follow-up action if needed. In the past, nuclear facilities and sites were abandoned or decommissioned without adequate documentation of their radiological status or even a record of their existence. As a result, federal agencies are uncertain about the location or status of some facilities and sites that may be in need of decommissioning. NRC, DOE, DOD, and EPA are attempting to locate and evaluate the hazards at old, inactive sites. Despite the problems that inadequate record keeping systems have caused federal agencies, only DOE is revising its current record keeping system to provide sufficient information on the location and radiological condition of its current and future nuclear facilities and sites. Federal decommissioning programs have not sufficiently considered and incorporated decommissioning needs during the facility planning and design phase. DOE and NRC are making some progress in developing comprehensive decommissioning policies which include many of the necessary provisions. DOD has not initiated action to develop a comprehensive decommissioning policy. Standards prescribing acceptable levels of residual radioactive contamination for decommissioned nuclear facilities are not expected to be available until mid-1986. EPA is responsible for setting these standards but has not done so because it considers their development a low priority.

GAO made recommendations to the Congress, NRC, DOD, DOE, and EPA for improving the cleanup and decommissioning of nuclear facilities.

Better Oversight Needed for Safety and Health Activities at DOE's Nuclear Facilities (GAO/EMD-81-108S) (04/14/82)

In this report supplement (GAO/EMD-81-108), GAO was asked to determine if the NRC or some other form of regulation would be preferable to the DOE oversight program currently in existence for safety and health matters at DOE nuclear facilities. To determine what arrangement would provide the best safety and health oversight for these facilities, GAO reviewed the four functional program areas: (1) occupational safety; (2) emergency preparedness; (3) facility design safety; and (4) environmental monitoring.

GAO found that the specific problems noted in the four DOE functional program areas warrant immediate corrective action. Some of these programs can be corrected by improved management techniques and a greater awareness of safety and health oversight. However, the underlying organization problems, a lack of headquarters authority, and the

decentralized nature of the program may be the more serious problems over the long term. GAO believes that several alternatives exist for improving the oversight at DOE nuclear facilities. These range from reorganizing the entire safety and health function within DOE to having outside agencies provide safety and health oversight. Each alternative has advantages and disadvantages. One alternative involves the reorganization of the safety and health organization within DOE. Major changes are required in the field/headquarters relationship. The current organization offers great potential for conflict between programmatic and safety and health activities. To increase program uniformity and to isolate field safety and health staff from program activities, DOE should reorganize those field organizations involved in safety and health oversight to report directly and exclusively to the elevated safety and health organization at headquarters. DOE has plans for establishing a separate reactor safety organization. However, it will be established at the same level as the existing program and GAO believes that it will do little to enhance the independence or authority of the DOE safety and health oversight program.

GAO's Response to DOE's Comments on EMD-81-108, "Better Oversight Needed for Safety and Health Activities at DOE's Nuclear Facilities"
(GAO/EMD-82-36) (01/27/82)

GAO responded to DOE's criticisms of report GAO/EMD-81-108 in which GAO recommended major changes in the safety and health oversight program at DOE contractor-operated facilities. GAO suggested that the Congress consider legislation to require NRC to review the safety of a number of facilities, including several defense-related activities. DOE criticized the report on the grounds that (1) GAO misunderstood the DOE approach to safety and health; (2) NRC lacks technical expertise in technology associated with DOE production nuclear reactors and operations; (3) the high cost of a review and evaluation by NRC would not provide a commensurate benefit; and (4) NRC oversight of this facet of DOE defense responsibilities could seriously interfere with national security.

GAO replied that (1) DOE believes that safety and health is the responsibility of the contractor, but GAO found that the safety and health personnel at DOE field offices lack the independence to effectively implement safety and health regulations; (2) while NRC is not intimately familiar with the exact combination of processes at many DOE facilities, GAO believes that NRC is capable of conducting the reviews, given that sufficient background material is made available; (3) though the report did not include a detailed cost/benefit analysis, GAO did comment on the

cost and effort involved in an NRC review of DOE facilities, but the DOE criticism did not add any additional insight to this aspect of such a review; and (4) there are a number of options available which offer potential for NRC involvement with an acceptable national security impact, such as limitation of the program to several DOE nuclear facilities to initially decrease the amount of classified information available to NRC personnel. In summary, GAO found nothing in the DOE arguments to support a change in any of the recommendations or positions in the report.

Congress Should Increase Financial Protection to the Public From Accidents at DOE Nuclear Operations (GAO/EMD-81-111) (09/14/81)

GAO examined the Price-Anderson Act (42 U.S.C. 2210) as it governs the nuclear accident liability of DOE contractors to determine the number of DOE contractors protected by the Act and to render an opinion on the necessity for continuing such protection.

The Act provides protection to both DOE contractors and the public to cover liability resulting from a nuclear accident. Although 75 DOE prime contractors are specifically protected by the Act, the protection is also extended to many thousands of subcontractors working at DOE facilities. GAO believes that the protection provided by the Act should be continued. This conclusion was arrived at after carefully considering the current U.S. position to develop nuclear power and the availability of other forms of insurance for nuclear activities. GAO believes that certain provisions in the Act should be changed or clarified to provide better public protection from catastrophic nuclear accidents. For example, the Act provides more financial protection for accidents resulting from a commercial activity than those resulting from a government operation. Further, the current limit on liability may not provide sufficient public financial protection to adequately compensate victims of catastrophic nuclear accidents. Moreover, GAO believes that the Act's definition of a nuclear incident is unclear. As a result, liability arising from some nuclear accidents may not be covered.

GAO recommended that the Congress (1) amend the Price-Anderson Act to increase protection for DOE-contractor activities to provide public protection equal to that for licensed commercial activities. This amendment should also include provisions to assure that, as commercial coverage increases, contractor coverage also increases; (2) amend the definition of nuclear incident by adding the following at the end of the definition: "and provided further, that it shall include any occurrence where the

Commission, or the Department of Energy in relation to its contractors, determines a release of radiation may be imminent;" and (3) reexamine the limit on liability to determine whether a new limit needs to be set and/or whether the limit should be tied to an index to allow for periodic readjustment.

Better Oversight Needed for Safety and Health Activities at DOE's Nuclear Facilities (GAO/EMD-81-108) (08/04/81)

GAO was requested to determine if NRC or some other form of regulation would be preferable to the DOE oversight program currently in existence for safety and health matters at DOE nuclear facilities. To determine the adequacy of the DOE oversight program, GAO reviewed the four functional program areas: (1) occupational safety; (2) emergency preparedness; (3) facility design safety; and (4) environmental monitoring.

GAO found that the DOE program is not adequate to assure that the employees at the nuclear facilities are provided with safe and healthful working conditions. Radiological emergency preparedness has not received sufficient priority in DOE to ensure a level of preparedness for a serious nuclear accident. The DOE emergency preparedness program lacks the coordinated, unified approach necessary to ensure adequate protection at all DOE facilities. The effort by DOE for assuring that emergency preparedness programs are in place and working are ineffective. DOE has not fulfilled responsibilities assigned to it by FEMA because it has failed to assign sufficient resources. In a previous report (GAO/EMD-78-110), GAO identified a number of weaknesses in the DOE emergency preparedness program which still exist. DOE is taking little action to assure that its older facilities meet current safety criteria and standards. The DOE safety analysis program, designed to provide such assurance, received relatively low priority and, as such, DOE is not aware of the level of design safety at many nuclear facilities. While the DOE operating contractors are reporting that their operations are conducted well within radiological environmental standards, the program lacks consistency from contractor to contractor and from DOE field office to field office. In addition, DOE relies virtually exclusively on the operating contractor for environmental oversight.

GAO recommended that the Congress consider legislation to require NRC to review and evaluate a number and a variety of DOE nuclear facilities and processes, including detailed review of plant operations, the contractors safety analysis methodology and reports, and actions taken to mitigate hazards. GAO also made 14 recommendations to the Secretary of

Energy aimed at improving oversight of safety and health activities at DOE's nuclear facilities.

Problems in Assessing the Cancer Risks of Low-Level Ionizing Radiation Exposure (GAO/EMD-81-1) (01/2/81)

Public concern about the health effects of low-level ionizing radiation exposure has increased in recent years. Therefore, GAO undertook a study to determine what definite conclusions, if any, can be drawn from current scientific knowledge about the cancer risks of low-level ionizing radiation exposure and what conclusions can be drawn about the best direction for current and future federal research. The immediate goal of the federal research program is to develop a data base for estimating the risk of low-level radiation exposure. The long-term goal is to understand the mechanisms and processes of how radiation causes cancer. Data from two studies involving low-level radiation were analyzed; a literature search was conducted; and the current status of ionizing radiation research was reviewed.

As yet, there is no way to determine precisely the cancer risks of low-level ionizing radiation exposure, and it is unlikely that this question will be resolved soon. There is a continuing need for federally sponsored research in this area, and GAO believes that federal research efforts can be strengthened. It also agrees with the objectives of current congressional and executive branch initiatives to coordinate federal research efforts in this area. The Interagency Radiation Research Committee, formed by Presidential memorandum, is such an important area that GAO believes a federal interagency research review group should be created by legislation. Epidemiologists have used estimates of the number of cancers induced by high-level exposures to radiation to predict the numbers that may be induced by lower exposures. These predictions can vary widely depending on which of several mathematical equations is used. An intensive effort to synthesize the results of radiation research might be accomplished by developing quantitative theories of radiation carcinogenesis and critically testing their predictions with cellular and animal experiments.

GAO recommended that Congress enact legislation giving statutory authority to an interagency committee to coordinate federal research on the health effects of ionizing radiation exposure. In addition, GAO made recommendations to the Interagency Radiation Research Committee aimed at improving low-level ionizing radiation exposure research.

The Department of Energy's Safety and Health Program for Enrichment Plant Workers Is Not Adequately Implemented (GAO/EMD-80-78) (07/11/80)

DOE is responsible for establishing and enforcing occupational safety and health standards for both radiological and nonradiological matters at many DOE-owned, contractor-operated facilities, including the nation's three uranium enrichment plants. Field responsibility for all three enrichment plants is administered by the Oak Ridge Operations Office. GAO was requested to review the DOE safety and health program to determine if its procedures are adequate to ensure the safe operation of the uranium enrichment facilities and if such procedures are adequately implemented. The DOE program for safety and health oversight and enforcement at the three plants relies primarily on a three-layered system: (1) inspections, (2) appraisals of the contractor's operations, and (3) investigations of employee complaints. Safety records of the three plants were examined and compared with national statistics and DOE-wide statistics. All major accidents which have occurred at the facilities were reviewed in addition to the 92 safety and health complaints filed by contractor employees.

Physical inspections of conditions at each plant are required annually, but DOE has conducted only five inspections at the three plants in the past 4 years. Appraisals have not been conducted as often as necessary and have failed to focus on major problem areas. Employees are encouraged to seek resolution of complaints with the operating contractor. Complaints that are not resolved at that level are filed with the Operations Office. In many cases, DOE delegated complete responsibility for handling complaints it received to the contractors. Thus, the employee is faced with the same situation for which he previously sought resolution. The Operations Office is not following up on changes recommended as a result of occupational safety and health complaints from employees at enrichment plants. Although DOE procedures require a written response to each contractor employee filing a complaint, the Operations Office did not provide a written response to 27 of the 92 complaints on file. Staff shortages appear to have contributed to the inability to meet safety and health program objectives. Because contractors have no immediate incentive to improve health and safety conditions, the ability of DOE to enforce safety and health standards is handicapped. Its primary enforcement power is the threat of nonrenewal or cancellation of the contract with the operators. The Operations Office's dual responsibilities of production and safety and health limit

its ability to administer a safety and health program independently and objectively.

GAO recommended that the Congress authorize the Secretary of Energy to institute a program of non-reimbursable fines and penalties for safety and health violations. GAO also recommended that the Secretary of Energy make sure that plant inspections and appraisals are performed as required and that all employees' complaints are investigated and followed up by the Oak Ridge Operations Office. Further, the Secretary should provide greater independence and objectivity in the Oak Ridge Operations Office Safety and Health Program through an organizational change to provide insulation between safety and health concerns and production goals and objectives.

Decommissioning and Dismantling of the 100-F Reactor (GAO/EMD-79-20)
(01/17/79)

DOE is presently considering methods of dismantling and disposing of its Hanford Power Station in Richland, Washington. GAO has reviewed the disposition plans for dealing with the highly contaminated nuclear site. The project involves the decontamination and dismantling of the shut-down reactor and its related facilities. The site will eventually be returned to public use. The final disposition of the radioactive material from the site has yet to be decided. The questions of how much radioactivity may be left in the area before the land reverts to public use and whether that particular site is needed for public use remain unanswered.

A laboratory study described several negative environmental conditions which could result from dismantling the Hanford plant. Transporting large volumes of contaminated material could result in exposure to the site employees and might release harmful radionuclides into the environment. The study recommended that the operation be postponed for 75 years when the radioactive effects will be minimal. Decontamination and decommissioning of the Hanford site does not seem justified at this time.

GAO recommended that the project be postponed until studies are completed as to whether the Hanford site will become a permanent repository for nuclear materials. Criteria still needs to be developed for the cleanup and return of nuclear sites to unrestricted use along with assessing the possible environmental impact such action may have on the area.

Additional GAO Reports and Testimonies on Nuclear Energy - January 1, 1979 Through May 15, 1986

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Information on Certain Aspects of TVA's Nuclear Power Program GAO/RCED-86-72FS, 01/08/86

Concerns Regarding the Nuclear Regulatory Commission's Implementation of the Freedom of Information Act GAO/RCED-85-101, 04/24/85

Response to Questions Raised Concerning the TMI-2 Cleanup Schedule and Cost GAO/EMD-82-90, 07/20/82

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Need for Better Policy and Control Over Public Information Requests—Nuclear Regulatory Commission GAO/GGD-81-70, 07/08/81

Further Evaluation of the Proposed Interim Consolidation of the Nuclear Regulatory Commission GAO/EMD-81-76, 06/24/81

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Three Mile Island: The Financial Fallout GAO/EMD-80-89, 07/07/80

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Review of the Department of Energy's Controversial Termination of a Research Contract GAO/EMD-79-21, 01/02/79

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The Funding of Generic Activities Within DOE's Office of Assistant Secretary for Nuclear Energy GAO/RCED-84-186, 08/31/84

The Impact of International Cooperation In DOE's Magnetic Confinement Fusion Program GAO/RCED-84-74, 02/17/84

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Status of DOE's Implementation of the Magnetic Fusion Energy Engineering Act of 1980 GAO/RCED-83-105, 04/29/83

Analysis of Alternative Approaches to Completing the Department of Energy's Water-Cooled Breeder Program GAO/RCED-83-87, 03/25/83

Analysis of the Department of Energy's Clinch River Breeder Reactor Cost Estimate GAO/RCED-83-74, 12/10/82

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The Department of Energy Did Not Provide the Subcommittee With All Documents Related to the Contract for the Clinch River Breeder Reactor's Steam Generator GAO/EMD-82-56, 03/17/82

Impact of Federal R&D Funding on Three Mile Island Cleanup Costs GAO/EMD-82-28, 01/15/82

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Proposed Nuclear Insurance and TMI Cleanup Assistance GAO/EMD-82-B1, 10/14/81

Update of Cost Information on the Clinch River Breeder Reactor Project GAO/EMD-81-112, 06/26/81

Termination Cost of the Clinch River Breeder Reactor Plant Project (Testimony), 05/11/81

Response to Questions Clarifying a Previous GAO Report on the Department of Energy's Breeder Reactor Program GAO/EMD-81-83, 05/04/81

The Department of Energy's Water-Cooled Breeder Program: Should It Continue? GAO/EMD-81-46, 03/25/81

The Department of Energy's Light Water Reactor Fuel Utilization Improvement Program GAO/EMD-81-51, 03/23/81

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Fusion—A Possible Option for Solving Long-Term Energy Problems GAO/EMD-79-27, 09/28/79

Comments on the Administration's White Paper: "The Clinch River Breeder Reactor Project—An End to the Impasse" GAO/EMD-79-89, 07/10/79

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Quarterly Report on DOE's Nuclear Waste Program as of December 31, 1985 GAO/RCED-86-86, 01/31/86

Progress and Problems in Implementing the Nuclear Waste Policy Act of 1982 (Testimony), 11/06/85

Quarterly Report on DOE's Nuclear Waste Program as of September 30, 1985 GAO/RCED-86-42, 10/30/85

The Nuclear Waste Policy Act: 1984 Implementation Status, Progress, And Problems GAO/RCED-85-100, 09/30/85

Status of the Department of Energy's Implementation of the Nuclear Waste Policy Act of 1982 as of June 30, 1985 GAO/RCED-85-156, 07/31/85

Status of the Department of Energy's Implementation of the Nuclear Waste Policy Act of 1982 as of March 31, 1985 GAO/RCED-85-116, 04/30/85

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Department of Energy's Initial Efforts to Implement the Nuclear Waste Policy Act of 1982 GAO/RCED-85-27, 01/10/85

Department of Energy Acting to Control Hazardous Wastes at Its Savannah River Nuclear Facilities GAO/RCED-85-23, 11/21/84

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The Department of Energy Does Not Plan to Use an Abandoned Salt Mine at Lyons, Kansas, for Nuclear High-Level Waste Disposal GAO/EMD-82-64, 03/23/82

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Issues Concerning the Department of Energy's Justification for Building the Gas Centrifuge Enrichment Plant GAO/EMD-82-88, 05/25/82

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