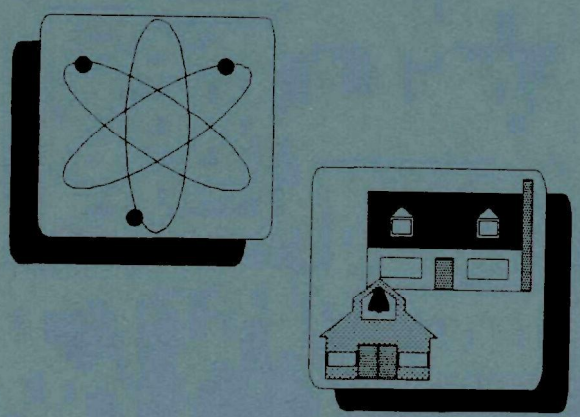
Air And Radiation
(6601J)

EPA 402-K-93-002
June 1993

Office Of Radiation And Indoor Air

Program Description



ORIA

402-K-93-002

OFFICE OF RADIATION AND INDOOR AIR

PROGRAM DESCRIPTION

JUNE 1993

U.S. Environmental Protection Agency
401 M Street S.W.
Washington, DC 20460

This document was prepared by Irma McKnight and Carmen Romero of the Office of Radiation and Indoor Air Program Management Office based on extensive input from each organizational unit. More specific information on any Office program may be obtained by writing to the following address or by contacting any of the persons listed in the Organizational Chart on page 27 of this document:

United States Environmental Protection Agency
Office of Radiation and Indoor Air (6601J)
401 M Street S.W.
Washington, DC 20460

The **ORIA Publications List** may be obtained from the same address.

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INTRODUCTION

The goal of the Environmental Protection Agency's (EPA) Office of Radiation and Indoor Air is to protect the public and the environment from exposures to radiation and indoor air pollutants. The Office develops protection criteria, standards, and policies and works with other programs within EPA and other agencies to control radiation and indoor air pollution exposures; provides technical assistance to states through EPA's regional offices and other agencies having radiation and indoor air protection programs; directs an environmental radiation monitoring program; responds to radiological emergencies; and evaluates and assesses the overall risk and impact of radiation and indoor air pollution. The Office is EPA's lead office for intra- and interagency activities coordinated through the Committee for Indoor Air Quality. It coordinates with and assists the Office of Enforcement in enforcement activities where EPA has jurisdiction. The Office disseminates information and works with state and local governments, industry and professional groups, and citizens to promote actions to reduce exposures to harmful levels of radiation and indoor air pollutants.

MAJOR PROGRAM AREAS

RADIATION

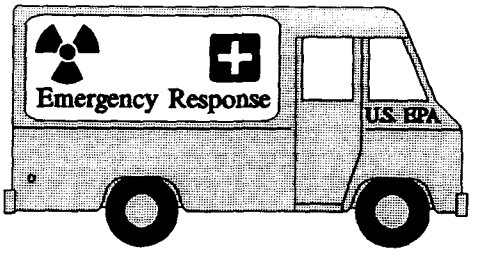
Ionizing radiation can be emitted from natural or man made sources. Natural background radiation includes cosmic rays; naturally occurring radioactive elements in the earth's crust, primarily those associated with uranium, thorium, and potassium; and radioactive decay products such as radon and its decay products.

Sources of man-made ionizing radiation include medical facilities such as hospitals, pharmaceutical factories, and research and teaching institutions; nuclear reactors and their supporting facilities such as fuel preparation plants; and federal facilities that are involved in nuclear weapons production.

The primary health effects of exposures to ionizing radiation are increases in the risk of cancer and deleterious genetic changes such as growth impairment and mental retardation.

The Office's radiation programs can be classified into four major areas: Radiological Emergency Preparedness and Response, Radioactive Waste Disposal, Radioactively Contaminated Sites, and Industrial Radiation Sources. (Indoor air, radon, and electromagnetic fields are addressed in a separate section.)

Radiological Emergency Preparedness and Response



EPA plays a major role in responding to radiological emergencies. The Agency is responsible for monitoring and assessing the effects of radiation exposures to the general population and the environment from accidents that involve radioactive materials, for providing guidance to appropriate officials concerning the radiation levels at which protective actions are warranted, and for advising those officials of which protective actions should be taken.

Radiological Emergency Preparedness

EPA performs several essential functions to assist the Federal Emergency Management Agency (FEMA) in coordinating Federal efforts to aid state and local governments in preparing for radiological emergencies. These functions include developing, reviewing, and testing their radiological emergency response plans; training emergency response personnel; and participating in emergency drills and exercises.

The Agency has participated in many tabletop drills, full-field exercises and precautionary team deployments. For example, EPA participated in Federal Field Exercises I & II held in Zion, Illinois, in 1987 and Crystal River, Florida, in 1982. These exercises tested the integrated federal response to a major nuclear power reactor accident. In 1992, the Agency participated in the Diamond Flame Exercise. This four-part exercise tested the federal response to a major nuclear weapons accident. Finally, EPA participated in the Plutonium Valley Exercise at Area 11 of the Nevada Test Site in November 1992. This exercise was also a simulated weapons accident. However, the area in which the participants demonstrated their capabilities contained actual plutonium contamination as a result of weapons tests that were conducted several decades earlier. Participation in these activities has greatly increased the capability of the Agency to respond to a radiological emergency. Agency personnel from headquarters, the labs, and the regional offices have all participated in these types of activities.

In addition to assisting FEMA, the Office is responsible for ensuring that the Agency's ability to respond to radiological emergencies is maintained at a high level of readiness. To accomplish this goal, the Office established the Emergency Response Section under the Policy and Emergency Response Branch when it reorganized in 1991. The Emergency Response Section is responsible for performing day-to-day radiological emergency preparedness activities. These activities include developing and maintaining procedures which implement the EPA Radiological Emergency Response Plan, coordinating physicals for Radiological Emergency Response Team (RERT) members, developing and conducting radiological emergency response training, designating the bi-monthly RERT, developing Federal guidance on protective actions, and assisting in the review of state and local emergency response plans.

Members of the Office's staff play active roles in several national and international organizations which address radiological emergency preparedness and response. These include, but are not limited to, the Federal Radiological Protection Coordination Committee, the Conference of Radiation Control Program Directors' Emergency Response Planning Committee, the International Atomic Energy Agency, and the World Health Organization.

Protective Action Guides

Under regulations governing radiological emergency planning and preparedness issued by FEMA, the Agency's responsibilities include (1) establishing Protective Action Guides (PAGs) (specification of projected radiation doses); (2) preparing guidance on implementing PAGs, including recommendations on protective actions; (3) developing and promulgating guidance to state and local governments on the preparation of emergency response plans; and (4) developing, implementing, and presenting training programs for state and local officials on PAGs and protective actions, radiation dose assessment, and decision making.

The Office originally issued PAGs and Implementation Guidance for use by state, local, and tribal governments relating to exposure of the whole body and the thyroid gland to airborne radioactivity from accidents at nuclear power plants. This guidance on the use of sheltering and evacuation was revised in 1991 to make it applicable to a wider range of radiological accidents and to incorporate lessons learned from the Chernobyl accident. These revised PAGs have been incorporated into the **"Manual of Protective Action Guides and Protective Actions for Nuclear Incidents"** which is used by federal, state, and local officials to establish emergency response plans and to make decisions during a radiological incident. The guidance contained in this manual may be used to respond to any type of radiological incident except for nuclear war.

To effectively implement the revised PAGs, the Office developed and conducted a series of training courses which provided instruction on the basis of the PAGs and how they should be used in the decision making process to determine which protective actions to institute. These courses were conducted in several locations around the country and have been incorporated into the curriculum at FEMA's Emergency Management Institute in Emmitsburg, Maryland. Members of the

Emergency Response Section assist in conducting these courses.

In addition to providing guidance on the use of sheltering and evacuation, the Office is working with the Food and Drug Administration to revise PAGs for contaminated food and water.

Radiological Emergency Response

The EPA Radiological Emergency Response Plan (RERP) establishes the framework for timely, coordinated EPA action to protect public health and safety and the environment in response to a peacetime radiological incident. The RERP identifies the authorities, responsibilities, capabilities, and procedures for implementing effective radiological emergency response actions by EPA offices. It also presents the EPA organizational structure and concept of operations for responding to radiological incidents as a participant in a multi-federal agency response using the Federal Radiological Emergency Response Plan and the Federal Response Plan and independently using the National Oil and Hazardous Substances Pollution Contingency Plan.

The RERP covers EPA responses, both as a lead and supporting agency, to all peacetime radiological incidents and emergencies within the United States, its territories, possessions, or territorial waters. Emergencies occurring at fixed nuclear facilities, domestic or foreign; emergencies involving foreign satellites that malfunction; or emergencies arising during the transportation of radioactive materials, including nuclear weapons, fall within the scope of the RERP, regardless of whether the facility or radioactive materials are publicly or privately owned, federally regulated, or regulated by an agreement state. EPA is the lead agency for emergencies involving radioactive material not licensed, owned, or operated by a federal agency or agreement state and emergencies with an environmental impact from foreign sources (e.g. Chernobyl).

The Office, with staff from its Washington headquarters and two field laboratories, the National Air and Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama, and the Las Vegas Facility (LVF) in Nevada, fields a Radiological Emergency Response Team capable of responding to any type of radiological emergency. The Agency's response as the lead agency includes notification, response, protective action recommendation, and information control and coordination.

Environmental Radiation Ambient Monitoring System

In addition to the emergency response actions discussed above, the Environmental Radiation Ambient Monitoring System (ERAMS) can be put on an emergency sampling schedule when needed. ERAMS is the nation's single major means of acquiring and analyzing environmental radiation data. It has 268 nationwide sampling stations that collect air, precipitation, surface and drinking water, and milk samples from which environmental radiation levels are derived. Many stations are located in the near-environment of major potential environmental release points. The stations were selected to effectively measure the wide-scale impact from global events and to provide optimal population coverage while monitoring fallout from any atmospheric testing of nuclear devices and other possible forms of environmental radioactive contamination.

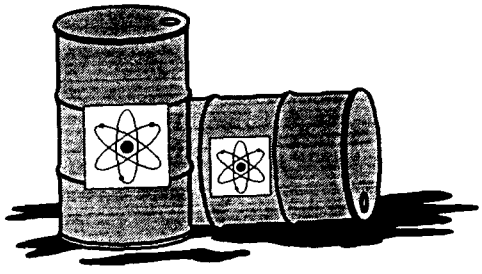
ERAMS, which is operated with the cooperation of state radiation program personnel, collects 65 composite pasteurized milk samples, which represent a significant fraction of the U.S. milk consumption. Air filter and precipitation samples are obtained twice weekly from locations in all 50 states, drinking water samples quarterly from 78 locations, and river water samples quarterly from 58 locations. These samples are then analyzed to determine their level of radioactivity. In all, the sampling stations submit a monthly total of about 2,000 samples for 6,000 analyses. Results of this monitoring are published in **Environmental Radiation Data**, a quarterly journal distributed to state agencies and interested private organizations.

Though there have been no atmospheric tests since the Chinese test of October 1980, ERAMS continues to assess levels of long-lived radionuclides in the environment. The system is also employed in certain emergency situations. For example, the network's sampling frequency was

increased in early 1983 as part of the federal emergency preparedness activity related to reentry of the nuclear-powered Russian satellite, Cosmos 1402. In 1986, following the Chernobyl accident, ERAMS' air sampling frequency was increased to provide daily measurements. The milk network sampling frequency was increased to two per week.

In 1992 ERAMS became part of the World Health Organization's Global Environment Radiation Monitoring Program, a component of the United Nations Environmental Programs, Global Environmental Monitoring System. The ERAMS data will be combined with that from 40 other nations to provide a single comprehensive global network for radiation data.

Radioactive Waste Disposal



One of the basic authorities for EPA under the Atomic Energy Act (AEA) is to establish "generally applicable environmental standards for the protection of the general environment from radioactive material." Since its inception, EPA has participated in many efforts to resolve radioactive waste management and disposal problems under legislative responsibilities to protect public health and the environment.

Typically any activity making use of radioactive material inevitably generates radioactive waste as a by-product of its operations. This waste contains varying levels or intensities of radioactivity and is produced both in the commercial sector and by federal government defense programs. Radioactive waste is usually classified into several categories including: (1) spent fuel and high-level radioactive waste from nuclear reactor operations; (2) transuranic waste (man-made) from the defense programs; (3) low-level radioactive waste from various activities; (4) waste from mining and milling of uranium and thorium ores; (5) and natural and accelerator-produced waste.

Disposal of Spent Nuclear Fuel, Transuranic and High-Level Radioactive Wastes

High-level radioactive waste (HLW) is liquid or solid waste from reprocessed spent nuclear reactor fuel. Some commercial HLW is now stored at West Valley, NY. Defense HLW is stored at special sites in Richland, WA; Aiken, SC; and Idaho Falls, ID. It is estimated that by the year 2000, commercial and defense sources will have generated 330,000 cubic meters of high-level liquid and solidified waste.

Spent nuclear fuel is fuel that has been withdrawn from a nuclear reactor following fissioning; the various constituent elements have not been separated by reprocessing. Commercial spent nuclear fuel is being stored temporarily in pools of water at individual power reactor sites. Some Defense spent fuel is at three specifically designated sites in the United States. In 1987, there were about 16,000 metric tons of commercial spent nuclear fuel. The total is expected to reach about 41,000 metric tons by the year 2000. The Department of Energy (DOE) is in the characterization phase of a candidate site in Nevada for spent nuclear fuel and solidified high-level radioactive waste.

Transuranic (TRU) waste is long-lived radioactive waste generated as by-products from nuclear weapons production. TRU waste is generated by DOE in its defense programs, and is currently either buried or stored at several DOE sites. In 1987 some 3,000 cubic meters of transuranic waste were stored awaiting disposal in a geologic repository. DOE is evaluating a geologic repository in New Mexico for the disposal of TRU waste.

On August 15, 1985, the Office issued environmental standards for the management and disposal of spent nuclear fuel, high-level, and transuranic radioactive wastes. Shortly after the rule was promulgated, several states and

environmental groups challenged it. In 1987, the U.S. Court of Appeals for the First Circuit agreed with the plaintiffs' objections to two sections of the standards and remanded Subpart B of 40 CFR Part 191 to EPA for further action.

EPA had been working on a repromulgation of the rule when the 102nd Congress directed a significant redirection in EPA's development of standards for high-level and transuranic wastes. The Waste Isolation Pilot Plant (WIPP) Land Withdrawal Act (PL 102-579) reinstated the major part of EPA's 40 CFR 191 radiation standard as it was promulgated in 1985. However, it limits its applicability to sites not developed under the Nuclear Waste Policy Act. It further requires that EPA promulgate a final standard in 6 months and gives EPA a major role in oversight of the New Mexico site's testing, design, and operation.

The Energy Policy Act (PL 102-486) prescribes a procedure for EPA to follow in setting radiation standards specifically for the Yucca Mountain, Nevada, site. This process requires contracting with the National Academy of Sciences and developing standards consistent with their findings and recommendations.

Waste Isolation Pilot Plant

On October 30, 1992, the Waste Isolation Pilot Plant Land Withdrawal Act became law. The Act requires EPA to oversee the Department of Energy's activities at the WIPP, a potential disposal facility for transuranic radioactive waste under development by DOE in southeastern New Mexico. The Act provides an extensive role for EPA in reviewing and approving many of DOE's activities at the plant and in ensuring compliance with all Federal environmental laws and regulations.

Because of uncertainties related to the long-term performance of the WIPP repository, DOE is proposing to conduct a series of underground storage tests with limited amounts of radioactive waste. According to DOE, data derived from these tests will be used to help determine whether the plant complies with EPA radioactive and hazardous waste disposal standards.

Under the Act, the test phase cannot begin until EPA: publishes final radioactive waste disposal standards, determines that DOE complies with the hazardous waste no-migration determination, reviews DOE's plans for test phase activities, and approves the plan, in whole or in part, by August 1993. DOE's waste retrieval plan must also be approved by August 1993. This plan guarantees that the waste will be retrievable if WIPP cannot comply with EPA's radioactive waste disposal standards. The test phase should not last longer than 10 years.

The actual disposal phase of the WIPP project cannot begin until (1) the tests are completed; (2) EPA determines that the WIPP meets the Resource Conservation and Recovery Act's requirements; and (3) EPA makes a determination that WIPP will comply with the radioactive waste disposal standards. DOE must submit an application for certification of compliance with the disposal standards within 7 years of the date of the first receipt of radioactive waste for tests at the WIPP. EPA then has 1 year to certify that the WIPP facility complies with the disposal standards. EPA will issue final criteria for determining compliance by October 1994. DOE must verify and EPA must recertify compliance every 5 years. The Agency must make bi-annual determinations of the WIPP's compliance with applicable environmental laws and regulations.

Land Disposal of Low-Level Radioactive Waste

Typically, low-level radioactive waste (LLW) is ordinary industrial or research waste such as paper, rags, plastic bags, protective clothes, cardboard, packing materials, organic fluids, or water treatment residues which are contaminated with radioactive materials. This waste is a by-product from a variety of both government and commercial activities: research, fuel-cycle activities for electric power generation (refining, enrichment, fabrication and reactor operations), diagnostic and therapy medicine manufacturing (pharmaceuticals, tools, and instruments), and defense programs (submarines, ships, and research).

It is estimated that for the 1990-2010 timeframe, there will be about 326,000 cubic meters of LLW

generated by commercial activities (about 16,000 cubic meters per year) and 1.8 million cubic meters generated by DOE activities (about 92,000 cubic meters per year).

In 1974 the Agency, with the U.S. Geological Survey, published hydrogeologic and hydrochemical criteria to help evaluate suitability of LLW disposal sites. The Office is discussing with the Nuclear Regulatory Commission (NRC) whether the present NRC regulations are adequate to meet all EPA objectives. This evaluation, along with an assessment of low-level waste at DOE facilities, will provide a basis for deciding if EPA standards are required.

There are currently two operational commercial sites: Barnwell, SC, and Richland, WA. Commercial sites for disposing of low-level waste have been closed at Maxey Flats, KY; West Valley, NY; Beatty, NV; and Sheffield, IL. There are 16 federal government disposal sites widely distributed around the country.

Under the Low-Level Radioactive Waste Policy Act of 1980 and the Amendments of 1985, each state would be responsible for providing disposal capacity for all commercial low-level radioactive waste generated within its borders. Regional cooperation through compacts was encouraged by this law, and is presently the method by which many states are carrying out their responsibility. As a result, 8 to 10 new disposal sites may be operating by the year 2000.

Naturally Occurring and Accelerator-Produced Radioactive Materials

Two broad categories of radionuclides not covered under the Atomic Energy Act are naturally occurring radionuclides and accelerator-produced radionuclides. Materials containing these nuclides are commonly referred to as naturally occurring and accelerator-produced radioactive materials (NARM).

Naturally occurring radioactive materials consist principally of uranium, thorium, and radium. There are two very different types of this waste: discrete sources or waste streams of higher radioactive concentration, such as radium needles used in medical practice or radium-contaminated drinking water cleanup resins, and lower activity diffuse sources such as residuals from mining and extraction industries.

Most accelerator-produced radionuclides are used in medicine or for research and have very short half-lives. A few are longer lived. Because accelerator-produced NARM radionuclides are indistinguishable from those that are produced at AEA-licensed facilities, they are usually disposed of with Atomic Energy Act Low-Level Waste.

EPA has been conducting several studies to make a preliminary risk assessment of various NARM waste. This includes a cooperative study with the State of Louisiana on waste from oil and gas production. These studies will serve as a basis for evaluating whether any further guidance or regulatory activities should be initiated.

Disposal of Radioactive Materials at Active Uranium and Thorium Processing Sites

On September 30, 1983, the Agency issued final standards for the control of effluents and emissions from uranium and thorium mill tailings during milling operations and for the final disposal of tailings. (Mill tailings are radioactive, sand-like materials that remain after uranium has been extracted from ore.)

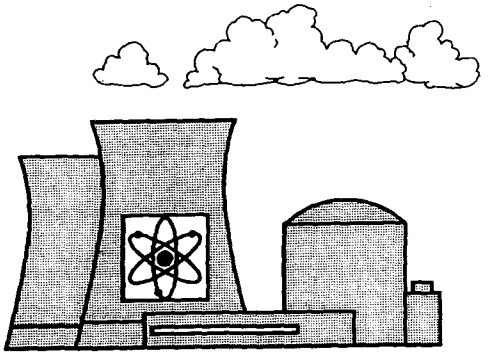
The standards require stabilization of tailings so that health hazards will be controlled and limited for at least 1,000 years. NRC or states having regulatory agreements with the Commission are directly responsible for implementing and enforcing these standards. There are 27 active (licensed) milling sites distributed among the States of Colorado, New Mexico, Texas, Utah, Wyoming, South Dakota, and Washington.

Groundwater Protection at Inactive Uranium Mill Tailings Sites

On January 5, 1983, the Agency issued final standards for the cleanup and disposal of uranium mill tailings at 24 inactive mill sites that qualify for remedial action under Uranium Mill Tailings

Radiation Control Act of 1978. The sites are located in Arizona, Colorado, Idaho, New Mexico, North Dakota, Oregon, Pennsylvania, Texas, Utah, and Wyoming. The standards include qualitative standards for groundwater protection which allowed DOE and NRC to determine what actions were needed on a site-by-site basis for the cleanup and disposal of uranium mill tailings at the inactive sites. However, as a result of a Court order, quantitative standards are now being developed.

Radioactively Contaminated Sites



The Office of Radiation and Indoor Air is EPA's primary source of radiation expertise needed to facilitate identifying, characterizing, and cleaning up the many sites around the country that have been contaminated through handling and processing radioactive materials. Such contamination is found at abandoned and active government-owned and commercial facilities. Most of these sites are addressed under the Superfund program or Solid Waste program. Within the Agency, the Office works closely with the Superfund and RCRA programs, the Office of Federal Facilities Enforcement, the Office of Research and Development, and EPA Regional Offices to identify, characterize, and clean up these sites. The Office also works closely with other federal agencies, in particular, the Department of Energy, Department of Defense, and the Nuclear Regulatory Commission.

Superfund Support

At present, there are an estimated 80 radioactively contaminated sites on the Superfund National Priorities List, 55 of which are federal facilities. In support of Superfund, Office staff provides remediation/mitigation technology reviews and evaluations, technical and policy guidance and advice, project development strategies, and seminars and training programs. The Office also provides site-specific support in developing and designing site monitoring programs, reviewing risk assessment methodologies, evaluating, testing, and demonstrating remedial technologies, analyzing laboratory samples and interpreting data, planning and participating in emergency removal actions and producing guidance for worker safety and health programs. The Office provides significant technical and compliance training support to DOE to assist that agency in complying with Superfund requirements in its major environmental cleanup program.

Cleanup Standards

The total number of sites contaminated with radionuclides in the United States may be in the thousands. Contamination extends to all environmental media and includes all types of radioactive materials. It also includes mixed waste, which is waste containing both radioactive and hazardous components.

To date, progress in cleaning up these sites has, in general, been slow, largely due to unknowns associated with the contamination and the absence of specific cleanup regulations. To address this problem, the Office is developing standards that will establish cleanup levels for sites contaminated with radionuclides. Further, the Office is developing standards that will address the management of radioactive waste generated during site remediation and will explore the feasibility of recycling or reusing site structures, equipment, and metals after cleanup.

As part of its standard setting program, the Office participated in NRC rulemaking workshops conducted to aid the NRC in developing its regulations for decommissioning nuclear facilities. The Office also chairs a high-level Interagency Steering Committee, comprising NRC and the Departments of Defense and Energy, concerned with effective federal coordination in cleaning up radioactivley contaminated sites. When issued, the cleanup standards will apply to all types of sites

with radioactive contamination, including Superfund sites, federal facilities, and sites operating under NRC licenses.

Mixed Waste

In addition to strictly radioactive contamination, many sites may be contaminated with hazardous, nonradioactive but toxic materials that may be commingled with radioactive materials; i.e., mixed waste. The Office evaluates methods to characterize mixed waste and reviews waste acceptance criteria for facilities that store, treat, and dispose of such waste. It also assesses and develops technologies for handling and treating mixed waste and develops specialized radiochemical analytical protocols.

Technical Assistance

The Office provides technical assistance upon request to other parts of the Agency, to other federal agencies, and to state and local governments. Such assistance is provided mainly by radiation personnel in each of the 10 EPA Regions and the Montgomery and Las Vegas Laboratories.

This assistance includes radiochemical analyses of environmental samples for selected radionuclides; site surveys of areas with known or suspected unusual conditions; and making measurement equipment available to other organizations. The Montgomery and Las Vegas Laboratories also advise other laboratories on conducting analyses and provide training in radiation monitoring and laboratory procedures.

Radiation Worker Safety and Health Program

The Office, in cooperation with the EPA Office of Administration, developed a comprehensive, nationwide Agency program to protect the health of EPA employees who work around radioactive materials, whether in laboratories or at radioactively contaminated sites. Elements of the program include: radiation safety training, uniform monitoring and dosimetry practices, medical surveillance and health consultations, and a centralized computer-based management information system.

International Programs

Internationally, the Office provides technical support for the United States' participation in meetings of the Contracting Parties to the London Dumping Convention and in activities of other organizations that guide the conduct of ocean dumping, such as the International Atomic Energy Agency and the Organization for Economic Cooperation and Development's Nuclear Energy Agency.

The Office has established cooperative programs with the Ministry of Ukraine for Protection of the Population from the Consequences of Chernobyl (Minchernobyl) and with the Ukrainian Academy of Sciences to conduct radiological monitoring in response to the Chernobyl nuclear accident.

Under these programs, the Agency has carried out two radiological assessments in the Black Sea. The Office is also preparing to conduct radiological monitoring in the Kiev reservoir and is reviewing proposals from Czechoslovakia and Romania for a cooperative effort to perform a Chernobyl-related regional ecological impact assessment. Additionally, the Office signed an agreement with the government of Belarus to cooperate on cleaning up radioactive contamination from the Chernobyl accident. The Office also works with United Nations Organizations to develop programs to monitor and remediate radiation contamination.

Under the U.S.-Russian bilateral agreement, the Office is participating in radiological assessments being conducted in the Kara/Barents Seas. In cooperation with other federal agencies (DOD, DOS, DOE), the International Atomic Energy Agency, and the governments of Russia and Norway, the Office is participating in monitoring, analyzing, and assessing the marine environment as well as the condition of radioactive waste packages and naval nuclear reactor compartments disposed of by the former Soviet Union over a 30-year period.

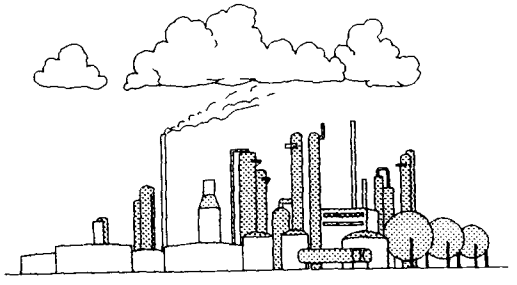
Under the auspices of the U.S-Polish Scientific and Technical Cooperative Agreement, the Office, the

Lawrence Livermore National Laboratory, and the Warsaw Medical School are exploring the use of Electron Paramagnetic Resonance (EPR) for radiation dosimetry in an aquatic environment. While EPR is routinely used to determine the physical properties of solids, this study will examine its suitability for use in measuring exposure to ionizing radiation.

The Office has also been working with Czechoslovakian scientists on a non-Chernobyl radon project. EPA has provided a 3-year grant to the International Atomic Energy Agency to support an epidemiological study of residential radon exposures and lung cancer mortality in the Petrovice Region of Czechoslovakia, south of Prague. The radon exposure in this region is due primarily to natural granitic rock formations.

The Office has had an ongoing cooperative program with the Japan Atomic Energy Research Institute (JAERI) for several years. Important aspects of this collaboration include an extensive study of occupational radiation exposure in the United States and the joint sponsorship of a workshop on Residual Radioactivity and Recycling Criteria.

Industrial Sources



National Emission Standards for Hazardous Air Pollutants (NESHAPS); Standards for Radionuclides

EPA has listed radionuclides as hazardous air pollutants under Section 112 of the Clean Air Act. This listing was based on a finding that radionuclides are carcinogens and are emitted in significant amounts into the air from thousands of sources across the nation.

On December 15, 1989, EPA published final standards controlling radionuclide emissions from industrial sources. The rule covers the following source categories: NRC-licensed facilities and non-DOE federal facilities, DOE facilities, uranium mill tailings piles, phosphogypsum piles, elemental phosphorous plants and underground uranium mines. At the time of promulgation, EPA stayed Subpart I of the regulation which regulates NRC-licensed facilities, due to allegations that the rule would cause negative impacts to the nuclear medical community. EPA agreed to reconsider Subpart I, and over the course of the reconsideration issued several continuations of the stay.

Several other petitions for reconsideration of other subparts of the rule were received by EPA. As a result of these reconsiderations, modifications were made to the rule concerning phosphogypsum piles and elemental phosphorus plants.

In 1990 Congress enacted amendments to the Clean Air Act which contains a new provision, Section 112(d)(9), that now allows EPA to decline to regulate NRC-licensed facilities after a finding that the NRC program protects the public health with an ample margin of safety. EPA is currently in the process of rescinding its rule for NRC-licensees pursuant to Section 112(d)(9). Also under that authority, EPA is revising its standards for the disposal of uranium mill tailings piles.

Guidance for Occupational Exposure

The types of employment and associated activities that involve worker exposure to radiation vary greatly. EPA estimates that approximately 1.3 million workers were employed in occupations in which they were potentially exposed to radiation in 1980, the latest year for which there are comprehensive assessments. Most of these workers receive very low exposures and the average worker is believed to incur a relatively small risk of harm.

On January 27, 1987, President Reagan issued revised guidance to Federal agencies significantly reducing the level of radiation to which workers

may be exposed occupationally. The guidance, developed by EPA, updates that issued by President Eisenhower in 1960.

Because there is no definitive evidence that radiation exhibits any "threshold" level, below which no health effects occur, EPA's occupational guidance is predicated on the tenet of achieving exposures "as low as reasonably achievable." It contains new provisions to protect the unborn. The new guidance applies to radiation workers employed by the federal government and by institutions or companies subject to federal regulation.

Diagnostic X Rays

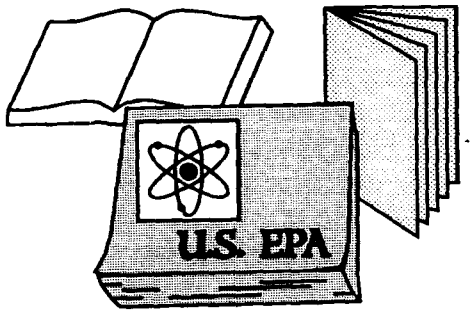
In 1976, based on recommendations developed by the Office in cooperation with other federal agencies, including the then Department of Health, Education, and Welfare, then President Ford issued federal guidance for radiation protection in the use of diagnostic x rays. The guidance is designed to eliminate unnecessary use of x rays and to ensure that x-ray personnel, equipment, and techniques are of the highest quality, resulting in lower radiation doses. Among its more significant provisions, the guidance recommends that mass screening by using x-ray examinations be eliminated unless specifically justified; that use of medical diagnostic x rays be limited only to obtaining diagnostic information; that certain numerical guides for common x-ray examinations not be exceeded; and that routine dental x-ray examinations not be performed.

Communicating Information on Radiation Issues

The Office carries on an existing effort to inform the public, interest groups, and other governmental organizations and to increase their understanding of radiation issues. A public outreach effort seeks to educate these groups on radiation issues, radioactive waste disposal, radionuclide air emissions, and radiological emergency response; and on how people are protected from and can protect themselves from exposure to radiation. The Office has developed a booklet entitled **"EPA: Ready to Respond"** which outlines EPA's role in response to a radiological emergency. Another series of publications: **"Radiation: Risks & Realities," "Radioactive Waste: An Environmental Perspective,"** and **"Industrial Sources of Radiation"** are soon to be published and will describe EPA's roles in regards to other radiation issues. The Office has developed graphics displays and an interactive display for use at conferences and workshops to inform groups about the Agency's role in radiation protection.

In addition to providing the public with information on radiation, the Office has begun efforts to inform the public of EPA's new responsibility for overseeing development and operation of DOE's Waste Isolation Pilot Plant (WIPP). The WIPP is a potential disposal facility for transuranic radioactive waste under development by the Department of Energy in New Mexico. The Office is undertaking an extensive communications and outreach effort to ensure that the public is adequately informed of EPA's actions on the WIPP and involved in the decisionmaking process.

Federal Guidance



To protect the public and the environment from radiation exposure, the Office develops environmental standards and recommendations for federal guidance, a unique authority that applies only to activities of federal agencies. In setting standards and developing federal guidance, the Agency considers technological, social, and, in some cases, economic factors in seeking to reduce exposure risks to acceptable levels.

The Office develops radiation standards in response to several pieces of legislation and set limits on human radiation exposure levels or on quantities or concentrations of radioactive materials that may be released to the environment. Once issued, EPA standards apply directly to all commercial or governmental organizations involved in the regulated activity. For instance, the Nuclear Regulatory Commission must incorporate the EPA environmental standards into its regulations governing their licensees.

Under federal guidance authority, the Agency may make recommendations to the President on guidance to Federal agencies for radiation protection. If the President issues the EPA recommendations as federal guidance, affected agencies must take them into account in carrying out their responsibilities. The basic philosophy behind EPA standards and guidance on radiation is that any exposure to radiation carries some risk with the risk increasing as the exposure increases. Following are lists of the radiation standards and recommendations for federal guidance developed and being developed by the Office of Radiation and Indoor Air.

Radiation Standards

1. Nuclear Power Operations
   - Promulgated 1977
2. Disposal of Spent Nuclear Fuel, Transuranic and High-Level Radioactive Waste
   - Issued 1985
   - Partially Reinstated 1992
   - Part to be Reproposed
4. Disposal of Radioactive Materials at Active Uranium and Thorium Processing Sites
   - Issued 1983
5. Remedial Actions at Inactive Uranium Processing Sites
   - Issued 1983

   Groundwater Processing
   - Reproposed 1987
6. National Emission Standards for Hazardous Air Pollutants: Radionuclides
   - Issued 1985
   - Reissued 1989

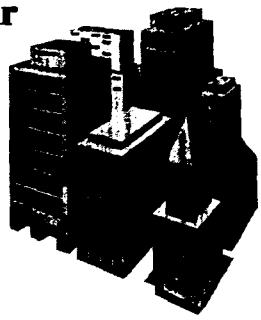
Federal Radiation Protection Guidance

1. Exposure of Underground Uranium Miners
   - Final 1971
2. Diagnostic X Rays
   - Final 1976
3. Occupational Exposure
   - Final 1987

INDOOR AIR/RADON/EMF

In recent years, comparative risk studies performed by EPA and its Science Advisory Board have consistently ranked indoor air pollution, including radon, among the top four environmental risks to public health. EPA, in close cooperation with other Federal agencies and the private sector, has begun a concerted effort to better understand indoor air pollution and to reduce peoples' exposure to air pollutants in offices, homes, schools and other indoor environments where people live, work and play.

Indoor Air



EPA studies of human exposure to air pollutants indicate that indoor levels of many pollutants may be 2-5 times, and occasionally more than 100 times, higher than outdoor levels. These levels of indoor air pollutants are of particular concern because it is estimated that most people spend as much as 90 percent of their time indoors.

Over the past several decades, our exposure to indoor air pollutants is believed to have increased due to a variety of factors such as the construction of more tightly sealed buildings, reduced ventilation rates to save energy, the use of synthetic building materials and furnishings, and the use of chemically formulated personal care products, pesticides and household cleaners.

Indoor Air Pollution and Health

The study of indoor air pollution is relatively new, and in many ways we are pushing the frontiers of environmental science forward in an attempt to understand the implications of being exposed to relatively low levels of many pollutants for long periods of time. What has been learned so far indicates that there may be significant long- and short-term health effects of concern.

Indoor Air Pollution Costs

Initial efforts by EPA to assess the costs of indoor air pollution (see *Report to Congress on Indoor Air Quality, August, 1989*) concluded that it was reasonable to estimate that the costs of indoor air pollution were in the tens of billions of dollars per year.

EPA's Strategy for Dealing with Indoor Air Pollution

Because of the potentially serious impacts on the health of individuals who may experience indoor air quality problems--as well as the dollar costs to society if indoor air pollution is not addressed--EPA has developed a comprehensive strategy to better understand the indoor air pollution problem and to take decisive steps to reduce people's exposures to indoor air contaminants of all types.

- Even in the absence of complete scientific understanding of indoor air pollution, prudent public policy dictates that intensive efforts be undertaken to **reduce people's exposure to potentially harmful levels of indoor air pollutants**, using the authorities available to the Federal government under current laws.

- **Pollution prevention**--and efficient resolution of indoor air quality problems of all types--must become a routine aspect of the design, construction, maintenance, and operation of public and commercial buildings, homes, health and day care facilities, educational institutions, and other special-use buildings.

- An effective **research and development** program must be conducted to achieve a more complete understanding of the factors affecting indoor air quality, exposure patterns, health effects, and control techniques for improving indoor air quality.

EPA is implementing this strategy using nonregulatory as well as regulatory tools available under a number of federal laws to provide information and incentives for action to product manufacturers, architects, engineers, builders, building owners and managers, and building occupants.

The primary objectives of the Office's program are to:

- establish effective partnerships with organizations representing the range of target audiences for indoor air quality information to communicate specific guidance and information and promote timely action on indoor air quality issues;
- forge constructive alliances with other federal agencies to leverage resources and ensure that existing statutory authorities are used most effectively;
- develop practical guidance on indoor air quality issues utilizing a broad-based consensus approach which includes representatives from industry and public interest groups to ensure that information provided is accurate and practical;
- design market-based incentives for industries to lower chemical emissions from their products and provide consumers and other decision-makers with information needed to make informed purchasing decisions;
- identify and fill research gaps in order to provide information to address outstanding indoor air quality policy issues;
- select appropriate environmental indicators to measure progress in reducing population exposure to indoor air quality problems as the program matures;
- enhance scientific understanding and public awareness of the complex factors that affect indoor air quality; and
- bring about substantial reductions in human exposure to the entire range of indoor air pollutants.

Reducing Pollutant Levels Indoors

The Building System Approach

EPA has set a high priority on improving the way buildings are designed and operated, having concluded that people's exposure to indoor air pollutants can be reduced significantly by implementing current knowledge about sound building operation and maintenance practices. Some of the major actions to date include:

- issuance, in cooperation with the National Institute for Occupational Safety and Health, of comprehensive guidance, entitled *Building Air Quality: A Guide for Building Owners and Facility Managers*, on how to prevent and resolve the full range of indoor air quality problems in public and commercial buildings; and
- publication of *The Inside Story: A Guide to Indoor Air Quality*, to help people identify and correct potential indoor air quality problems in their own homes.

In addition, the Office is developing guidance for school facility managers, new home builders, and architects and design engineers to acquaint them with the most current information on how to prevent indoor air quality problems from occurring or resolve them quickly if they do occur.

The Pollutant-Specific Approach

This emphasis on a "buildings approach" holds the most promise for addressing all of the factors--including those related to the ventilation system as well as sources of individual pollutants--that affect indoor air quality. However, the Agency also strongly believes that it must aggressively utilize its combined statutory authorities to identify specific pollutants that present direct health risks in the indoor environment, and to use a variety of means to reduce their levels indoors. The indoor air pollutants that are currently receiving significant

Agency attention include: radon, environmental tobacco smoke, asbestos, toxic substances, pesticides, and lead.

Increasing Access to Indoor Air Information

Information Dissemination

In addition to publishing a wide range of information materials on indoor air quality, the Office is also developing additional strategies for disseminating information to key audiences. To ensure that a full range of information about indoor air quality problems and solutions is readily available to both the technical and nontechnical public, a National Indoor Air Quality Information Clearinghouse opened in 1992.

Training Key Indoor Air Audiences

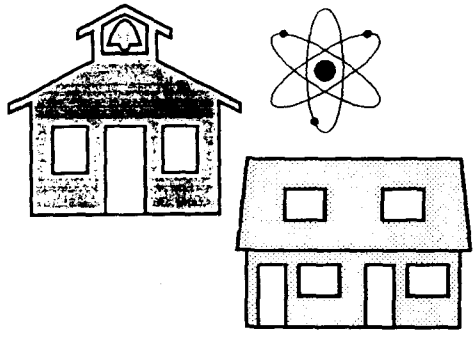
Because concern about indoor air problems is a relatively recent phenomenon, many of the people who are in the best position to prevent problems or resolve them when they do occur are not sufficiently informed about the issue. Many indoor air quality problems can be avoided through sound building operation practices, or resolved by knowledgeable building personnel without the need for potentially costly outside assistance.

The Office has developed a training course for building owners to acquaint them with the guidance contained in *Building Air Quality: A Guide for Building Owners and Facility Managers* (December 1991). Because many indoor air quality problems are best resolved by responsible government agencies at the state and local level, the Office has developed both a live instructional course on indoor air quality issues, entitled *Orientation to Indoor Air Quality*, and a self-paced learning module entitled *Introduction to Indoor Air Quality* (April 1991) for these audiences.

Working with Other Federal Agencies

More than 20 different federal agencies have responsibilities associated with indoor air quality, either through their own statutory responsibilities or because they are major property managers. The activities of these agencies are coordinated through a variety of mechanisms, including an interagency Committee on Indoor Air Quality (CIAQ) which meets on a quarterly basis to exchange information on indoor air issues. Five federal agencies--EPA, the Consumer Product Safety Commission, the Department of Energy, the National Institute for Occupational Safety and Health, and the Occupational Safety and Health Administration--are CIAQ co-chair agencies. In addition, EPA works closely with other agencies on regulatory and information development efforts and jointly sponsors many of its guidance and public information documents with these other agencies to help ensure that federal actions are well-coordinated.

Indoor Radon



Indoor radon is one of the most serious environmental health problems in the United States. Next to smoking, it is the second leading cause of lung cancer, resulting in approximately 7,000-30,000 deaths each year. The combination of tobacco smoke and radon exposure is especially serious. Millions of homes and other buildings across the country have elevated levels of indoor radon.

Unlike most other environmental pollutants, radon gas is naturally occurring, resulting from the radioactive decay of uranium-238 that commonly exists in trace quantities in ordinary rock and soil. The primary health risks associated with exposure to radon do not result from contact with the gas itself, but rather from two of its decay products, polonium-218 and polonium-214. If inhaled, these radioactive particles can become deposited in the respiratory tract, where they undergo further

radioactive decay by emitting alpha radiation. It is the alpha radiation that causes damage to surrounding tissue, which can lead to lung cancer. Although smokers face a greater risk of radon-induced lung cancer, the health risks for nonsmokers is also serious. Radon in water drawn from wells can also pose a risk when it is released to the air through household use. Ingestion may also pose some small risk. However, radon in water will in most cases be a much smaller source of risk than radon entering in homes from soil and rocks.

Elevated radon levels occur in homes, schools, and workplaces. EPA and the states have initiated activities to assess the extent of the problem in homes and schools, and to reduce radon risks. Because the radon problem involves large numbers of private homes and is highly variable from house to house, EPA recognized that the problem is best addressed by states and localities. In 1985 the Agency developed a nonregulatory, technical assistance and public information program relying on a strong partnership between federal, state, and local governments, as well as private industry and local civic and professional organizations. To help citizens make informed decisions regarding radon, the program responds to radon in five key areas:

- assessing the distribution of indoor radon levels and the magnitude of associated health risks;
- developing cost-effective technologies that can be used to mitigate and prevent high levels of indoor radon;
- developing the infrastructure and capabilities needed for effective state and local government programs and technically adequate services from the private sector;
- setting quantitative program goals for environmental results in the areas of awareness, testing, mitigation, real estate, and new construction; and
- communicating information on radon to the public and institutionalizing radon programs within key organizations.

In 1992, EPA's Office of Policy, Planning and Evaluation (OPPE) conducted a Radon Program Review to provide recommendations on approaches to increase radon risk reduction. The OPPE report recommends continuation of EPA's national public information program; targeting high risk areas and populations; promoting radon risk reduction as part of real estate transfers and in new construction; and developing a coordinated research plan. The Office is implementing these recommended actions and has revised its program strategies to reflect these priorities.

Assessing Radon Health Risks and Distribution and Targeting High Risk Areas

Through its own research and by incorporating the latest research produced by the scientific community, EPA develops and refines the best models to project the risk of exposure to indoor radon to individuals and the general population. Based on the extensive body of data on the lung cancer mortality of underground miners, the lifetime lung cancer risks to miners can be estimated using mathematical equations or models that reflect the relationship of key risk-influencing factors. The National Academy of Sciences (NAS) conducted an extensive study on risk assessment methods and issued a report in 1991 which concluded that residential risk is 20-30 percent lower than the risk to miners for the same exposure. EPA has incorporated these findings in its risk assessment.

The Agency will continue to refine its risk estimates in cooperation with leading scientific organizations such as NAS, which is currently undertaking an updated review of related health data. In addition, the Agency reviews and uses the findings of epidemiological studies to advance the understanding of health effects of indoor radon exposure.

Residential Exposure Assessment

In 1989 and 1990, the Agency conducted long-term nationwide measurements through the National Residential Radon Survey (NRRS). This survey provided a frequency distribution of annual average

radon concentrations in all residences across the country. The NRRS found that about 6 percent of residences have average annual radon levels above 4 pCi/L, the level above which EPA recommends that action be taken to reduce indoor radon concentrations.

To ensure a uniform approach to these and other radon measurement programs, EPA developed measurement protocols to provide cost-effective, standardized approaches for measuring radon. From 1987 through 1992 EPA assisted states and Indian tribes in conducting a survey program using short-term, screening measurements to identify potential radon problem areas. As of the end of 1992, 42 states and Indian Lands in 9 states had participated in this survey. Six states (New York, New Jersey, Delaware, Florida, New Hampshire, and Utah) conducted their own surveys. Their findings are similar to those in EPA surveys.

The survey results show that one in five homes in the surveyed jurisdictions has a screening level above 4 pCi/L. (Note that these surveys have identified 20 percent of single family homes as having screening levels above 4 pCi/L, as opposed to the 6 percent of all residences, including housing, identified by the National Residential Radon Survey as having annual average levels above 4 pCi/L. As previously mentioned, these state screening surveys are intended to identify potential radon problem areas and the relative magnitude of problems between states, not for estimating actual exposures or risk.)

Assessing Exposure in Schools

EPA has undertaken a program to identify the magnitude of radon exposure in schools and to develop programs to support radon risk reduction in schools. In 1989, EPA published guidance for radon testing in schools. Updated guidance will be published in 1993. In late 1992, the Agency completed the National School Radon Survey. This survey had four goals:

- to characterize the frequency distribution of radon measurements in schools nationwide as well as in high risk areas;
- to determine the relationship between short-term and long-term measurements in schools;
- to determine the correlation between ground-floor and upper-floor radon measurements; and
- to allow EPA to investigate specific construction and ventilation characteristics associated with different radon levels in schools.

The survey results show that nearly one in five of the nation's school's have at least one ground contact room with screening levels over 4 pCi/L.

Radon Exposure in Large Buildings

Legislation now requires federal agencies to test buildings that they own. These buildings vary according to type and age and are typical of most American workplaces. Results of testing in Federal buildings and other limited work EPA has done in large buildings indicate that elevated levels of radon do occur in large buildings, although EPA has not undertaken a survey of radon in large buildings or workplaces.

Developing a Radon Potential Map

In cooperation with the United States Geological Survey and the Association of American State Geologist, EPA is developing a Radon Potential Map. This map will be issued in 1993 and will show the relative differences in radon levels throughout the country and will provide a tool for the Agency and states to direct further program activities toward areas expected to have the worst problems. The map will also help national, state, and local building officials to assess the need to implement model new construction standards (discussed below).

Mitigating and Preventing Radon Problems

To prevent elevated radon levels in new homes and to transfer these techniques to builders, the Agency developed the New Construction Demonstration Program and Model New Construction Standards that can be used to develop and implement state and local building codes. For the New

Construction Demonstration Program, the Agency worked with a number of builders in seven states to employ radon-resistant construction techniques in houses being built. Subsequent evaluations confirmed that it is generally less expensive to incorporate such techniques into building new homes than to retrofit existing houses with elevated radon levels. These techniques are also cost effective and result in increased energy efficiency.

To assess the effectiveness of the proposed model construction standards, the Agency developed the New House Evaluation Program. This program is coordinated with the National Association of Home Builders, National Research Center, and is currently evaluating radon resistant construction techniques in nine states.

Mitigating Radon Problems in Schools

Through EPA and state-sponsored surveys, elevated radon levels have been found in many schools. Because schools are designed, built, and used differently than residences, the Agency initiated the School Evaluation Program, which demonstrates and evaluates techniques for diagnosing and mitigating elevated levels of radon in school buildings. In 1989, EPA issued interim technical guidance on techniques to reduce radon in schools. This guidance emphasized application of residential mitigation technologies where suitable. Current research demonstrations are focusing on reducing radon levels through an integrated approach that considers ventilation as another control strategy. Revised school mitigation guidance will be issued later in 1993. EPA meets periodically with school organization representatives to understand and consider their concerns. Other indoor air pollutants are also being monitored.

Ensuring Industry Proficiency and Consumer Protection

Anticipating that increased public awareness of the health risks of indoor radon would create a demand for companies qualified to make indoor measurements of radon and its decay products, the Agency established the Radon Measurement Proficiency Program (RMP). The RMP is a voluntary program to test the proficiency of companies that perform measurements of indoor radon levels and to provide the public with information on listed measurement companies. EPA recommends that consumers acquire measurement services from listed providers.

Because of the dramatic growth in the RMP, the Agency restructured the program to meet the increased demand. For example, EPA now provides for continuous testing. EPA also added a stricter performance test and continuous updating of participant lists, applications and proficiency testing, restrictions on acceptable phrases in advertising, and mandatory quality assurance plans. A required individual measurement exam component has been added.

There is also a need to establish a means to ensure the availability of contractors qualified to mitigate elevated radon levels. To meet that need, EPA conducts the Radon Contractor Proficiency (RCP) Program. Through the RCP, the Agency evaluates radon mitigation contractors and provides a list of proficient contractors to the public. The centerpiece of this program is the hands-on training requirement and proficiency exam, designed to set a national baseline measure for evaluating a contractor's knowledge of radon and radon reduction methods. Nearly 1,000 contractors nationwide have met the RCP requirements, carry RCP identification cards, and are listed. Some states have developed similar proficiency or certification programs of their own.

All EPA activities are targeted to "high risk areas" identified in the Radon Potential Map. Early environmental results indicator data show that radon awareness and testing rates are higher in high risk areas.

Transferring Information to States, Industry, and the Public

Four Regional Radon Training Centers make training in radon measurement, mitigation, and prevention techniques available to contractors, state personnel, and the general public throughout the country. The Regional Training Centers are responsible for developing curriculum, providing

radon training courses, and administering the proficiency exams.

Promoting State Radon Programs

The Agency's efforts have enhanced the development of state radon programs over the past several years. This facet of the EPA program was augmented by the establishment of the State Indoor Radon Grant Program in 1990. Through the grant program the Agency provides funding to all states. In a February 1991 survey conducted by the Conference of Radiation Control Program Directors, 82 percent of the states responding reported that the grants were either instrumental in starting a radon program or in accelerating expansion of an existing program. EPA encourages states to use grant funds to target high-risk areas and to set targets to achieve higher levels of awareness, testing, and mitigation.

Communicating Information On Radon

The Agency provides the states and the public with a wide variety of public information materials regarding the risks associated with radon exposure and the methods for reducing that exposure. EPA has produced over a dozen public information documents on radon. The centerpiece of the public information program has been **"A Citizen's Guide to Radon."** This pamphlet was revised in 1992 to reflect the latest scientific information on radon. The Agency also published the **"Consumers Guide to Radon Reduction,"** which assists consumers with the process of reducing radon in their homes; and the **"Homebuyers and Sellers Guide to Radon,"** which provides consumers with guidance on how to address radon in connection with real estate transfers.

EPA is working with over a dozen national organizations, including the American Lung Association, National Association of Counties, and the American Public Health Association, to promote radon action. These groups have developed strong programs through their community-based affiliates.

In addition to providing the public with information on radon, the Agency developed an aggressive program urging individuals to test their homes for radon and to take measures to reduce elevated radon levels. The foundation of this program has been a national radon media campaign developed in cooperation with the Advertising Council. Since October 1989, four waves of TV, radio, and print public service announcements have been released nationwide.

Evaluations show that EPA's public information program media campaign has been very effective at increasing public awareness and action. About 6-8 million U.S. homes have been tested, a result that compares favorably with results achieved during the early years of other nonregulatory, federal public health programs such as the Anti-Smoking and Seat Belt campaigns.

Grass roots awareness and support have produced results in many areas. Five states have enacted real estate radon disclosure laws, and the real estate industry have voluntarily adopted disclosure policies in many other areas of the country. Also, some home builders are voluntarily constructing homes with radon-resistant features. In 1990, approximately 12 percent of new homes were built with such features. The relocation industry regularly requires a radon test and remediation, if necessary, as a condition of property transfer. About one-fifth of U.S. schools also have been tested for radon.

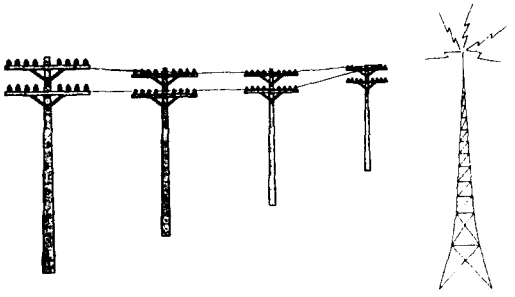
International Activities

The Agency sponsors an International Symposium on Radon and Radon Reduction Technology, which is held approximately every other year. We have assisted the International Atomic Energy Agency by co-funding several of their radon projects including the production of a video on the world aspects of the radon problem and a small residential case-control study in a very high radon area of Czechoslovakia. The Agency has been a participant in both the first and second International Workshops on Residential Radon which were co-sponsored by DOE and the Commission of European Communities (1989 and 1991).

Earlier this year, EPA played a major role in the World Health Organization's (WHO) Working Group on Indoor Air Quality: A Risk-Based

Approach to Health Criteria for Radon Indoors, held in Eilat Israel. Agency representatives were instrumental in helping to forge an international consensus that will serve as the basis for the revision of the chapter on radon in the revised and enlarged version of WHO's book on Air Quality Guidelines for Europe, slated for publication in 1994/95. EPA also makes presentations at appropriate international symposia and maintains close ties to numerous international scientists who are involved in ongoing epidemiologic case-control studies on residential radon health risk.

Electromagnetic Fields



Electric and magnetic fields or electromagnetic fields (EMFs) may occur alone or in a combination and are a form of nonionizing radiation. Electric fields are produced by the presence of electrical charges and magnetic fields are produced by the movement of those charges. Electricity flowing in a wire or being used in an appliance creates electric and magnetic fields. All power lines and electrical appliances that draw current have electric and magnetic fields around them.

Essentially everyone in the United States is exposed continuously to radiation from electromagnetic fields. The principal sources of radiofrequency (RF) radiation, another source of exposure, are AM and FM radio transmitters and UHF and VHF television broadcast systems. Other RF sources include radars, microwaves, and satellite earth terminals. Although neither radiation from EMFs nor radiofrequency, another source of exposure, change the structure of atoms, enough evidence exists to suggest that, despite scientific uncertainty as to health effects, more research is needed.

The Office maintains a small program to keep abreast of new developments in the EMF area. This program focuses on assessing risks, exposure capability, and disseminating information. Additionally, the Office responds to numerous requests for assistance from EPA Regional offices, state and local officials, industries and broadcasters and Federal agencies to make EMF measurements around broadcast towers. A Notice of Proposed Rulemaking for radiofrequency radiation was published in 1986. The Office is now investigating the benefits of completing the regulatory process and is sponsoring an RF conference toward that end.

AUTHORITIES FOR EPA's RADIATION AND INDOOR AIR PROGRAMS

AUTHORITY	SUBJECT
1. Atomic Energy Act of 1954, as amended, 42 USC 2011 et seq. (1970), and Reorganization Plan #3 of 1970	All Federal radiation guidance functions and generally applicable environmental and radiation standards
2. Public Health Service Act 42 USC 201 et seq (1970)	Radiation monitoring, research, training, and technical assistance to States
3. National Environmental Policy Act of 1969 33 USC 4321 et seq (1970)	*Evaluation of Federal actions involving radiation
4. Toxic Substances Control Act, 15 USC 2601 et seq (1970)	*Commodities containing carcinogenic (e.g., naturally occurring radionuclides) materials
5. Marine Protection, Research and Sanctuaries Act of 1972, 42 USC 1401 et seq (1972)	Ocean disposal of radioactive waste
6. Federal Water Pollution Control Act as amended, 33 USC 1251 (1973) and 7. Safe Drinking Water Act, 42 USC 300f et seq (1974)	Radionuclides in drinking and surface water
8. Resource Conservation and Recovery Act, 42 USC 6901 et seq (1976)	*Naturally occurring radionuclides in wastes of all types
9. Uranium Mill Tailings Radiation Control Act of 1978 (an amendment to the Atomic Energy Act), 42 USC 7901 et seq (1978)	Uranium Mill Tailings
10. Comprehensive Emergency Response, Compensation and Liability Act of 1980; and Superfund Amendments and Reauthorization Act of 1986, 42 USC 9601 et seq	Radioactive waste cleanup, radon surveys and demonstration projects, indoor air quality program
11. Nuclear Waste Policy Act of 1982 P.L. 97-425	Generally applicable environmental standards for high-level radioactive waste
12. Indoor Radon Abatement Act of 1988, 15 USC 2661-2671	Radon surveys, mitigation proficiency programs, training centers, assistance to States, public information
13. Clean Air Act as amended, 42 USC 7401 et seq (1990)	Airborne emissions of radionuclides
14. Waste Isolation Pilot Plant Land Withdrawal Act of 1992, Public Law 102-579	Oversight of DOE's activities at the Waste Isolation Pilot Plant
15. Energy Policy Act of 1992, Public Law 102-486	Radiation standards specifically for the Yucca Mountain, NV, site

16. Administrative Procedures Act, 5 USC 551-559, 701-706	Rulemaking procedures
17. Executive Order 10831, "Federal Compliance with Pollution Control Standards" (1959)	Federal guidance on radiation
18. Executive Order 12088, "Federal Compliance with Pollution Control Standards" (1978)	Extension of EPA standards to Federal activities
19. Executive Order 12148, "Federal Emergency Preparedness Management" (1979)	Radiological emergencies
	*The Office of Radiation and Indoor Air is not the lead office in these areas.

OFFICE ORGANIZATION AND FUNCTIONS

The Office of Radiation and Indoor Air is responsible to the Assistant Administrator for Air and Radiation. The Office develops protection criteria, standards, and policies; works with other regulatory programs within EPA and other agencies to control exposures to radiation and indoor air pollutants; provides technical assistance to states through EPA's regional offices and other agencies having radiation and indoor air protection programs; establishes and directs an environmental radiation monitoring program; evaluates and assesses the overall risk and impact of radiation and indoor air pollutants on the general public and the environment; and maintains liaison with other public and private organizations involved in environmental radiation and indoor air pollution protection activities. The Office also coordinates with and assists the Office of Enforcement and Compliance Monitoring in enforcement activities where EPA has jurisdiction.

To carry out its activities, the Office relies on a staff with diverse backgrounds including radiobiology, radiochemistry, epidemiology, health physics, physical sciences, oceanography, engineering, economics, law, and business administration. Staff are located in the Office's headquarters in Washington, DC, and in two field laboratories. In addition, each of EPA's 10 Regional offices has active radiation and indoor programs that work in concert with the Office of Radiation and Indoor Air.

Headquarters Office

The Office of Radiation and Indoor Air's Washington, DC, office is composed of the Director's office and four divisions: Criteria and Standards; Radiation Studies; Radon; and Indoor Air.

Office of the Director

The Office of the Director provides policy direction and management oversight to all components of the Office. In addition, it is responsible for the integration of headquarters, laboratory, and regional radiation and indoor air activities, relations with the Agency's Science Advisory Board and other scientific organizations, establishment and execution of the Office-wide Quality Assurance program, and maintenance of an effective working dialogue with the Conference of Radiation Control Program Directors, the national group representing state radiation control programs. The Program Management Office (PMO) is responsible for Office-wide strategy development, program planning and reporting, budget development and execution, and most facets of the Office's human resources programs. PMO also provides a full range of administrative and support services to the Office.

Criteria and Standards Division

The Criteria and Standards Division (CSD) formulates and recommends policies, criteria, and standards for protecting the environment and the public from ionizing radiation. Specific activities carried out by CSD include:

- developing guidance to protect people who are occupationally exposed to ionizing radiation;
- identifying and evaluating new radiation sources to determine the public health significance of sources of radiation exposures; and
- developing standards and guidance to protect the public and the environment from radiation exposure.

Radiation Studies Division

The Radiation Studies Division (RSD) is responsible for several aspects of the Agency's ionizing and nonionizing radiation programs. Responsibilities regarding ionizing radiation include:

- developing standards, guidance and criteria for cleaning up radioactively contaminated sites; and

- providing technical assistance and support to EPA's Office of Solid Waste and Emergency Response and other Federal agencies in their efforts to clean up radioactively contaminated sites. RSD's involvement with site cleanup may include: coordination, facilitation, development/identification of remediation technology, development of assessment tools, and other forms of technical assistance.

Technical functions regarding nonionizing radiation include:

- assessing health risks;
- assessing exposures;
- developing measurement protocols and measurement devices; and
- assessing mitigation techniques.

Nontechnical functions regarding nonionizing radiation include:

- collecting and disseminating data;
- communicating with the public;
- coordinating and facilitating between the government, industry, and the public; and
- evaluating societal impacts.

Radon Division

The Radon Division has been designated as the lead organization in developing, coordinating, and implementing the Agency's Radon Action Program. Under this program, the Agency addresses national and regional problems of indoor radon through an integrated effort to mitigate elevated radon levels in structures and to inform the public about radon. Radon Division activities include:

- identifying areas with high levels of radon in homes, schools, and workplaces; and determining the national distribution of radon levels and associated risks;
- developing mitigation and prevention technologies to reduce radon concentrations significantly in existing and new buildings;
- stimulating the development of state and private sector capabilities to assess radon problems in homes, and helping people to mitigate such problems; and
- working with states and the private sector to provide information to the public on radon, its risks, and what can be done to reduce those risks. The public can also get information on radon by calling the National Radon Hotline, 1-800-SOS-RADON.

Indoor Air Division

The Indoor Air Division coordinates research and develops and implements policies regarding the impact of indoor air pollutants on the general public. The main objectives of the Division are to:

- establish EPA policy by carrying out risk management studies of available data on exposure and health risks associated with indoor air pollution;
- implement a plan that reduces present levels of exposure;
- work with other regulatory programs within EPA and with other agencies to minimize risks associated with exposure to indoor contaminants; and
- educate the public about indoor air pollution and its associated health risks.

The Division is also the lead for interagency activities coordinated through the Committee for Indoor Air Quality (CIAQ), which has 21 Federal agencies on its roster.

Laboratories

The Office operates two laboratories, the National Air and Radiation Environmental Laboratory in Montgomery, Alabama, and the Las Vegas Facility in Nevada. These laboratories can conduct a wide variety of technical radiation activities, including

radiochemical analyses, radiation-contaminated site assessments, oversight of Superfund removal actions, radon/radon decay product measurements, emergency response, and electromagnetic field analyses.

National Air and Radiation Environmental Laboratory

The National Air and Radiation and Environmental Laboratory (NAREL), located in Montgomery, AL, conducts activities to support the Office's Headquarters components. NAREL provides technical support to headquarters; technical assistance to states, EPA Regional Offices, and other EPA Programs in their radiation-related activities; and special laboratory support to other government agencies as required.

The Laboratory provides the following services:

- Measurement and calibration for the Radon Action Program. NAREL operates three radon calibration chambers to evaluate instruments and methods for radon measurements, to assist states in preparing for their radon programs, and to provide known exposures for the Office's radon quality assurance program. NAREL also analyzes charcoal canister monitors for the Office's state survey program.

- Field and laboratory measurements to help the Office set appropriate environmental radioactivity standards and provide a basis for evaluating environmental radiation sources.

- Assessment of ambient radiation levels and levels resulting from nuclear accidents by operating the Environmental Radiation Ambient Monitoring System.

- Field measurements in emergency situations involving releases of radioactivity to the general environment. NAREL maintains two well-equipped vehicles, a mobile analytical laboratory and a communications unit, in a state of readiness to respond to accidental releases of radioactivity that pose potential danger to the population and the environment. NAREL's role in a typical response is to help states assess the environmental impact of an accident and to ensure public health.

- Evaluation and assessment of environmental radiation sources and their movement in environmental pathways through the development and validation of computer dose models.

- Special studies and programs in support of Superfund. NAREL has provided radio-analytical analyses for two Superfund sites and has been involved in evaluating innovative technologies for site remediation. In response to the growing problem of Superfund sites contaminated with radioactivity and mixed-waste, the NAREL has been designated a Superfund Technical Support Center (TSC). As a TSC, the laboratory provides specialized radiation-related assistance to Regional Superfund programs. This includes radiological monitoring and assessment of technologies for remediating radioactively contaminated sites. The laboratory also provides radiological and mixed-waste analytical support, health physics consultations, radiological site surveys and risk assessments, and radon measurements and associated quality assurance.

- Laboratory and field measurements of radiofrequency, power lines, and extremely low frequency radiation sources. Assess and make recommendations for exposure reduction.

Las Vegas Facility

The Las Vegas Facility (LVF) provides technical support for numerous radiation protection and control activities. The Facility conducts site investigations, radon assessments and evaluations, health assessment modeling, and indoor air studies. LVF also maintain an emergency response capability for radiation accidents and provide technical assistance to other EPA offices, states, and the private sector. LVF staff provides the following services:

- Evaluation and development of protocols for all types of existing and experimental radon

detection instruments. LVF operates three environmental radon chambers to support the Radon Action Program.

- Staff and mobile laboratory assistance to EPA's Superfund, Federal Facilities & RCRA programs. Conduct studies in radiation-contaminated areas and perform site-specific computer modeling and dose assessments.

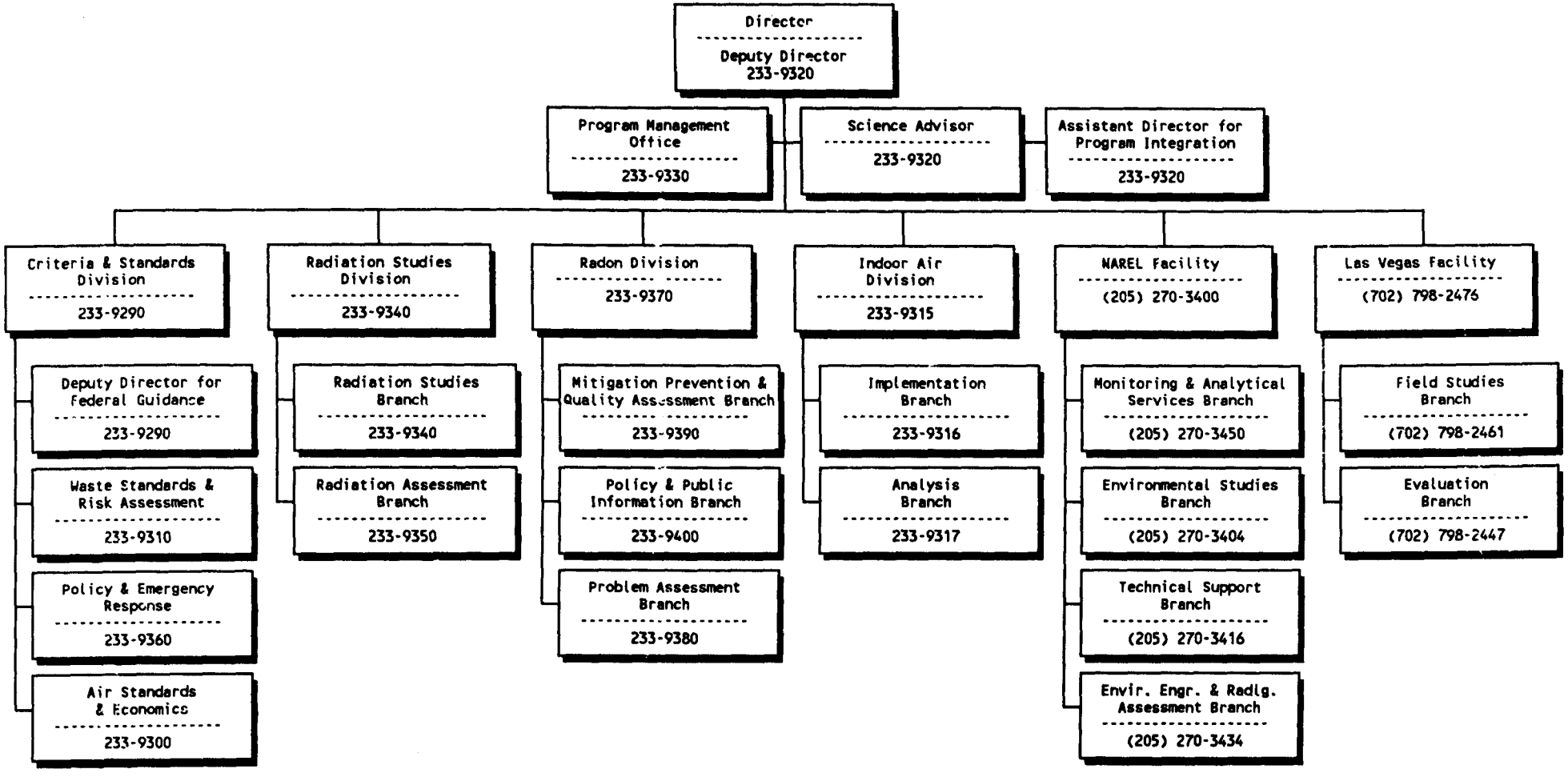
- Management, staff, and health physics expertise and field monitoring for all aspects of a radiological emergency response.

- Development of compliance software programs to support the Clean Air Act and Nuclear waste rulemaking. LVF also conducts dose and risk assessments and audits.

- Radiological technical assistance to EPA regions, state, and local governments including site assessments, environmental monitoring and restoration, and management of radioactive waste.

- Onsite studies of the quality of indoor air; and field evaluations and demonstrations focusing on innovative technology and mechanisms for improving indoor air quality and personal comfort.

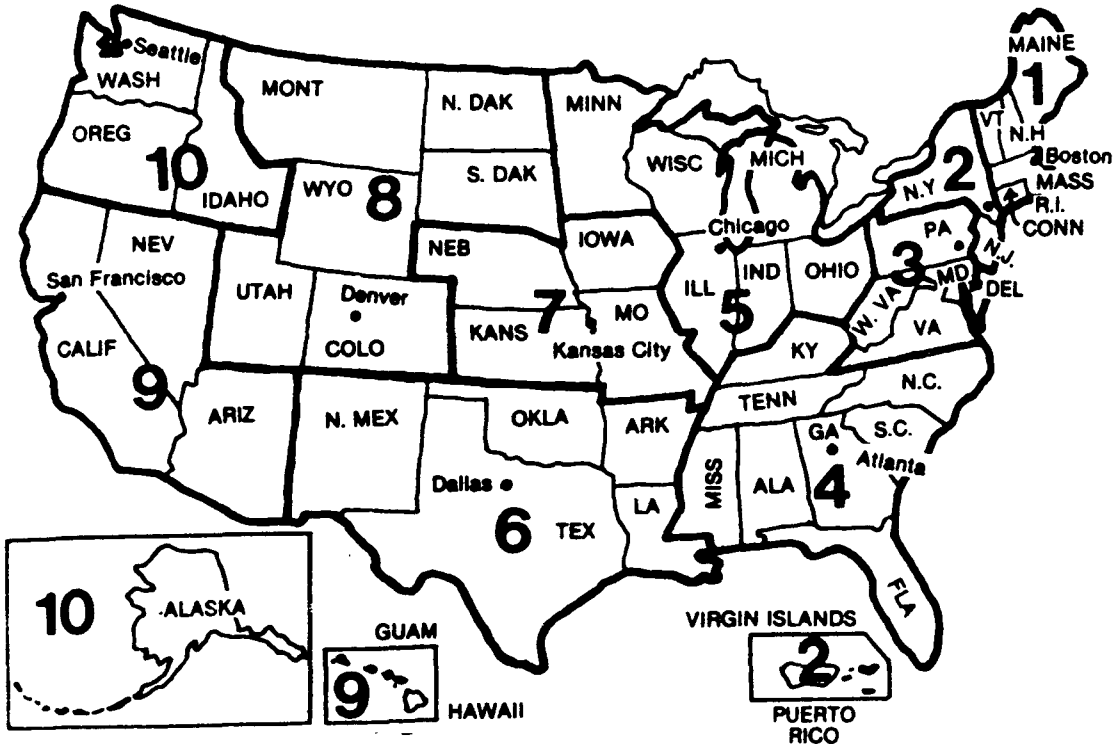
OFFICE OF RADIATION AND INDOOR AIR



Regional Offices

The Office also supports a regional complement, with staff located in each of the Agency's 10 regional offices. The regional staff bear principal responsibility for outreach activities with state and local programs in their respective areas, particularly for such subjects as radon and other indoor air problems, where there is strong public interest. In addition, the regional offices have a major role in the implementation program for the National Emission Standards for Hazardous Air Pollutants for radionuclides.

Radiation Program Managers and/or Radiation Representatives frequently serve on the Regional Advisory Committee (RAC) for radiation accidents, and are directly involved in the review and testing of nuclear response plans developed for nuclear facilities. The regional staff also participates in headquarters work groups, and serves as the advisor to the Agency's regional managers on radiation matters which are of interest or concern within the regions.



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