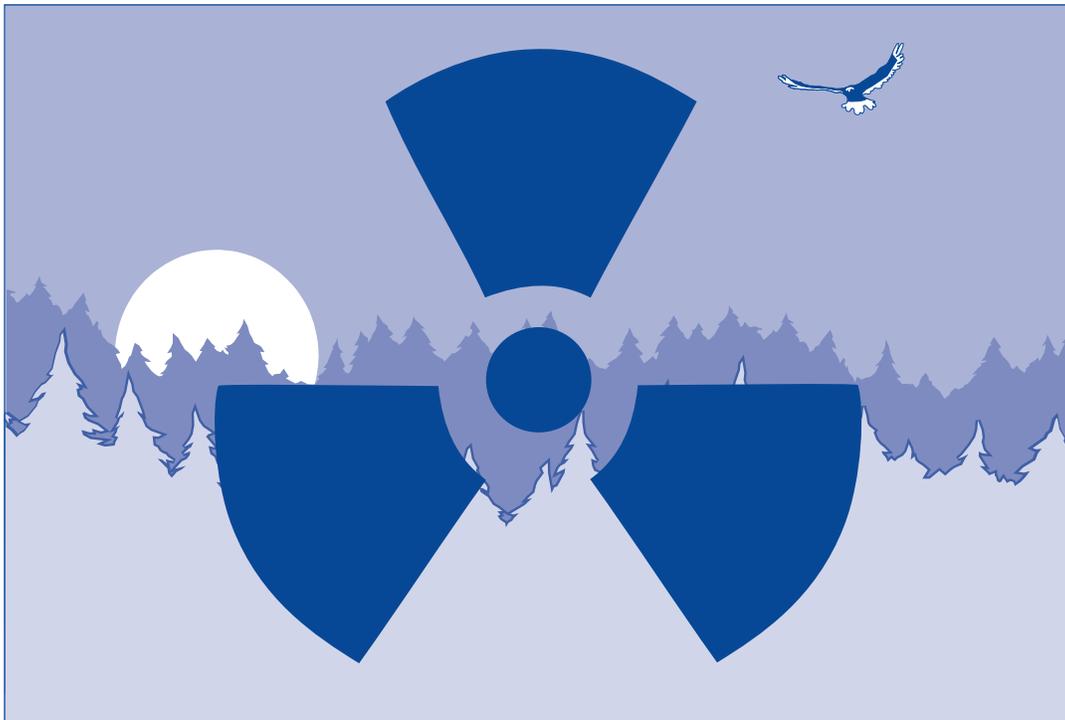




# Reference Guide

## Radiation Reference Guide: Relevant Organizations and Regulatory Terms



**December 1999**

Prepared by  
Interstate Technology and Regulatory Cooperation Work Group  
Radionuclide Work Team

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Established in 1995, the Interstate Technology & Regulatory Council (ITRC) is a state-led, national coalition of personnel from the environmental regulatory agencies of some 40 states and the District of Columbia; three federal agencies; tribes; and public and industry stakeholders. The organization is devoted to reducing barriers to, and speeding interstate deployment of, better, more cost-effective, innovative environmental techniques. ITRC operates as a committee of the Environmental Research Institute of the States (ERIS), a Section 501(c)(3) public charity that supports the Environmental Council of the States (ECOS) through its educational and research activities aimed at improving the environment in the United States and providing a forum for state environmental policy makers. More information about ITRC and its available products and services can be found on the Internet at [www.itrcweb.org](http://www.itrcweb.org).

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## **ACKNOWLEDGMENTS**

The members of the Interstate Technology and Regulatory Cooperation (ITRC) Radionuclide Work Team wish to acknowledge the individuals, organizations, and agencies that contributed to this Radiation Reference Guide.

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The Radionuclides Work Team also wishes to recognize the efforts of its participating members, both in the initial stages of document development and the final stages of review and completion. State regulatory representatives who participated in developing this document included Mr. Carl Spreng, Colorado Department of Public Health and Environment; Mr. Tom Schneider, Ohio Environmental Protection Agency; and Mr. Robert Jolley, Tennessee Department of Environment and Conservation. Technical and administrative support was provided by Dr. Smita Siddhanti, Ms. Michelle Brown, and Ms. Patricia Reyes of Booz-Allen & Hamilton Inc. We also wish to thank the organizations that made the expertise of these individuals available to the ITRC on this project. The following pages list members of the ITRC Radionuclide Team.

# ITRC RADIONUCLIDE TEAM

## Team Co-Leaders

### **Tom Schneider**

Ohio Environmental Protection Agency  
Ohio Office of Federal Facilities  
Oversight  
401 East 5<sup>th</sup> Street  
Dayton, OH 45402  
P (937) 285-6466  
F (937) 285-6404  
[Tom.schneider@epa.state.oh.us](mailto:Tom.schneider@epa.state.oh.us)

### **W. Carl Spreng**

Colorado Department of Public Health  
Environment  
Hazardous Materials & Waste  
Management Division  
4300 Cherry Creek Drive South,  
HMWMD-B2  
Denver, CO 80246-1530  
P (303) 692-3358  
F (303) 759-5355  
[Carl.spreng@state.co.us](mailto:Carl.spreng@state.co.us)

## Team Members

### **Gary Ballew**

Environmental Technology Application  
Pacific Rim Enterprise Center  
660 George Washington Way, Suite B  
Richland, WA 99352  
P (509) 946-0611  
F (509) 943-8431  
[Gballew@owt.com](mailto:Gballew@owt.com)

### **Craig DeRemer**

Office of Environmental Management  
US Department of Energy  
1000 Independence Ave., SW  
Room 5A-014  
Washington, DC 20585  
P (586-7946  
F (202) 586-9732  
[Craig.deremer@em.doe.gov](mailto:Craig.deremer@em.doe.gov)

### **Karen Beckley**

Nevada Department of Conservation &  
Natural Resources  
Division of Environmental Protection  
333 West Nye Lane  
Carson City, NV 89706-0866  
P (775) 687-4670, ext. 3033  
F (775) 687-6396  
[Kbeckley@ndep.carson-city.nv.us](mailto:Kbeckley@ndep.carson-city.nv.us)

### **Dibakar (Dib) Goswami**

Washington State Department of Ecology  
1315 W. 4<sup>th</sup> Ave.  
Kennewick, WA 99336  
[Dgos461@ecy.wa.gov](mailto:Dgos461@ecy.wa.gov)

### **Robert Jolley**

Tennessee Department of Environment &  
Conservation  
761 Emory Valley Road  
Oak Ridge, TN 37830  
P (423) 481-0995  
F (423) 482-1835  
[Rjolley@mail.state.tn.us](mailto:Rjolley@mail.state.tn.us)

### **Victor Holm**

8795 West Cornell Avenue, #2  
Lakewood, CO 80227  
P (303) 989-9086  
F (303) 989-9076  
[Vholm@aol.com](mailto:Vholm@aol.com)

**Wade Waters**

P.O. Box 622  
Pooler, GA 3122  
P (912) 748-7909  
F (912) 748-1060  
[wwater258@aol.com](mailto:wwater258@aol.com)

**Levon Benally**

Navajo EPA/Superfund  
P.O. Box 2946  
Window Rock, AZ 86515  
P (520) 871-6859  
F (520) 871-7333  
[Navajos@cia-g.com](mailto:Navajos@cia-g.com)

Radionuclides Team E-mail  
List Server Address  
[Radteam@geoview.epa.state.oh.us](mailto:Radteam@geoview.epa.state.oh.us)

**Jonathan McInnis**

South Carolina Department of Health &  
Environmental Control  
Bureau of Land & Waste Management  
2600 Bull Street  
Columbia, SC 29201  
P (803) 896-4061  
F (803) 896-4001  
[mcinnijg@columb34.dhec.state.sc.us](mailto:mcinnijg@columb34.dhec.state.sc.us)

**Kathleen Trever**

State INEEL Oversight Program  
1410 N. Hilton  
Boise, ID 83706  
P (208) 373-0498  
F (208) 373-0429  
[ktrever@deq.state.id.us](mailto:ktrever@deq.state.id.us)

## Contractor Support

**Dr. Smita Siddhanti**

Booz-Allen & Hamilton Inc.  
8283 Greensboro Drive  
McLean, VA 22102  
P (703) 917-2447  
F (703) 902-3613  
[Siddhanti\\_Smita@bah.com](mailto:Siddhanti_Smita@bah.com)

**Michelle Brown**

Booz-Allen & Hamilton Inc.  
8283 Greensboro Drive  
McLean, VA 22102  
P (703) 902-5838  
F (703) 902-3613  
[Brown\\_michelle@bah.com](mailto:Brown_michelle@bah.com)

**Patricia Reyes**

Booz-Allen & Hamilton Inc.  
8283 Greensboro Drive  
McLean, VA 22102  
P (703) 917-2447  
F (703) 902-3613  
[Reyes\\_Patricia@bah.com](mailto:Reyes_Patricia@bah.com)

## EXECUTIVE SUMMARY

This Radiation Reference Guide was written by the Interstate Technology and Regulatory Cooperation (ITRC) Radionuclides Work Team. The purpose of the guide is to provide easy access to information pertinent to organizations, activities and technical terminology related to radioactive contamination. The ITRC Radionuclide Work Team recognizes that State managers and regulators fulfill numerous technical, management and regulatory responsibilities, all driven by the goal of making careful decisions about site response actions. These decisions are particularly challenging when dealing with the complexity of radioactive contamination. Regulators have the responsibility of managing the radioactive waste on their sites, regulating the operations at the sites, selecting efficient technologies, and coordinating with various other agencies, organizations and stakeholder groups. This Radiation Reference Guide is designed to assist ITRC regulators and State managers in familiarizing themselves with other organizations dealing with radionuclide contamination/waste management and understanding the basic terminology used in the radionuclide regulatory arena.

The Radiation Reference Guide is divided into two sections. The first Section is the *Catalog of Radionuclide-Related Organizations* and the second Section is the *Glossary of Basic Radiation Regulatory Terms*.

There are numerous organizations whose activities relate to radionuclide contamination, and radioactive and mixed-waste management. For the specific purpose of forming partnerships, identifying resources increasing stakeholder participation, understanding other organizations with related or similar activities, and sharing innovative technologies, Section 1.0 consolidates relevant information about these organizations. The catalog provides a brief description of the mission, pertinent activities, and contact information for organizations actively involved in radioactive contamination at all levels of government. The catalog is organized into the following subsections:

- *Local Organizations* include groups that are local, independent, and non-partisan, such as the local Citizens Advisory Boards (CAB) and non-profit groups.
- *State Organizations* include radioactive waste regulatory programs run by regional compacts and commissions and individual State governments. These also include State organizations that operate on a nationwide basis.
- *Federal Organizations* include programs or government agencies that provide policy implementation, guidance, technical oversight and regulatory authority on the nation's radioactive waste issues.
- *National Organizations* include national non-profit organizations whose main goal is to raise public consciousness and awareness concerning the environmental impact of radioactive waste, disposal and storage.
- *International Organizations* are those with an international membership. These organizations provide guidance on international radiation issues, or provide expertise and unique insight on the major issues relating to international radioactive waste management. They also disseminate information to their member countries and collaborate with other national and federal organizations.

The purpose of Section 2.0 is to consolidate pertinent regulatory and basic technical terms and acronyms used in the radioactive waste management field to be used as a handy reference tool.

Most of these terms have been extracted from existing glossary sources. For convenience, these terms have been grouped by usage or source into the following subgroups:

- Basic Radionuclide terms - commonly used in the ionizing radiation field and also those used in health physics and exposure/risk assessment;
- NRC/DOE regulatory terms - related to the Atomic Energy Act (AEA) and the Department of Energy;
- EPA regulatory terms - relating to Environmental Protection Agency activities; and,
- DOT regulatory terms - specific to regulations relating to transportation of radioactive materials.

To complement the basic terminology summarized in this Guide, Appendix A includes useful information related to radiological units and their common conversions, Standard International (SI) prefixes, and basic information on some common radionuclides. Appendix B includes a bibliography of pertinent technical and regulatory documents that are referenced in Section 2.0, and are useful for the activities of ITRC Radionuclide Work Team. Appendix C includes additional information about ITRC Work Team Contacts, ITRC Fact Sheet, ITRC Product List, and a Document Evaluation Survey form.

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## **CATALOG OF RADIONUCLIDE-RELATED ORGANIZATIONS**

# CATALOG OF RADIONUCLIDE-RELATED ORGANIZATIONS AND ACTIVITIES

## 1.1 INTRODUCTION

There are numerous organizations whose activities relate to radionuclide contamination, and radioactive and mixed-waste management. Since many of these organizations' activities could be overlapping or complimentary to those of the State managers and environmental regulators, it is important to know who these organizations are and what they do. For the specific purpose of forming partnerships, identifying resources, increasing stakeholder participation, understanding other organizations with related or similar activities, and sharing innovative technologies, this catalog consolidates relevant information about many of these organizations. Although this catalog is an attempt to be comprehensive, some organizations have not been included because of the lack of available information.

This Section provides brief description of the mission, pertinent activities, and contact information for organizations actively involved in the radiation waste management at the local, State, federal, national and international level.

## 1.2 LOCAL ORGANIZATIONS

### **BERKELEY CENTER FOR NUCLEAR AND TOXIC WASTE MANAGEMENT (CNTWM)**

The Berkeley CNTWM was established in 1993, bringing together experts from many disciplines to address the issues surrounding nuclear and toxic waste management. The premise of their activities is that decisions leading to effective solutions for nuclear and toxic waste management problems require the simultaneous consideration of a broad set of technical and non-technical issues.

The Berkeley CNTWN is attempting to assemble expertise from different disciplines in a common location. The idea is to go beyond complementing expertise from one discipline with another. CNTWN strives to have the engineers start thinking the way social scientists analyze problems and have social scientists incorporate engineering methods in addressing the same issues.

The Berkeley CNTWM has participants from several departments on the University of California, Berkeley campus as well as participants from the Lawrence Berkeley Laboratory, the Lawrence Livermore National Laboratory (LANL) and private organizations.

Current projects include:

- Nuclear Materials Stewardship,
- Narrative Analysis of the Debate over Shipment of Research Reactor Fuel through the Concord Naval Weapons Shipyard,

- Design for Regulatory Transparency at LANL,
- Regulatory and Technical Dimensions of Decommissioning Nuclear Facilities.

**CONTACT:**

The Center for Nuclear and Toxic Waste Management  
Etcheverry Hall, MC-1730  
University of California at Berkeley  
Berkeley, CA 94720-1730  
Phone: (510) 642-1480  
Fax: (510) 643-9685  
Web address: <http://www.nuc.berkeley.edu/cnwm/index.html>

**FERNALD CITIZENS ADVISORY BOARD (FCAB)**

The FCAB -- DOE's site-specific advisory board composed of Fernald Environmental Management Project (FEMP) community leaders from key stakeholder groups -- was created to help guide FEMP cleanup activities. Representatives of constituencies affected by cleanup decisions, including local residents, governments, businesses and labor organizations, comprise the advisory board membership. In July 1995, after months of careful study, the FCAB issued its final report to DOE. The FCAB provided DOE with recommendations on remedial action priorities, cleanup levels, waste disposition alternatives, and future uses for the FEMP property after remediation is completed. The board continues to advise DOE on remediation, stewardship and transportation issues.

**CONTACT:**

Fluor Daniel Fernald Liaison  
Phoenix Environmental Corp.  
6186 Old Franconia Rd.  
Alexandria, VA 22310  
Phone: (513) 648-6478  
Fax: (513) 648-3629  
Phone: (703) 971-0030 (Alexandria, VA office)  
Fax: (703) 971-0006  
E-mail: [webmaster@fernald.gov](mailto:webmaster@fernald.gov)  
Web address: <http://www.fernald.gov/stakeholders/CitizensAdvisoryBoard/taskforc.htm>

**HANFORD ADVISORY BOARD (HAB)**

The HAB is an independent, non-partisan, and broadly representative body consisting of a balanced mix of the diverse interests that are affected by Hanford cleanup issues. As set forth in its charter, the primary mission of the Board is to provide informed recommendations and advice to the U.S. Department of Energy (DOE), the US Environmental Protection Agency (EPA), and the Washington Department of Ecology (Ecology), on selected major policy issues that are related to the cleanup of the Hanford site.

The goal of the HAB is to develop consensus policy recommendations and advice. When this is not possible, the HAB will convey its recommendations and advice in a manner that communicates the points of view expressed by all HAB members.

The HAB is intended to be an integral component for some Hanford tribal and general public involvement activities, but not to be the sole conduit for those activities. The HAB assists the agencies in focusing public involvement and makes efficient use of HAB member's time and energy. Through its open public meetings, advice on agency public involvement activities, and the responsibilities of HAB members to communicate with their constituencies, the HAB assists the broader public in becoming more informed and meaningfully involved in Hanford cleanup decisions. HAB committees include: Dollars and Sense; Environmental Restoration; Health, Safety & Waste Management; and the Executive Committee.

CONTACT:

U.S. Department of Energy  
P.O. Box 550, MSIN A7-75  
Richland, WA 99352  
Phone: (509) 372-4016  
Fax: (509) 376-1563

or

U.S. Environmental Protection Agency  
712 Swift Boulevard, Suite 5  
MSIN B5-01  
Richland, WA 99352  
Phone: (509) 376-8631  
Fax: (509) 376-2396

or

Washington Department of Ecology  
P.O. Box 47600  
Olympia, WA 98504  
Phone: (360) 407-7118  
Fax: (360) 407-7151  
E-mail: [Hanford\\_Advisory\\_Board@rl.gov](mailto:Hanford_Advisory_Board@rl.gov)  
Web address: <http://www.hanford.gov/boards/hab/index.htm>

### **HANFORD SITE TECHNOLOGY COORDINATION GROUP (STCG)**

The vision of the Hanford STCG is to be an effective decision-making body and a strong, unified voice for technology activities that affect the Hanford Site. The STCG's main role is to identify, prioritize, and communicate site technology needs to the four U.S. Department of Energy (DOE) Focus Area Teams: High-Level Waste Tank Remediation; Subsurface Contamination; Mixed Waste Characterization, Treatment, and Disposal; and Facility Transitioning, Decommissioning, and Final Disposition. The STCG provides an essential link between technology providers and technology users, as well as a mechanism for regulator and stakeholder input to the site technology planning process. Timely and cost-effective demonstration and implementation of technologies for site cleanup is a primary objective of the STCG.

The Hanford STCG has two tiers. The first tier is the *Management Council*, which is chaired by the DOE-RL Deputy Manager and consists of 16 voting members representing DOE-RL, the Washington State Department of Ecology, the Environmental Protection Agency, the Hanford Advisory Board, the Yakima Indian Nation, the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, and the State of Oregon. It also includes five ex-officio members

that represent Battelle Memorial Institute, Bechtel Hanford, Inc., Fluor Daniel Hanford, and the Pacific Rim Enterprises Center.

The second tier includes *four subgroups*:

1. The *Tanks subgroup* focuses on characterization, treatment, retrieval and closure of Hanford's underground radioactive waste tanks.
2. The *Subsurface Contamination* subgroup focuses on detection, characterization, containment, and remediation of hazardous and radioactive contaminants in soil and groundwater, as well as landfill stabilization.
3. The *Mixed Waste subgroup* focuses on management, characterization, treatment, and disposal of Hanford's contact and remote handled low-level, mixed and transuranic waste.
4. The *Decontamination & Decommissioning subgroup* focuses on deactivation, and D&D of Hanford Site facilities including reactors, processing facilities, fuel storage pools, and laboratories contaminated with radionuclides and hazardous materials.

**CONTACT:**

U.S. Department of Energy  
P.O. Box 550, MSIN A7-75  
Richland, WA 99352  
Phone: (509) 372-4084

**IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY  
CITIZENS ADVISORY BOARD (INEEL CAB)**

The INEEL CAB is a nonpartisan, broadly representative organization of independent citizens with concerns related to INEEL activities. The INEEL CAB is a federally chartered advisory board composed of 15 Board members from the State of Idaho. It is dedicated to providing informed recommendations and advice to the Department of Energy Idaho Operations Office, Environmental Protection Agency Region 10, and the State of Idaho, regarding the full scope of INEEL issues. These issues include environmental restoration, waste management and economic aspects.

**CONTACT:**

INEEL CAB  
C/o Jason Associates  
477 Shoup Ave., Suite 205  
Idaho Falls, ID 83402  
Phone: (208) 522-1662 x3028 or 1-800-320-1662  
Board Fax: (208) 522-2531  
Fax: (208) 522-2076  
Web address: <http://www.ida.net/users/cab/>

**NEW MEXICO ENVIRONMENTAL EVALUATION GROUP (EEG)**

The purpose of the New Mexico Environmental Evaluation Group (EEG) is to conduct an independent technical evaluation of the Waste Isolation Pilot Plant (WIPP) project to ensure protection of the public health, safety, and the environment. The EEG has also been measuring background radioactivity in the air, water, and soil around the WIPP site and in surrounding communities since 1985.

The EEG was established in 1979 with funds provided by the U.S. Department of Energy (DOE) to the State of New Mexico. Public Law 100-456, the National Defense Authorization Act, Fiscal Year 1989, Section 1433, assigned EEG to the New Mexico Institute of Mining and Technology and continued the original contract through DOE. The 1991 New Mexico Statutes Annotated Section 74-4A-4c affirms the EEG's role to conduct the independent technical evaluation of the WIPP. Public Law 102-579, Waste Isolation Pilot Plant Land Withdrawal Act (1992) required DOE to consult and cooperate with the EEG. The National Defense Authorization Act of Fiscal Year 1994, Public Law 103-160 continues the authorization.

CONTACT:

EEG

7007 Wyoming Blvd. NE, Suite F-2

Albuquerque, NM 87109

Phone: (505) 828-1003

Fax: (505) 828-1062

E-mail: [druck@eeg.org](mailto:druck@eeg.org)

Web address: [http://www.rt66.com/~eeg/home\\_frames.htm](http://www.rt66.com/~eeg/home_frames.htm)

### **NORTHERN NEW MEXICO CITIZENS ADVISORY BOARD (NNMCAB)**

The original NNMCAB was created in the fall of 1995 and was reorganized in mid-1998. Its function is to ensure that decisions related to environmental cleanup and waste management at Los Alamos National Laboratory (LANL) include informed advice from the community. A diverse group of 17 individuals currently serve on the Board. Three Native American pueblo communities, San Ildefonso Pueblo, Picuris Pueblo and San Juan Pueblo, immediately surround LANL and are affected by activities at the site. A representative from each community serves on the Board.

During its early stages, the NNMCAB established an Issues Committee to help prioritize the issues to be addressed by the Board. At the time, the Board agreed to form the following standing committees: Environmental Remediation/Waste Management; Science Education and Public Participation; Alternative Energy; and Economic Development. NNMCAB also has an Executive Committee, which deals with matters relating to functions of the Board.

CONTACT:

Phone: (505) 665-5048

Fax: (505) 665-4872

E-mail: [staff@nnmcab.org](mailto:staff@nnmcab.org)

Web address: <http://www.nnmcab.org/>

### **NEVADA TEST SITE COMMUNITY ADVISORY BOARD (NTS CAB)**

The CAB for NTS Programs is a formal group of volunteer, independent, nonpartisan citizens and ex-officio members formed in 1994. These members are organized and dedicated to providing informed recommendations and advice to the Department of Energy (DOE) on policy, technical issues and decisions related to cleanup and waste management activities at the NTS. The CAB meetings are open to the public and public participation is encouraged.

The Board has numerous working committees that are responsible for in-depth study of cleanup and waste issues and providing position recommendations to the Board. The committees

welcome participation from interested persons, and they meet for a few hours at least once a month. Some of the issues the CAB work on include: site-specific cleanup criteria, risk assessment, land use, priority setting, management effectiveness, cost/benefit analyses, and strategies for site waste management and disposal facilities.

**CONTACT:**

Department of Energy  
Nevada Support Facility  
2437 Losee Road  
North Las Vegas, NV 89030  
Phone: (702) 633-5300  
Fax (702) 633-5200  
Web address: <http://www.unlv.edu/Colleges/Urban/cab/cabmain.htm>

**OAK RIDGE RESERVATION ENVIRONMENTAL MANAGEMENT SITE SPECIFIC ADVISORY BOARD (ORREMSSAB)**

The ORREMSSAB is a nonpartisan, broadly representative group of citizens with interests and concerns related to the environment at the Oak Ridge Reservation and surrounding areas. The ORREMSSAB is dedicated to providing informed recommendations and advice to the Department of Energy regarding environmental restoration; waste management; future land use, and economic development of specified areas. Consequently, recommendations concerning environmental health, environmental justice, and safety issues may be included, as well as other subjects the ORREMSSAB determines to be appropriate. The ORREMSSAB is also committed to serving as a communications link between the public and the relevant government agencies.

**CONTACT:**

Chairperson, ORREMSSAB  
Department of Energy  
P.O. Box 2001, EM-90  
Oak Ridge, TN 37831  
Phone: (423) 241-3665  
Fax: (423) 576-5333  
Phone: (423) 483-6831  
Fax: (423)483-1372  
Web address: <http://www.oakridge.doe.gov/em/ssab/>

**PADUCAH GASEOUS DIFFUSION PLANT SITE SPECIFIC ADVISORY BOARD (SSAB)**

The Paducah Gaseous Diffusion Plant SSAB was formally chartered in August 1996. Currently there are eleven Citizen Board members and four ex-officio members' service on the SSAB. Its members represent broad categories of citizens in the area such as public officials, plant employees, environmental activists, ministers, health care workers, union representatives, teachers, and site neighbors. The Board has three committees: Budget, Membership, and Policy.

The purpose of the Board is to make recommendations to DOE and its regulators in the areas of environmental restoration and waste management activities. Some of the major issues the Board will review and make recommendations on in the near future include groundwater contamination, and the approximately 35,000 cylinders of depleted uranium located onsite.

**CONTACT:**

Paducah Gaseous Diffusion Plant  
Site Specific Advisory Board Coordinator  
Department of Energy  
Paducah Site Office,  
Post Office Box 1410, MS-103  
Paducah, Kentucky 42001  
Phone: (502) 441-6804  
Web Address: <http://www.doe.gov/>

**PANTEX PLANT CITIZENS' ADVISORY BOARD (PPCAB)**

The PPCAB is an independent body consisting of a balance of diverse interests affected by Pantex Plant activities. The primary mission of the PPCAB is to provide informed recommendations and advice to the DOE concerning the health, safety, environmental, and waste management aspects of all past, present, and future Pantex activities, including associated costs and benefits.

The PPCAB advises the DOE, as well as other federal, State and local participating and enforcement agencies. Additional functions include but are not limited to the following:

- identifying community concerns and providing an additional avenue for the public to make their concerns and questions known to the appropriate agencies.
- providing appropriate means to inform the community about PPCAB activities; develop procedures to disseminate information, report to the public, and promote their involvement.
- serving the need or public involvement by calling on the DOE, the Environmental Protection Agency, or other appropriate entities to conduct public information meetings and/or hearings which the PPCAB deems relevant.

**CONTACT:**

724 S. Polk, Suite 300  
Amarillo, Texas 79101  
Phone: (806) 372-3311  
Fax: (806) 372-3999  
Web address: <http://www.ppcab.org/>

**ROCKY FLATS CITIZENS ADVISORY BOARD (RFCAB)**

The Rocky Flats CAB was formed in 1993 to provide informed, community-based recommendations on the cleanup of Rocky Flats. The Board is comprised of up to 30 individuals representing a diversity of views and interests from the community around Rocky Flats. Each year the Board develops a work plan that includes a prioritized list of issues it will address.

The RFCAB recommendations are presented to the Department of Energy, the Colorado Department of Public Health and Environment and the Environmental Protection Agency. The agencies consider this advice as part of their decision-making process. Once they make a decision on a particular issue, the agencies are expected to explain how the Board's advice was incorporated, or why it was not.

The RFCAB meets once a month. These meetings are open to the public and there is time reserved for public comment. Also, anyone interested in the cleanup of Rocky Flats may apply to become a Board member. The RFCAB also publishes a quarterly newsletter that shares information about Rocky Flats cleanup as well as activities of the RFCAB.

**CONTACT:**

Rocky Flats Citizens Advisory Board  
9035 Wadsworth Parkway, Suite 2250  
Westminster, CO 80021  
Phone: (303) 420-7855  
Fax: (303) 420-7579  
E-mail: [rfcab@indra.com](mailto:rfcab@indra.com)  
Web address: <http://www.indra.com/rfcab/>

### **SANDIA NATIONAL LABORATORY CITIZENS ADVISORY BOARD (SNL CAB)**

The purpose of the SNL CAB is to advise and recommend options for all environmental management programs, such as environmental restoration, disposal facilities, and waste management. Such advice also includes criteria for specific site clean-up, risk assessment, cost/benefit analyses, present and future land use, the setting of priorities and strategies, budget and planning, etc.

Some current issues are:

- No Further Action Requests
- Mixed Low-level Waste Disposition
- Risk Assessment
- Low-level Waste Disposition

Board membership reflects a diversity of interest and views of the community and region with a balance of viewpoints. Membership is open to all interested stakeholders as individuals or from neighborhood associations, labor organizations, environmental and civic groups and educational institutions, or from local, State, and all other governments including Indian tribes.

**CONTACT:**

Citizens Advisory Board  
Sandia National Laboratories/DOE  
8338A Comanche Rd. NE  
Albuquerque, NM 87110  
E-mail: [admin@abqcab.com](mailto:admin@abqcab.com)  
Web address: <http://www.abqcab.com/>

### **SAVANNAH RIVER SITE CITIZENS ADVISORY BOARD (SRS CAB)**

The SRS CAB was formed in 1993 and is composed of 25 individuals from South Carolina and Georgia. Chosen by an independent panel of citizens from approximately 250 applicants, the board members reflect the cultural diversity of the population affected by Savannah River Site.

The members, who serve two- or three-year terms, are from the business, academia, local government, environmental and special interest groups, and the general public. Two of the members specifically represent economically disadvantaged persons. The Board provides advice

and recommendations to the U. S. Department of Energy, the U. S. Environmental Protection Agency Region IV, and the South Carolina Department of Health and Environmental Control on environmental remediation, waste management and related issues. Recently, the Board has formed the following four issues-based subcommittees:

- Environmental Remediation & Waste Management
- Nuclear Materials Management
- Risk Management and Future Use
- Public Outreach

**CONTACTS:**

Westinghouse Savannah River Company Support Personnel, Board Administrator  
Building 742-A, Room 190  
Savannah River Site  
Aiken, SC 29808  
Phone: (803) 725-9668  
Phone: 1(800) 249-8155  
Fax (803) 725-8057

or

Manager, Public Involvement  
Building 703-A, Room 141  
Savannah River Site  
Aiken, SC 29808  
Phone: (803) 725-2272  
Fax: (803) 725-4023  
E-mail: [mary.flora@srs.gov](mailto:mary.flora@srs.gov)

or

Nuclear Materials Management (NMM)  
Building 742-A, Room 185  
Savannah River Site  
Aiken, SC 29803  
Phone: (803) 725-7169  
E-mail: [donna.martin@srs.gov](mailto:donna.martin@srs.gov)  
Web address: <http://www.srs.gov/general/people/srs-cab/srs-cab.html>

### **TEXAS RADIATION ADVISORY BOARD (TRAB)**

The TRAB members, appointed by the Governor with confirmation by the Senate, are the State's advisors on all radiation issues. The Health and Safety Code, Chapter 401, describes the board's purpose and mission. The advisory board shall:

- review and evaluate State radiation policies and programs;
- make recommendations and furnish technical advice that may be required on matters relating to development, use, and regulation to the department, the Texas Natural Resource Conservation Commission, the Railroad Commission of Texas, and other State agencies; and
- review proposed rules and guidelines of the department, the Texas Natural Resource Conservation Commission, the Railroad Commission of Texas, and other State agencies

relating to regulation of sources of radiation and recommend changes in proposed or existing rules and guidelines relating to uses of radiation.

The board holds meetings to review the rules and guides the programs of the agencies that regulate radiation. Board members participate in hearings by providing expert testimony. They make recommendations about various issues and provide those to the agencies, the legislature and the Governor. Board members also visit facilities in Texas to review pertinent radiation issues.

**CONTACT:**

TRAB

1100 W. 49th St.

Austin, TX 78756

Phone: (512) 834-6688

Fax: (512) 834-6708

Web address: <http://www.tdh.state.tx.us/ech/rad/pages/page12.htm>

## **1.3 STATE ORGANIZATIONS**

### **1.3.1 COMPACTS**

Congress has made each State responsible for providing for the availability of capacity, either within or outside its borders, for disposal of low-level radioactive waste generated within its borders (except for waste generated as a result of atomic energy defense activities of the federal government). This Congressional declaration is defined in the Low-Level Radioactive Waste Policy Act (P.L. 96-573). A Compact is an agreement between the States of a particular region that provides for the cooperative and safe disposal of commercial low-level radioactive waste. Some Compacts have also established a governing body called Commissions.

#### **APPALACHIAN COMPACT**

##### **APPALACHIAN STATES LOW-LEVEL RADIOACTIVE WASTE COMMISSION**

In 1986, Maryland ratified the Appalachian States Low-Level Radioactive Waste Compact (Chapter 33, Acts of 1986). Delaware, Pennsylvania and West Virginia also have ratified the Compact. The Compact established the Appalachian States Low-Level Radioactive Waste Commission to assure interstate cooperation for the proper packaging and transportation of low-level radioactive wastes. The Commission identifies a host State (based on the volume and curie content of radioactive waste generated) to receive and dispose of radioactive waste from party States. Costs and benefits are distributed equitably among party States. After establishment of a regional facility, the Commission may ban wastes generated outside the region.

The Commission conducts research and establishes regulations to reduce the volume of low-level radioactive waste. The Commission also prepares contingency plans in the event the regional facility is closed; collects fees from party States until the regional facility becomes available; and enters into temporary agreements for emergency disposal.

#### **CONTACT:**

Waste Management Administration

MD Dept. of the Environment

2500 Broening Highway

Baltimore, MD 21224

Phone: (410) 631-3441

E-mail: [ggietka@mde.state.md.us](mailto:ggietka@mde.state.md.us)

Web address: <http://www.mdarchives.state.md.us/msa/mdmanual/38inters/html/02aps.html>

#### **CENTRAL COMPACT**

##### **CENTRAL INTERSTATE LOW-LEVEL RADIOACTIVE WASTE COMMISSION**

##### **(CILLRWC)**

The Central Interstate Low-Level Radioactive Waste Commission is the governing body for the Central Interstate Low-Level Radioactive Waste Disposal Compact, consisting of Arkansas, Kansas, Louisiana, Nebraska, and Oklahoma.

The purpose and objectives of the Commission are:

- to carry out the mandate of the CILLRW Compact by providing for and encouraging the safe and economical management of CILLRW within the five-state Compact region;
- to provide a framework for a cooperative effort to promote the health, safety, and welfare of the citizens and the environment of the Compact region;
- to select the necessary regional facilities to accept compatible wastes generated in and from party States, and meeting the requirements of the Compact, giving each party State the right to have the wastes generated within its borders properly managed at such regional facilities;
- to take whatever action is necessary to encourage the reduction of waste generated within the Compact region; and
- to faithfully and diligently perform its duties and powers as are granted by the Compact.

**CONTACT:**

Central Interstate LLRW Commission  
1033 "O" Street, Suite 416  
Lincoln, NE 68508  
Phone: (402) 476-8247  
Fax: (402) 476-8205  
Web address: <http://cillrwcc.org/>

or

Director  
Host State Office  
Nebraska Department of Environmental Quality  
P.O. Box 98922  
Lincoln, NE 68509-8972  
Phone: (402) 471-4231  
Fax: (402) 471-2909

**CENTRAL MIDWEST COMPACT**  
**CENTRAL MIDWEST INTERSTATE LOW-LEVEL RADIOACTIVE WASTE**  
**COMMISSION (CMWILLRWC)**

The Central Midwest Interstate Low-Level Radioactive Waste Compact is an agreement between the States Illinois and Kentucky. According to the Central Midwest Radioactive Waste Compact Act [45 ILCS 140/0.01 - 140/1], effective September 7, 1984 the Compact was created and established the Central Midwest Interstate Low-Level Radioactive Waste Commission. The purpose of the Commission is to:

- adopt a regional management plan for the management of waste generated within the region;
- designate a party State as a host State and with the approval of the General Assembly;
- enter into agreements regarding the use of regional facilities;
- enter into agreements for the import of waste for disposal at a regional facility (so long as the host has so authorized by law); and
- submit an annual report to provide an update of the status of the Commission's activities.

**CONTACT:**

704 Stratton Office Building  
Springfield, Illinois 62706  
Phone: (217) 524-5511  
Fax: (217) 524-2220  
Web address: <http://www.state.il.us/idns/lawsregs/statutes/cmcc.htm>

**MIDWEST COMPACT****MIDWEST INTERSTATE LOW-LEVEL RADIOACTIVE WASTE COMPACT COMMISSION**

The Midwest Interstate Low-Level Radioactive Waste Compact is an agreement between the States of Indiana, Iowa, Minnesota, Missouri, Ohio, and Wisconsin that provides for the cooperative and safe disposal of commercial low-level radioactive waste. The Compact was enacted into law by each member State legislature during the period from 1982 through 1984.

The Midwest Interstate Low-Level Radioactive Waste Compact Commission (the Commission) is the administrative body of the Compact. It consists of one voting Commissioner from each of the six member States. Each State determines how it will appoint its Commissioner, and the State's Governor must provide written notification to the Commission of the appointment of a Commissioner and any Alternate Commissioners.

**CONTACT:**

Indiana Alternate Commissioner  
Office of Solid and Hazardous Waste, Department of Environmental Management  
100 N. Senate Avenue, Suite 1154  
Indianapolis, IN 46204  
Phone: (317) 232-8892  
Web address: <http://www.midwestcompact.org/default.htm>

**NORTHEAST COMPACT****NORTHEAST INTERSTATE LOW-LEVEL RADIOACTIVE WASTE (LLRW) MANAGEMENT COMMISSION**

The Northeast Interstate LLRW Management Compact was originally developed by representatives of eleven northeastern States. Soon after enactment of the LLRW Policy Act of 1980, these States conducted public meetings to develop the provisions of the Northeast Compact. This task was completed in February 1983, and the legislation establishing the Northeast Compact was sent to the respective eleven governors. The legislatures of four States - Connecticut, New Jersey, Maryland and Delaware - adopted the Northeast Compact legislation. Of the remaining seven State, Delaware and Maryland later joined the Appalachian Compact, some have joined other compacts, and a few have yet to join any compact. The US Congress, as part of the LLRW Policy Amendments Act of 1985, ratified the law establishing the Northeast Compact. The President approved the law in early 1986 and the Northeast Compact became a two-state compact.

The States of Connecticut and New Jersey both entered into a regional low-level radioactive waste management compact as a way to:

- facilitate an interstate cooperative effort; providing for proper transportation of low-level waste generated in the region;
- minimize the number of facilities required to effectively and efficiently manage low-level radioactive waste generated in the region;
- encourage the reduction of the amount of low-level waste generated in the region, and
- distribute the costs, benefits and obligations of proper low-level radioactive waste management equitably among the party States and ensure the environmentally sound and economical management of low-level radioactive waste.

**CONTACT:**

Northeast Interstate Low-Level Radioactive Waste Commission  
703 Hebron Avenue  
Glastonsbury, CT 06033  
Phone: (860) 633-2060  
Fax : (860) 633-2737  
E-mail: [NELLRWCMASN@aol.com](mailto:NELLRWCMASN@aol.com)

### **NORTHWEST INTERSTATE COMPACT ON LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT**

The Northwest Interstate Compact on Low-Level Radioactive Waste Management's member States include Alaska, Hawaii, Idaho, Montana, Oregon, Utah, Washington, and Wyoming. The compact is a cooperative effort by these States to provide safe and economical management of low-level radioactive wastes within the compact region.

**CONTACT:**

Executive Director  
Northwest Interstate Compact on Low-Level  
Radioactive Waste Management  
P.O. Box 47600  
Olympia, WA 98504-7600  
Phone: (360) 407-7107  
Web address: [http://www.eq.state.ut.us/eqrad/nwi\\_cmpc.htm](http://www.eq.state.ut.us/eqrad/nwi_cmpc.htm)

### **ROCKY MOUNTAIN LOW-LEVEL WASTE COMPACT** **ROCKY MOUNTAIN LOW-LEVEL RADIOACTIVE WASTE BOARD**

The Rocky Mountain Low-Level Waste Board is an interstate government agency that administers the Rocky Mountain Low-Level Radioactive Waste Compact. The Compact was created by legislation passed by the member States: Colorado, Nevada and New Mexico. The Compact received Congressional Consent Act, P.L. 99-240. Thus, the Compact is authorized by both federal and State law. The main purposes of the Compact are to provide for the disposal of Low -level radioactive waste (LLW) produced within the member States and to regulate the interstate commerce aspects of LLW.

The Compact regulates certain aspects of LLW management. LLW regulated by the Compact includes radioactive waste other than: high-level radioactive waste, transuranic waste, nuclear

weapons waste, uranium and thorium tailings, and wastes from mining, milling, smelting, or similar processing of ores and mineral-bearing material primary for minerals other than radium.

**CONTACT:**

Executive Director  
Rocky Mountain Low-Level Radioactive Waste Board  
1675 Broadway, Suite 1400  
Denver, CO 80202  
Phone: (303) 825-1912  
Fax: (303) 892-3882  
E-mail: slosky@netway.net

### **SOUTHEAST LOW-LEVEL WASTE COMPACT**

Member States of the Southeast Compact include North Carolina, Virginia, Tennessee, Florida, Georgia, Mississippi, and Alabama. In 1986, North Carolina was designated as the second State to host a low-level radioactive waste repository for members of the Southeast Compact Commission for Low-Level Radioactive Waste Management.

**CONTACT:**

Director  
Tennessee Division of Radiological Health  
3rd Floor,  
L&C Annex 401 Church Street  
Nashville, TN 37243-1532  
Phone: (615) 532-0364

or

116 West Jones Street  
Suite 2109,  
Raleigh, North Carolina 27603-8003  
Phone: 1-800-248-6421  
Web address: <http://www.inel.gov/national/national.html>, <http://www.doa.state.nc.us/doi/llrw/welcome.htm>

### **SOUTHWESTERN LOW-LEVEL RADIOACTIVE WASTE COMPACT**

The Southwestern Low-Level Radioactive Waste Disposal Compact, consists of Arizona, California, North Dakota, and South Dakota. The Southwestern Low-Level Radioactive Waste Commission is the governing body for the Compact and was created by Public Law 100-712 in 1988. Its key duties include controlling the importation and exportation of low-level waste into and out of the region. The Commission has no authority over disposal facility siting, which is the responsibility of the host State of California, but is a separate legal entity and can make recommendations and comments as it feels are appropriate in keeping with its charge under law to do whatever is reasonably necessary to ensure that low-level waste is safely disposed of and managed within the region.

**CONTACT:**

Southwestern Low-Level Radioactive Waste Commission  
PO Box 277727  
Sacramento, CA 95827-7727  
Phone: (916) 448-2390  
Phone: (209) 296-3680  
Fax: (815) 361-3848  
E-mail: [swllrwcc@volcano.net](mailto:swllrwcc@volcano.net)  
Web address: <http://www.volcano.net/~swllrwcc/>

**TEXAS-MAINE-VERMONT COMPACT**

The Texas-Maine-Vermont Compact is an agreement between the States of Maine, Texas and Vermont regarding the disposal of commercial low-level radioactive waste. As a compact, these States require only one disposal facility for the compact region (rather than one in each State) and have the authority to deny out-of-compact wastes access to regional disposal facilities. The formation of each Compact requires the approval of the federal government through Congressional consent legislation. Thus far nine Compacts have received the approval of Congress. The Texas Compact, though approved by all three party States, has not yet received Congressional approval.

Under the Texas Compact agreement, the States of Maine and Vermont each contribute \$25 million to the State of Texas, in exchange for 50 years of access to the proposed Texas low-level radioactive waste disposal facility. Maine and Vermont benefit under this arrangement by being ensured access to a low-level radioactive waste disposal facility, avoiding a far more expensive in-state siting process. The benefits for Texas are two-fold. Firstly, as a Compact, Texas may exclude the importation of any out of Compact low-level radioactive wastes, as provided by the 1980 Low-Level Radioactive Waste Policy Act and its 1985 amendment. Secondly, Texas will use the majority of the \$50 million towards construction costs of a facility. (Ten percent of the \$50 million will be paid to the host county.) Notwithstanding the costs described above, Maine generators will be assessed disposal fees at the same rate as Texas generators.

**CONTACT:**

TLLRWDA  
7701 N. Lamar, Suite 300  
Austin, TX 78752  
Phone: (512) 451-5292  
Fax: (512) 451-5296  
Web address: [http://link.tsl.state.tx.us/tx/TLLRWDA/pro\\_comp.htm](http://link.tsl.state.tx.us/tx/TLLRWDA/pro_comp.htm)

**1.3.2 INDIVIDUAL STATE ORGANIZATIONS****ALABAMA OFFICE OF RADIATION CONTROL**

The Office of Radiation Control is an office within the Alabama Department of Public Health. The mission of the Office of Radiation Control is to protect public health and safety and the environment from ionizing radiation by maintaining exposures to radiation as low as reasonable through a program of registration, licensing, and inspection of sources and uses of radiation.

**CONTACT:**

Alabama Department of Public Health  
Alabama Office of Radiation  
P.O. Box 303017  
Montgomery, AL 36130  
Phone: (334) 206-5391

**ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION (ADEC)  
RADIATION PROGRAM**

The ADEC Radiation Program has the lead for administering the Agreement in Principle (AIP) between the US DOE and the State of Alaska DEC. This AIP provided oversight of DOE characterization and monitoring activities to ensure compliance with applicable Federal, State, and local laws and regulations at the Amchitka Island, Alaska underground nuclear test site. ADEC's main purpose is to assure citizens of Alaska that the environment, as well as the public health and safety, are protected through existing programs and commitments by DOE, and through a program of independent monitoring and vigorous oversight of DOE characterization and monitoring activities by State officials.

ADEC Environmental Radiation section staff are also responsible for developing appropriate environmental engineering instrumentation and sampling procedures for Statewide radiological monitoring activities in Alaska to respond to radioactive releases from other countries that may deposit radioactive materials in Alaska's air, land or water.

The Environmental Radiation section manager also represents the Governor as a voting member of the Northwest Low-Level Radioactive Waste Compact. This compact allows Alaska to have low-level radioactive waste produced in the State disposed of at the Hanford Site in Richland, WA.

**CONTACT:**

Radiation Program Manager  
Alaska Department of Environmental Conservation  
610 University Avenue  
Fairbanks, AK 99709-3643  
Phone: (907) 451-2172  
Fax: (907) 451-2187  
Web address: (The radiation program web site is currently being developed)

**ARIZONA RADIATION REGULATORY AGENCY (ARRA)**

The ARRA has an agreement with the US Nuclear Regulatory Commission and must license commercial low-level waste disposal facilities in accordance with health and safety requirements. The ARRA serves to protect the health, safety and welfare of the citizens of Arizona against unnecessary radiation exposure from all sources. The ARRA is responsible for regulatory oversight, monitoring and inspection of users of radiation sources throughout the State. The ARRA is also responsible for developing appropriate environmental engineering instrumentation and sampling procedures for Statewide radiological monitoring activities.

**CONTACT:**

Arizona Radiation Regulatory Agency  
4814 South 40<sup>th</sup> Street  
Phoenix, AZ 85040  
Phone: (602) 255-4845 ext. 227

**CALIFORNIA RADIOACTIVE MATERIALS MANAGEMENT FORUM (CAL RAD) FORUM**

Cal Rad Forum is an association of public and private institutions and corporations that use radioactive materials and generate low-level radioactive waste in the four-state Southwestern Low-Level Waste Disposal Compact region: Arizona, California, North Dakota, and South Dakota. Their corporate and institutional members include universities, medical centers, electric utilities with nuclear power plants, numerous industrial and manufacturing firms, and professional societies in engineering, science, radiation safety, and the medical sciences.

Cal Rad Forum's primary interest is the safe management and disposal of low-level radioactive waste. It supports prompt development of the proposed Ward Valley, California disposal facility that was licensed for construction and operation by the California Department of Health Services in 1993.

**CONTACT:**

Administrative Director  
California Radioactive Materials Management Forum  
Phone: (916) 688-0742  
Web Address: <http://members.aol.com/calradcal/>

**COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT- (CDPHE), HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION, FEDERAL FACILITIES PROGRAM**

The Federal Facilities Program is responsible for regulatory oversight of DOE's Rocky Flats Environmental Technology Site as well as other Federal facilities. Areas of oversight at Rocky Flats include decontamination and decommissioning, emergency planning and preparedness, environmental monitoring, public exposure studies, and regulation of environmental cleanup and waste management. A federal facilities agreement with DOE and EPA, known as the Rocky Flats Cleanup Agreement (RFCA), guides the cleanup, which is scheduled to be completed in 2006.

**CONTACT:**

Rocky Flats Oversight Unit Leader  
Colorado Department of Public Health and Environment  
HMWMD-B2  
4300 Cherry Creek Drive South  
Denver, CO 80246-1530  
Phone: (303) 692-3367  
Fax: (303) 759-5355  
Web address: <http://www.cdphe.state.co.us/hm/rf/rfhom.asp>

**COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT - (CDPHE),  
LABORATORY AND RADIATION SERVICES DIVISION**

This division of the CDPHE is responsible for controlling radioactive materials. It operates the Radioactive Materials Licensing and Inspection Program. The Division issues approximately 400 radioactive materials licenses which give the licensee the right to operate in a specified location, with specified radioactive materials, in accordance with approved operating procedures.

**CONTACT:**

Director  
Laboratory and Radiation Services Division  
Colorado Department of Public Health and Environment  
8100 Lowry Blvd  
Denver, CO 80220-6928  
Phone: (303) 692-3090  
Fax: (303) 343-3697  
Web address: <http://www.cdphe.state.co.us/lr/lrhom.htm>

**CONNECTICUT HAZARDOUS WASTE MANAGEMENT SERVICE LOW-LEVEL  
RADIOACTIVE WASTE PROGRAM (CHWMS LLRWP)**

The State of Connecticut created the CHWMS LLRWP to promote the responsible management of hazardous waste (this role is now discontinued) and low-level radioactive waste (LLRW) generated in Connecticut. With regards to LLRW, the CHWMS LLRWP is required by State law (Connecticut General Statutes 22a-163 et seq.) to:

- prepare and revise a LLRW Management Plan for the State
- select a site for a LLRW disposal facility
- select a disposal technology to be used at the site
- select a firm to develop and operate the facility; and
- serve as the custodial agency for the facility.

The CHWMS LLRWP's primary goal, as established in State statute, is the protection of public health and safety and the environment.

**CONTACT:**

Connecticut Hazardous Waste Management Service  
Low-Level Radioactive Waste Program  
50 Columbus Boulevard  
Hartford, CT 06106  
Phone (860) 244-2007 or 1-800-246-LLRW (toll-free in Connecticut)  
E-mail: [Ctllrw@aol.com](mailto:Ctllrw@aol.com)  
Web address: <http://members.aol.com/ctllrw/>

**GEORGIA DEPARTMENT OF NATURAL RESOURCES,  
ENVIRONMENTAL PROTECTION DIVISION,  
ENVIRONMENTAL RADIATION PROGRAM**

By Executive Order of the Governor, the Department of Natural Resources has been the lead State agency for response to and technical assessment of peacetime radiological emergencies.

The Environmental Radiation Program implemented this responsibility, with assistance from the Radioactive Materials Program. The Program also plays a major role in radiological emergency planning and preparedness efforts for the State, including participation in radiological emergency exercises at Plant Hatch, Plant Vogtle, Plant Farley, and the Savannah River Site. Program associates are also involved in emergency preparedness activities related to the transportation of radioactive materials, including spent nuclear fuel and transuranic waste, through the State of Georgia.

The Environmental Radiation Program regulates the disposal of radioactive waste in Georgia through the Rules and Regulations for Radioactive Waste Material Disposal. Georgia is a member of the Southeast Interstate Low-Level Radioactive Waste Management Compact (Southeast Compact), along with the States of Alabama, Florida, Mississippi, North Carolina, Tennessee and Virginia.

**CONTACT:**

Manager

Georgia Department of Natural Resources

Environmental Protection Division

Environmental Radiation Program

4244 International Parkway, Suite 114

Atlanta, GA 30354

Phone: (404) 362-2675

Fax: (404) 362-2653

Web address: [http://www.voap.org/dnr/environ/branches/progcoord/env\\_rad.html](http://www.voap.org/dnr/environ/branches/progcoord/env_rad.html)

## **IDAHO INEEL OVERSIGHT PROGRAM**

The INEEL Oversight program independently oversees operations at the INEEL on behalf of the citizens of the State of Idaho. They work closely with government agencies at all levels; with citizens' groups; teachers and students; contractors; and one-on-one with individuals. They hope to establish a dialogue with the people of Idaho about the site, its effects on the environment, the economic vitality of the State, and how operations at the site could affect their health.

The main goal of the INEEL Oversight Program is to provide the people of the State of Idaho with independently evaluated information about DOE activities in Idaho; help ensure the safety of citizens by identifying and taking steps to eliminate or reduce threats to public health and the environment from DOE activities; and make radiological expertise available to other State agencies.

**CONTACT:**

Coordinator-Manager

Idaho Division of Environmental Quality

INEEL Oversight Program

1410 North Hilton

Boise, ID 83706-1290

Phone: (208) 373-0498

Fax: (208) 373-0429

Web address: [http://www2.state.id.us/deqinel/main\\_op.htm](http://www2.state.id.us/deqinel/main_op.htm)

## **ILLINOIS DEPARTMENT OF NUCLEAR SAFETY (IDNS)**

The IDNS began operation on October 1, 1980. The new department consolidated the radiation responsibilities of several State agencies, commissions and boards. With a staff of about 220, IDNS is involved with remote monitoring of nuclear power stations, enforcing radiation regulations, emergency preparedness, and inspecting and licensing users of radiation-producing machines and radioactive materials.

Funds for department programs mainly come from fees paid by the nuclear power utilities and the various licensees, registrants, accredited technologists and waste generators operating in the State. IDNS is the State agency responsible for protecting Illinois residents from the potentially harmful effects of ionizing radiation.

The IDNS:

- establishes, implements and enforces radiation protection measures and standards that provide the maximum reasonably achievable protection of individuals and their environment from the potentially harmful effects of radiation, and
- researches, advances and applies technologies, bodies of knowledge and communications to enhance radiation protection and to make useful information available to others.

CONTACT:

Illinois Department of Nuclear Safety  
1035 Outer Park Drive  
Springfield, IL 62704  
Phone: (217) 785-9900  
TDD: (217) 782-6133  
Fax: (217) 785-9962  
Web address: [www.state.il.us/idns/default.htm](http://www.state.il.us/idns/default.htm)

## **MAINE RADIATION CONTROL PROGRAM**

The Radiation Control Program exists to minimize necessary radiation exposure through the licensing and inspection of radiation sources, oversight of low-level radioactive waste generators, and conducting environmental surveillance of nuclear facilities.

### *Radioactive Materials Section*

The Radioactive Materials Section is responsible for licensing and inspection of radioactive materials users, and the maintenance of the regulatory agreement with the Nuclear Regulatory Commission. The Radioactive Materials Section of the Radiation Control Program is granted authority by the U.S. Nuclear Regulatory Commission to license the possession and use of radioactive materials within the State of Maine. There are currently 135 licensees within the State of Maine. These include hospitals, construction companies, lead-in-paint testers, paper mills, energy production facilities and colleges and universities. Out-of-State companies entering the State to work must register with the program, pay an annual fee and file notices when performing work in-State.

### *Radioactive Waste Section*

The Radioactive Waste Section of the Radiation Control Program was formed in September 1994. The section is responsible for the implementation and enforcement of rules complying

with the provisions of the Texas Compact and provide staff support to the Advisory Commission on Radioactive Waste.

**CONTACT:**

Program Manager

11 State House Station

Augusta, Maine 04333

Phone: (207) 287-8401.

Web address: <http://janus.state.me.us/dhs/eng/rad/rad.htm>

### **MAINE ADVISORY COMMISSION ON RADIOACTIVE WASTE AND DECOMMISSIONING**

The Advisory Commission on Radioactive Waste and Decommissioning is an appointed State commission charged with advising the Governor, the Legislature and other pertinent State agencies and entities on matters relating to radioactive waste management and provide information to the public and create opportunities for public input in order to facilitate public understanding of radioactive waste issues. The Advisory Commission is supported by the Maine Radiation Control Program.

**CONTACT:**

Advisory Commission on Radioactive Waste

10 State House Station

Augusta, ME 04333

Phone: (207) 287-8401

Fax: (207) 287-4172

### **MASSACHUSETTS LOW-LEVEL RADIOACTIVE WASTE (LLRW) MANAGEMENT BOARD**

The Low-Level Radioactive Waste Management Board was established pursuant to M.G.L. c.111H, the State's Low-Level Radioactive Waste Management Act. The Management Board is responsible for controlling low-level radioactive waste (LLRW) storage, treatment, and disposal in any centralized facilities that may be developed for those purposes within the Commonwealth, or may be arranged outside Massachusetts. The Management Board also is charged with the task of negotiating with other States and regional groupings of States (called compacts) for access to their existing and newly developing LLRW facilities.

The LLRW Management Board consisting of nine members, comprises the Management Board. Two are statutorily defined to be the Secretaries of the Executive Office of Environmental Affairs and the Executive Office of Health and Human Services. The other seven Board members are gubernatorial appointees, who are charged by State law to use their professional experiences in business management, engineering, radiological health, environmental protection, and public administration, as they act "in the public interest."

**CONTACT:**

Executive Director  
Low -Level Radioactive Waste Management Board  
100 Cambridge St. - 9th Fl.  
Boston, MA 02202  
Phone: (617) 727-6018  
Fax: (617) 727-6084  
Web address: <http://www.state.ma.us/llrw/>

**MICHIGAN ENVIRONMENTAL SCIENCE BOARD LOW-LEVEL RADIOACTIVE WASTE PANEL (MESB LLRWP)**

Under federal law, Michigan is responsible for providing disposal capacity for low-level radioactive waste (LLRW) generated within its borders. In 1987, the State passed the Michigan Low-Level Radioactive Waste Act (Public Act 204) which established a set of minimum criteria for the siting of a LLRW isolation facility.

On July 26, 1995, the MESB was charged to evaluate the scientific basis for Michigan and the federal government's siting criteria for low-level radioactive waste isolation facilities. On September 20, 1995, a LLRW Panel, composed of four MESB members and three guest scientists, with expertise in radiation, nuclear medicine and health physics, was convened to begin the investigation. The investigation consisted of the accumulation and evaluation of peer-reviewed and some non-peer-reviewed literature and data on the subject. In addition, industry representatives, State and federal regulatory agencies, and concerned citizens were considered at four meetings. The report was prepared by the Panel with each individual assigned a specific topic or topics to address.

**CONTACT:**

Chairperson  
Michigan Environmental Science Board  
Knapps Centre, Suite 340  
P.O. Box 30680  
Lansing, MI 48909-8180  
Phone: (517) 373-4960  
Fax: (517) 373-6492  
Web address: <http://mesb.org/pubs/rw/rw.html>

**MICHIGAN STATE GOVERNMENT RADIATION SAFETY SECTION**

The Radiation Safety Section is responsible for all non-federal, non-tribal, radiation machine and facility regulation in Michigan. This includes numerous activities to help ensure compliance with Michigan's Ionizing Radiation Rules and applicable portions of the Public Health Code.

The Radiation Safety Section serves to reduce unnecessary exposure to ionizing radiation from x-ray machines and other radiation machines; to protect and improve the health of Michigan's population through the development and enforcement of appropriate regulatory requirements pertaining to the use of radiation machines; and to help ensure through the regulatory process that mammography machines and facilities are capable of high-quality mammography.

**CONTACT:**

Chief, Radiation Safety Section  
Michigan Department of Consumer & Industry Services  
P.O. Box 30664  
Lansing, MI 48909  
Phone: (517) 241-1989  
Fax: (517) 241-1981  
Web address: <http://www.cis.state.mi.us/bhs/hfs/rss/home.htm>

**MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY  
RADIATION HEALTH BUREAU**

The Department of Environmental Quality's mission is to protect, sustain, and improve a clean and healthful environment to benefit present and future generations.

**CONTACT:**

Director  
Occupational & Radiation Health Bureau  
Department of Environmental Quality  
1520 E. Sixth Avenue  
Helena, MT 59620  
Phone: (406) 444-2544  
Fax: (406) 444-4386  
Web address: <http://www.deq.state.mt.us/>

**NEBRASKA DEPARTMENT OF ENVIRONMENTAL QUALITY (NDEQ)  
LOW-LEVEL RADIOACTIVE WASTE PROGRAM - NE LLRWP**

NDEQ was established in 1971, as the State agency responsible for the protection and enhancement of the environment. The agency received authorization to carry out much of the framework of environmental laws in 1972. Under the NDEQ, the NE LLRWP is responsible for evaluating applications submitted for the construction, operation, and closure of commercial low-level radioactive waste disposal facilities within the State of Nebraska. The NE LLRWP is also responsible for the evaluation of applications for licenses to dispose of low-level radioactive waste.

**CONTACT:**

Nebraska Department of Environmental Quality  
NE-LLRWP  
P.O. Pox 98922  
Lincoln, NE 68509  
Phone: (402) 471-2186  
Fax: (402) 471-2909  
Web address: <http://www.deq.state.ne.us/Programs.nsf/pages/LLRW>

**NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION (NJDEP)  
RADIATION PROTECTION PROGRAMS**

The New Jersey Radiation Protection Program is a division of New Jersey's Department of Environmental Protection. The three Bureaus that form the Radiation Protection Program include

the Bureau of Environmental Radiation; Bureau of Radiological Health; and Bureau of Nuclear Engineering.

Bureau of Environmental Radiation - The Bureau of Environmental Radiation addresses the protection of the public from excessive exposure to radiation, exclusive of x-ray and nuclear power plant sources. This includes the State's program to reduce radon gas exposure in homes and other buildings; licensing the use of certain radioactive materials in medicine, industry and research; supporting the clean-up of the State's radioactively contaminated sites; supporting the siting, design and construction of a low-level radioactive waste (LLRW) disposal facility; and the control of non-ionizing radiation from industrial microwave and radio frequency sources of such radiation.

The Bureau of Environmental Radiation includes:

- Radon Section - The Radon Section provides information to the public on the health risk of radon in the home; performs radon health risk and various technical studies; and certifies radon testing and mitigation businesses operating in New Jersey.
- Radioactive Materials Section - The Radioactive Materials Section (RMS) regulates many radioactive materials within New Jersey in medical, industrial, laboratory, and academic applications. RMS staff are involved in inspections, investigations, licensing actions, and other activities that do not involve nuclear power plants.
- Nonionizing Radiation Section - The Nonionizing Radiation Section (NRS) maintains a registration and inspection program for all radio frequency and microwave heaters, sealers and industrial ovens within the State of New Jersey operating at a frequency of 300 kHz to 100 GHz. In addition, NRS provides general information to the public on power lines, cellular telephones, laser safety, microwave towers, electromagnetic fields, and other nonionizing radiation topics of interest to New Jersey citizens.
- Radiological Assessment Section – The Radiological Assessment Section (RAS) is involved in several different radiation protection issues. Currently, staff are working on projects covering areas as diverse as radiologically contaminated site cleanups (including the development of cleanup standards); low-level radioactive waste (LLRW) disposal; radionuclide air emissions; and comprehensive rule revisions.

Bureau of Nuclear Engineering - The Bureau of Nuclear Engineering provides radiation protection for individuals in New Jersey through establishing, implementing, and enforcing radiation protection measures and standards as applicable to the nuclear power industry. The sections under this Bureau include:

- Nuclear-Environmental Engineering Sections
- Nuclear Engineering Section
- Nuclear Emergency Preparedness Section

Bureau of Radiological Health - The Bureau of Radiological Health has the following sections to undertake protection and health due to radiation exposure:

- X-ray medicine Source Section
- Technologist Certification Section
- Mammography Section

- Registration and Fees

**CONTACT:**

New Jersey Department of Environmental Protection  
Radiation Protection Programs  
25 Arctic Parkway  
CN 415  
Trenton, NJ 08625  
Phone: (609) 984-5400  
Fax: (609) 633-2210  
E-mail: [rpp@dep.state.nj.us](mailto:rpp@dep.state.nj.us)  
Web address: <http://www.state.nj.us/dep/rpp/ber/index.htm>

**NEW JERSEY LOW-LEVEL RADIOACTIVE WASTE DISPOSAL FACILITY SITING BOARD (LRWSB)**

The LRWSB was created by a State law passed in 1987, which also created a Radioactive Waste Advisory Committee. Both groups are composed of volunteers nominated by the Governor and confirmed by the State Senate, with the LRWSB also including representatives of the Commissioners of Environmental Protection and Health. The Board and Advisory Committee are administered through the staff of the New Jersey Department of Environmental Protection (NJDEP) in the Radiation Protection programs group. The quasi-independent Board was given the statutory responsibility to find a site, choose a disposal technology and site operator, and oversee the construction, operation, and eventual closure of the facility. The Advisory Committee was charged with providing objective and independent advice to the Board, and reviewing all matters related to siting and developing a facility. Amendments to the Act in 1991 authorized the LRWSB to assess and collect fees from generators of low-level radioactive waste in New Jersey to cover the costs of planning, siting, and developing a disposal facility. It was envisioned that generators would also pay all costs related to operating and closing the facility, including monitoring and protection measures, and the compensation and benefits that were to be given to the host community.

**CONTACT:**

New Jersey Low-Level Radioactive Waste Disposal Facility Siting Board  
PO Box 415  
Trenton, NJ 08625-0415  
Phone: (609) 777-4247  
Fax: (609) 777-4252  
E-mail: [sitingboard@dep.state.nj.us](mailto:sitingboard@dep.state.nj.us)  
Web address: <http://www.state.nj.us/llrwsb/>

**NEW MEXICO HAZARDOUS AND RADIOACTIVE MATERIALS BUREAU**

The mission of the NM Hazardous and Radioactive Materials Bureau is to regulate all present hazardous waste and radioactive management activities in order to prevent environmental degradation.

**CONTACT:**

New Mexico Environment Department  
2044-A Galisteo Street  
Santa Fe, NM 87502  
Phone: (505) 827-1557  
Fax: (505) 8271544

**NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY  
(NYSERDA)**

The New York State Low-Level Radioactive Waste Management Act (1986) charged NYSERDA with acquiring lands for, designing, obtaining necessary regulatory approvals for, constructing, and operating facilities for the disposal of low-level radioactive waste (LLRW) generated in New York State. These actions are predicated on the selection of a site and disposal methods by an ad hoc siting commission. The siting process has been suspended while the State reexamines its LLRW management alternatives and program strategy.

In the interim, NYSERDA will continue to play an important role by:

- providing policy and technical advice to the Governor and the Legislature regarding waste management options;
- representing New York State in interactions with other States and regional LLRW compacts;
- monitoring generation and management of LLRW in the State, including collection of annual reports from generators and preparation of an annual status report;
- managing the annual assessment on nuclear power plants that supports LLRW facility-development activities, and the LLRW surcharge rebate account; and
- maintaining technical files and records from the former Siting Commission for potential future application in meeting the State's LLRW management needs.

**CONTACT:**

Program Director  
New York State Energy Research and Development Authority  
Corporate Plaza West  
286 Washington Avenue Extension  
Albany, NY 12203-6399  
Phone: (518) 862-1090, ext. 3302  
Web address: <http://www.nyserda.org/index.html>

**NEVADA NUCLEAR WASTE PROJECT OFFICE (NWPO)**

The mission of the NWPO is to assure that the health, safety, and welfare of Nevada's citizens and the State's unique environment and economy are adequately protected with regard to any federal high-level nuclear waste disposal activities in the State. The NWPO functions under the authority specified in the Nevada Revised Statutes (NRS 459.009 - 459.0098).

The NWPO operates as part of the Nevada Governor's Office and consists of a Division of Technical Programs and a Division of Planning. The Executive Director is appointed by the Governor and serves at the pleasure of the Commission on Nuclear Projects. The seven-member Commission advises the governor and legislature on nuclear waste issues and oversees NWPO

activities. The NWPO oversees the federal high-level radioactive waste disposal program; carries out independent technical, socioeconomic and other studies; works closely with State agencies and local governments on matters relating to radioactive waste; and provides information to the governor, legislature, and any interested parties. The NWPO uses a small, central staff supplemented by contractual services for needed technical and specialized expertise in order to provide high quality oversight and monitoring of federal activities, to conduct necessary independent studies, and to avoid unnecessary duplication of efforts and resources.

**CONTACT:**

State of Nevada  
Nuclear Waste Project Office  
Capitol Complex  
Carson City, NV 89710  
Phone: (702) 687-3744  
Web address: [www.state.nv.us/nucwaste/](http://www.state.nv.us/nucwaste/)

### **NORTH CAROLINA LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT AUTHORITY**

In 1986, North Carolina was designated as the second State to host low-level radioactive waste repository for members of the Southeast Compact Commission for Low-Level Radioactive Waste Management. Their General Assembly appointed the Authority in August of 1987 to oversee the development of a repository to serve North Carolina and members of the Southeast Compact. Members of the NC. Low-Level Waste Authority are private citizens who have volunteered their time to this project to site a safe repository. The 15-member panel serves four-year terms. The Speaker of the NC. House and the President Pro-Tem of the NC. Senate each appoint five members. The Authority members' terms are staggered so experience and leadership has some continuity. Members of the public are invited to participate in this process by writing or calling the Authority, or by attending open meetings. The Authority meets regularly each quarter.

**CONTACT:**

North Carolina Low-Level Waste Management Authority  
116 West Jones Street  
Suite 2109  
Raleigh, NC 27603-8003  
Phone: 1(800) 248-6421 (in NC only)

### **OHIO DEPARTMENT OF HEALTH (ODH) BUREAU OF RADIATION PROTECTION**

The Ohio Department of Health regulates radionuclide-related activities within the State of Ohio with the exception of some federal facilities. ODH recently received Nuclear Regulatory Commissions Agreement State status expanding its regulatory role in Ohio.

**CONTACT:**

Ohio Department of Health  
Bureau of Radiation Protection  
P.O. Box 118  
Columbus, OH 43266-0118  
Phone: (614) 644-2727  
Web Address: <http://www.odh.state.oh.us/>

**OHIO EPA OFFICE OF FEDERAL FACILITIES OVERSIGHT (OFFO)**

The Ohio EPA Office of Federal Facilities Oversight (OFFO) was created to oversee investigation and remediation activities at federal cleanup sites. OFFO facilitates environmental monitoring, emergency response, remedial guidance and public outreach at Department of Energy (DOE) and Department of Defense (DOD) sites in Ohio. OFFO is charged with ensuring the health and safety of the public and the environment through effective cleanup of federal sites.

**CONTACT:**

Office of Federal Facilities Oversight  
401 E Fifth Street  
Dayton OH 45402-2911  
Phone: (937) 285-6357  
Fax: (937) 285-6404  
Web address: <http://offo2.epa.state.oh.us/offo.htm>

**OREGON OFFICE OF ENERGY, NUCLEAR SAFETY DIVISION**

The Nuclear Safety Division of the Oregon Office of Energy is responsible for:

- technical review of the Hanford cleanup and assessment of potential impacts on Oregon and the Columbia River;
- the safe transport of radioactive material in and through Oregon;
- staffing the Oregon Hanford Waste Board;
- emergency preparedness for a nuclear accident at Hanford, the Washington Public Power Supply System's Nuclear Plant 2 or at Trojan;
- informing the public about Hanford issues;
- representing Oregon on the Hanford Natural Resources Trustee Council, which seeks to avoid damage to the natural resources during Hanford cleanup;
- oversight and regulation of the cleanup of the White King and Lucky Lass Mines in southern Oregon.

**CONTACT**

Oregon Office of Energy  
Nuclear Safety Division  
625 Marion St. NE  
Salem, OR 97301-3742  
Phone: (503) 378-4040  
E-mail: [energy.in.internet@state.or.us](mailto:energy.in.internet@state.or.us)  
Web address: <http://www.cbs.state.or.us/external/ooe/nucsaf/nucsaf.htm>

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## **PENNSYLVANIA BUREAU OF RADIATION PROTECTION (BRP)**

The mission of the Pennsylvania BRP is to reduce unnecessary radiation exposure to the citizens of Pennsylvania from all potential sources. The Bureau oversees the regulation and inspection of users of radiation sources throughout the Commonwealth; conducts a comprehensive environmental radiation monitoring program; conducts a nuclear safety review and continuing evaluation of nuclear power plants; carries out an emergency radiation response program; administers a Statewide radon program; licenses users of radium and accelerator-produced radioactive material; and administers a program for siting and regulating a low-level radioactive waste disposal facility.

### **CONTACT:**

Pennsylvania Department of Environmental Protection

Rachel Carson State Office Building

400 Market Street

Harrisburg, Pennsylvania 17101

Phone: (717) 787-2480

Web address: <http://www.dep.state.pa.us/dep/deputate/airwaste/rp/rp.htm>

## **PENNSYLVANIA LOW-LEVEL RADIOACTIVE WASTE SECTION (LLRWS)**

The Pennsylvania Low-level Waste Section regulates and oversees the activities associated with the siting of a LLRW disposal facility in Pennsylvania. In 1980, the US Congress enacted the Low-Level Radioactive Waste Policy Act, which made each State responsible for the disposal of LLRW generated within its borders, and encouraged States to enter into compacts. The Pennsylvania General Assembly responded to the federal act by enacting the Appalachian States Low-Level Waste Compact Act of 1985. The Act permits Pennsylvania to establish a regional LLRW disposal site for the Appalachian Compact States of Delaware, Maryland, West Virginia, and Pennsylvania. Pennsylvania was selected as the initial Host State because it generates the largest amount of the waste within the compact. The Act also designates and authorizes The Department of Environmental Protection (DEP) to select a site operator, and to develop a comprehensive program to license and regulate the siting, operation, decommissioning and long-term care of the regional disposal facility. DEP selected Chem Nuclear Systems, through an open public process, to site, develop and operate the regional facility.

### **CONTACT:**

Division Chief

Pennsylvania Low-Level Radioactive Waste Section

P.O. Box 8469

Harrisburg, PA 17105-8469

Phone: (717) 787-2163

Nuclear Safety Division Hotline: 1(800) 232-2786

Web address:

[http://www.dep.state.pa.us/dep/deputate/airwaste/rp/Nuclear\\_Safety\\_Division/LLWR\\_Section/Low\\_Level\\_Waste\\_Section\\_Homepage.htm](http://www.dep.state.pa.us/dep/deputate/airwaste/rp/Nuclear_Safety_Division/LLWR_Section/Low_Level_Waste_Section_Homepage.htm)

## **TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION** **DIVISION OF DOE OVERSIGHT**

The purpose of the Department of Energy (DOE) Oversight Division is to ensure that the environmental impacts associated with past and present activities at the DOE Oak Ridge Reservation (ORR) are thoroughly investigated and monitored. The primary objective of the Division is to assure the citizens of Tennessee that their health, safety, and environment are being protected during environmental restoration and ongoing activities at the ORR and to assist in cleanup decisions.

### CONTACT:

Director, Division of DOE Oversight  
Tennessee Department of Environment and Conservation  
761 Emory Valley Road  
Oak Ridge, TN 37830-7072  
Phone: (865) 481-0995  
Web address: <http://www.state.tn.us/environment/doeo/index.html>

## **TENNESSEE DIVISION OF RADIOLOGICAL HEALTH**

The Division of Radiological Health is responsible for protecting Tennesseans and the environment from the hazards associated with ionizing radiation. This responsibility encompasses regulating the use and possession of radioactive materials and radiation producing machines within the State, as well as responding to accidents involving radiation. In addition, the Division monitors the environment for radiation, especially around nuclear facilities and other major radioactive material users.

The Division is composed of four sections as follows:

1. *The Licensing/Registration/Planning Section* licenses medical, academic, and industrial facilities to possess x-ray equipment.
2. *The Inspection and Enforcement Section* inspects licensed and registered facilities to determine compliance with State regulations and special conditions of their licenses or registration.
3. *The Technical Services Section* performs ambient and site-specific environmental monitoring, provides personnel monitoring and instrument calibration services for the Division, conducts emergency response training for the Division and others, provides oversight for Tennessee's low-level radioactive waste activities, and handles special projects.
4. *The Administrative Section*

### CONTACT:

Director  
3rd Floor, L&C Annex  
401 Church Street  
Nashville, TN 37243-1532  
Phone: (615) 532-0364  
Web address: <http://www.state.tn.us/environment/rad/index.html>

## **TEXAS DEPARTMENT OF HEALTH, BUREAU OF RADIATION CONTROL (BRC)**

The Texas Department of Health BRC regulates the uses of radiation in Texas. The regulatory program is designed to prevent unnecessary radiation exposure to the public and perform vital public health functions guided by their regulatory philosophy. The bureau:

- licenses the use of radioactive material
- registers radiation producing equipment
- inspects licensees and registrants
- enforces regulations
- operates an emergency response program
- operates the Radiological Defense Program
- develops standards for the control of radiation.

Texas is a NRC Agreement State. The Governor of Texas signed an agreement with the US Nuclear Regulatory Commission so that Texas government is responsible for all regulation of radiation within the State except for on-site activities of nuclear power plants and federal facilities.

### CONTACT:

Bureau Chief

Texas Department of Health

Bureau of Radiation Control

1100 W. 49th Street

Austin, TX 78756-3189

Phone: (512) 834-6688

Fax: (512) 834-6690

Web address: <http://www.tdh.state.tx.us/ech/rad/pages/brc.htm>

## **TEXAS LOW-LEVEL RADIOACTIVE WASTE DISPOSAL AUTHORITY (TLLRWDA)**

The mission of the TLLRWDA is to protect the environment and human health from unacceptable exposure to radioactive materials and to allow the continued beneficial uses of radioactive materials in Texas.

The TLLRWDA is responsible for siting, developing, operating, decommissioning, and eventually closing a low-level radioactive waste disposal facility for waste generated in Texas. A board of directors composed of a certified health physicist, a geologist, an attorney, a medical doctor, and two private citizens governs the Authority. All board members are appointed by the governor and confirmed by the senate. Chapter 402 of the Texas Health and Safety Code is the State statute that addresses the agency's activities. Prior to constructing a disposal facility, the Authority must obtain a license from the Texas Natural Resource Conservation Commission (TNRCC) which will serve as the regulator for the facility.

CONTACT:  
TLLRWDA  
7701 N. Lamar, Suite 300  
Austin, TX 78752  
Phone: (512) 451-5292  
Fax: (512) 451-5296  
Web address: <http://isadore.tsl.state.tx.us/tx/TLLRWDA/>

### **UTAH DIVISION OF RADIATION CONTROL (DRC), LOW-LEVEL WASTE SECTION**

The mission of the Utah DRC is to assure the citizens of Utah the lowest exposure to any form of radiation. The DRC protects Utah citizens and the environment from sources of radiation that constitute a significant health hazard. A board, appointed by the governor, establishes rules and policies to meet this requirement. The Division staff is divided between eight programs. Division staff carries out the Division's mission and assist customers in complying with the rules.

The Low-level Waste Section ensures safe handling, storage and disposal of low-level radioactive waste. Two licensees in Utah are authorized to receive and process radioactive waste.

CONTACT:  
State of Utah  
Division of Radiation Control  
Low-Level Waste Section  
P.O. Box 144850  
Salt Lake City, UT 84114-4850  
Phone: (801) 536-4250  
Fax: (801) 533-4097  
Web Address: [http://www.eq.state.ut.us/equad/drc\\_lows.htm](http://www.eq.state.ut.us/equad/drc_lows.htm)

### **VERMONT LOW LEVEL RADIOACTIVE WASTE PROGRAM**

Each State is required by Federal law to provide for the disposal of low-level radioactive waste generated within its borders. The States are allowed, with congressional approval, to form compacts with other States for the disposal of low-level radioactive waste. The States of Vermont and Maine have joined with Texas to fulfill this mandate for disposal, which encourages State groupings. Passed by all three State legislatures, the Texas Low-Level Radioactive Waste Disposal Compact awaits Congressional approval. The compact calls for Vermont and Maine generators to dispose of waste in a facility sited in Texas. Once the Compact is passed by Congress, under the agreement, Vermont must meet its responsibilities to the State of Texas. These responsibilities include: costs of disposal; volume determinations; waste minimization; meeting packaging, processing and waste form specifications; and reporting on proposed transportation methods, routes, and shipment schedules.

**CONTACT:**

State Geologist  
Vermont Geological Survey  
103 S. Main St., Laundry Bldg.  
Waterbury, VT 05671-0301  
Phone: (802) 241-3608  
FAX: (802) 241-3273  
E-mail: [marjieg@dec.anr.state.vt.us](mailto:marjieg@dec.anr.state.vt.us)  
Web address: <http://www.anr.state.vt.us/geology/radwaste.htm>

**VIRGINIA DEPARTMENT OF HEALTH  
RADIOLOGICAL HEALTH PROGRAM**

The Radiological Health Program manages the Virginia Department of Health's radiation protection activities. These activities include:

- registration, inspection and certification of radiation producing machines
- measuring environmental radiation levels
- licensing and inspection of naturally occurring and accelerator produced radioactive materials
- responding to radiological emergencies
- distributing information on indoor radon.

**CONTACT:**

Virginia Dept. of Health  
Radiological Health Program  
1500 East Main Street, Room 240  
P. O. Box 2448  
Richmond, VA 23218  
Web address: <http://www.vdh.state.va.us/rad/index.htm>

**WASHINGTON STATE DEPARTMENT OF ECOLOGY,  
NUCLEAR WASTE PROGRAM (NWP)**

The mission of the NWP is to ensure sound management of nuclear waste Statewide and to promote the sound management and protection of the environment at, and adjacent to, the U.S. Department of Energy's Hanford site.

The Department of Ecology, the U.S. Environmental Protection Agency and the U.S. Department of Energy established the Tri-Party Agreement in 1989. This agreement sets in place milestones and due dates for Hanford site cleanup. After ten years there have been many accomplishments, such as eliminating the direct discharge of hundreds of thousands of gallons of contaminated water into Washington's soil and water each year.

In addition to Hanford site issues, the Nuclear Waste Program works with the Northwest Interstate Compact on Low-level Radioactive Waste Management. Washington is the Host State for the regional commercial low-level waste disposal facility operated by U.S. Ecology. Their program also provides oversight of this waste disposal by issuing disposal permits and ensuring that the waste regulations are in compliance with all applicable State and federal regulations.

**CONTACT:**

Nuclear Waste Program Manager  
Washington State Department of Ecology  
Phone: (360) 407-7150  
Web Address: <http://www.wa.gov/ecology/nwp/index.html>

### **1.3.3 NATIONWIDE STATE ORGANIZATIONS**

#### **ENVIRONMENTAL COUNCIL OF STATES (ECOS)**

The Environmental Council of the States (ECOS) is the national non-profit, non-partisan association of State and territorial environmental commissioners. The mission of ECOS is to improve the environment of the United States by providing for the exchange of ideas, views and experiences among States and territories, fostering cooperation and coordination in environmental management, and articulating State positions to Congress and the Environmental Protection Agency on environmental issues.

ECOS was established in December, 1993 at a meeting of approximately 20 States in Phoenix, Arizona. Initially operated out of the State office of the first association president, ECOS then retained a Washington firm to represent its interests. Near the end of 1994, a decision was made to switch to a more traditional organizational style with permanent staff. The first full-time executive director began work on March 1, 1995, and an office was established and occupied on May 1, 1995.

ECOS current major projects and research include:

- CBEP-NEPPS - Integrating Community-based Environmental Protection with the National Environmental Protection Partnership System
- ECOS-EPA Cooperative Agreement - Forms the basis for numerous projects involving EPA
- GPRA - Government Performance Results Act
- LGEAN Cooperative Agreement - A cooperative agreement with the Local Government Environmental Assistance Network
- Environmental Data Management/OneStop - ECOS/EPA partnership to build locally and nationally accessible environmental systems
- OSWER Cooperative Agreement - Cooperative agreement with EPA's Office of Solid Waste and Emergency Response
- Regulatory Innovations Agreement - To develop a process for the consideration of innovative ideas to comply with regulatory requirements.

**CONTACT:**

ECOS  
444 N Capitol St, NW  
Suite 305  
Washington, DC 20001  
Phone: 202-624-3660  
Fax: 202-624-3666  
E-mail: [ecos@sso.org](mailto:ecos@sso.org)  
Web address: <http://www.sso.org/ecos/ecosweb.htm>

## **ENVIRONMENTAL RESEARCH INSTITUTE OF THE STATES (ERIS)**

The Environmental Research Institute of the States (ERIS) is a 501(c)3 organization, formed under ECOS and incorporated in the District of Columbia. ERIS has no staff, but uses staff from ECOS, on a reimbursable basis, to carry out its projects. ERIS is governed by a board, four members of which are appointed by ECOS, and three members of which are appointed by the ERIS board itself. Its focus is on educational and research issues. The goals of ERIS are:

- to improve the environment of the United States;
- to further the understanding of the roles and activities of the States in the federal system with respect to environmental protection;
- to conduct environmental policy research including the dissemination of results through publications, meetings, electronic media and similar venues;
- to act as a forum where State environmental policy makers may interact with other environmental stakeholders regarding environmental policy in the United States;
- to provide educational programs to assist in the development of environmental policy in the United States; and
- to support and operate on behalf of the Environmental Council of the States.

### CONTACT:

President  
ECOS  
444 N Capitol St, NW  
Suite 305  
Washington, DC 20001  
Phone: (202) 624-3660  
Fax: (202) 624-3666  
E-mail: [ecos@sso.org](mailto:ecos@sso.org)  
Web address: <http://www.sso.org/ecos/eris.htm>

## **INTERSTATE TECHNOLOGY AND REGULATORY COOPERATION (ITRC) RADIONUCLIDE WORK TEAM**

The Interstate Technology & Regulatory Cooperation (ITRC) Radionuclides Work Team was initiated by the Western Governors' Association to expedite the use of innovative technologies for the characterization and cleanup of contaminated sites. Currently, the ITRC has expanded to include more than 25 States, three federal partners, numerous stakeholders, and two State associations. In 1999, the Environmental Research Institute of the States (ERIS) became the new host of the ITRC.

Remediation of soil and water contaminated with radionuclides is a complicated and costly issue at numerous federal facilities. The Radionuclides Work Team was formed in 1999 to facilitate cleanup at these facilities by fostering dialogue between States and with stakeholders and federal agencies in order to increase awareness of issues and procedures at sites in other States, encourage regulatory cooperation and share technological successes.

**The ITRC Radionuclide Work Team:**

- provides a forum for States to exchange technical information and lessons learned related to cleanup levels, characterization, cleanup technologies, waste issues, and stewardship;
- creates a network of State contracts to promote the use of innovative technologies for radioactive waste
- identifies and participates in deployment of technologies at radioactive waste sites
- benchmarks State perspectives about innovative technologies, and
- develops consensus among State regulators with input from industry and public stakeholders on technical regulatory aspects of radioactive waste management.

**CONTACT:**

ITRC Program Manager

c/o ECOS

444 N Capitol St, NW

Suite 305

Washington, DC 20001

Phone: (202) 624-3660

Fax: (202) 624-3666

E-mail: [radteam@geoview.epa.state.oh.us](mailto:radteam@geoview.epa.state.oh.us)Web address: <http://www.sso.org/ecos/eris.htm>**ASSOCIATION OF STATE AND TERRITORIAL SOLID WASTE MANAGEMENT OFFICIALS (ASTSWMO) RADIATION FOCUS GROUP**

The ASTSWMO is an organization supporting the environmental agencies of the States and trust territories. ASTSWMO focuses on the needs of State hazardous waste programs; non-hazardous municipal solid waste and industrial waste programs; recycling, waste minimization, and reduction programs; Superfund and State cleanup programs; waste management and cleanup activities at federal facilities, and underground storage tank and leaking underground storage tank programs.

The Radiation Focus Group was formed in November 1998, and was designed to be a Focus Group researching the growing issue of Radiation and Federal Facilities. The Focus Group also works with the ASTSWMO Resource Conservation and Recovery Act (RCRA) Hazardous Waste and Solid Waste Subcommittees.

The mission of the group is to:

- identify national level radiation issues;
- coordinate State input;
- encourage better partnerships between State and Federal Agencies; and
- produce issue papers and other products to promote State interest in national radiation issues involving site cleanup and health and safety at federal facilities and other sites.

CONTACT:  
ASTSWMO  
444 North Capitol St., NW  
Suite 315  
Washington, DC  
Tel. (202) 624-5828  
Fax. (202) 624-7875  
Web address: <http://www.astswmo.org/>

### **CONFERENCE OF RADIATION CONTROL PROGRAM DIRECTORS, INC. (CRCPD)**

The Conference of Radiation Control Program Directors, Inc. (CRCPD) is a 501(c)(3) nonprofit professional organization whose primary membership is made up of individuals in State and local government who regulate the use of radiation sources, and individuals with an interest in radiation protection. CRCPD was formed in 1968. The main purpose of the CRCPD is to serve as a common forum for governmental radiation protection agencies to communicate with each other, and to promote uniform radiation protection regulations and activities.

CONTACT:  
CRCPD  
205 Capital Avenue  
Frankfort, KY 40601  
Phone: (502) 227-4543  
Fax: (502) 227-7862.  
Web address: <http://www.crcpd.org/menu>

### **LOW-LEVEL WASTE (LLW) FORUM**

The LLW Forum is an association of State and Compact representatives, appointed by Governors and Compact Commissions, established to facilitate State and compact implementation of the Low-Level Radioactive Waste Policy Act of 1980, and the Low-Level Radioactive Waste Policy Amendments Act of 1985 and to promote the objectives of low-level radioactive waste regional Compacts. The LLW Forum provides an opportunity for State and compact officials to share information and to exchange views with officials of federal agencies and other interested parties.

LLW Forum participants include representatives of regional low-level radioactive waste compact commissions, States that are not members of low-level radioactive waste compacts, and States that host regional disposal facilities. LLW Forum participants meet regularly to discuss issues related to low-level radioactive waste management and low-level radioactive waste compacts. LLW Forum participants operate mainly by consensus. To encourage participation, meetings are held at different locations throughout the country. Meetings of the LLW Forum are open to the public and are regularly attended by compact, State and federal officials -- as well as by representatives of industry, academia, community groups, and the press.

**CONTACT:**

LLW Forum, Management Advisor  
Afton Associates, Inc.  
403 East Capitol Street  
Washington, DC 20003  
Phone: (202)547-2620  
Fax: (202) 547-1668  
E-mail: [llwforum@afton.com](mailto:llwforum@afton.com)  
Web address: <http://www.afton.com/llwforum/default.html>

**NATIONAL CONFERENCE OF STATE LEGISLATURES (NCSL),  
LOW-LEVEL RADIOACTIVE WASTE WORKING GROUP**

The NCSL is a bipartisan organization that serves the legislators and staffs of the nation's 50 States, its commonwealths and territories. NCSL provides research, technical assistance and opportunities for policymakers to exchange ideas on the most pressing State issues. NCSL is an effective and respected advocate for the interests of State governments before Congress and federal agencies. The Low-level Radioactive Waste Working Group consists of legislators appointed by legislative leaders of States designated as the hosts for the low-level waste compacts for unaffiliated States.

**CONTACT:**

National Conference of State Legislatures  
Low-Level Radioactive Waste Working Group  
444 North Capitol Street, NW, Suite 515  
Washington, D.C. 20001  
Phone: (202) 624-5400  
Fax: (202) 737-1069  
E-mail: [info@NCSL.ORG](mailto:info@NCSL.ORG)  
Web address: <http://www.ncsl.org>

**NATIONAL GOVERNORS' ASSOCIATION (NGA)**

Since 1993, the NGA Center for Best Practices has been working with States hosting weapons production and research facilities to aid them in discussing and negotiating waste and disposal issues among themselves and with DOE. This work led to the successful negotiation in 1995 of approximately forty-eight cleanup agreements between States (and the U.S. Environmental Protection Agency) and DOE. It also provides an opportunity for continuing dialogue on waste treatment, nuclear materials disposition, and waste disposal options. A Task Force composed of State regulators and Governors' policy advisors, guides project activities. Project activities center around periodic task force meetings that are open to federal and State regulators

Topics to be explored through this project include:

- decisions involving disposal of mixed, low-level, and transuranic waste and disposition of nuclear materials;
- decisions involving DOE budget requests and their effect on environmental cleanup and compliance at DOE facilities;
- strategies to treat mixed, low-level, and transuranic waste and their effect on individual sites in the complex;
- changes to the Federal Facility Compliance Act (FFCA) site treatment plans as a result of proposals in the DOE's Accelerating Cleanup-Paths to Closure;

- interstate waste and materials shipments.

**CONTACT:**

National Governors' Association  
Hall of States  
444 North Capitol Street  
Washington, D.C. 20001-1512  
Phone: (202) 624-5300  
Web address: <http://www.nga.org/INDEX.HTM>

**SOUTHERN STATES ENERGY BOARD (SSEB)  
RADIOACTIVE MATERIALS TRANSPORTATION COMMITTEE**

The SSEB Radioactive Materials Transportation Committee continues to be an active participant in the policymaking process concerning the U.S. Department of Energy's (DOE) radioactive materials transportation programs. The committee is comprised of gubernatorial appointees from 16 member States. Since 1986, this committee has provided DOE with a regional perspective on the transportation of high-level radioactive waste and commercial spent nuclear fuel as mandated by the Nuclear Waste Policy Act of 1982 and its 1987 amendments. The committee broadened its scope to address transportation issues associated with all of DOE's unclassified shipments of radioactive materials in 1996. Both the DOE Office of Civilian Radioactive Waste Management and the Office of Environmental Management support the activities of this committee.

The committee's activities include its focus on the disposal of the nations spent fuel and high-level radioactive waste that will necessitate a massive shipping campaign that will impact every State in the SSEB region. The committee recommended that DOE maintain a cooperative relationship between the Regional Servicing Contractors (RSC) and the States in regard to planning, preparation, waste acceptance, and transportation from commercial sites to a federal facility. Most importantly, the Committee stressed that DOE work with the RSC's and States to develop a single national transportation plan instead of allowing each RSC to develop their own plan.

**CONTACT:**

Southern States Energy Board  
6325 Amherst Court  
Norcross, GA  
Phone: (770) 242-7712  
Web address: <http://www.sseb.org>

**WESTERN GOVERNORS' ASSOCIATION (WGA)**

Established in 1984, the Western Governors' Association is an independent, non-partisan organization of Governors from 18 western States, two Pacific-flag territories and one Commonwealth. The Association was formed to provide strong leadership in an era of critical change in the economy and demography of the west. The Western Governors recognize that many vital issues and opportunities shaping their future span State lines and are shared throughout the west.

WGA members include the Governors of Alaska, American Samoa, Arizona, California, Colorado, Guam, Hawaii, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Commonwealth of the Northern Mariana Islands, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming.

**CONTACT:**

Communications Director  
Western Governors' Association  
600 17th Street, Suite 1705 South Tower  
Denver, CO 80202-5452  
Phone: (303) 623-9378  
Fax: (303) 534-7309  
Web address: <http://www.westgov.org/>

**Western Interstate Energy Board (WIEB)**

The WIEB is an organization of 12 western States and three western Canadian provinces, which are associate members of the Board. The WIEB serves as the energy arm of the Western Governors' Association. The Governor of each State appoints a member to the Board. The legal basis of the WIEB is the Western Interstate Nuclear Compact (Public Law 91-461). The Compact provides for the President of the United States to appoint an ex-officio member to the WIEB.

The Compact states that the purpose of the WIEB is to provide the instruments and framework for cooperative State efforts to "enhance the economy of the west and contribute to the well-being of the region's people." The WIEB seeks to achieve this purpose through cooperative efforts among member States/provinces and with the federal government in the energy field.

**CONTACT:**

Executive Director  
Western Interstate Energy Board  
600 17th Street, Suite 1704 South Tower  
Denver, CO 80202  
Phone: (303) 573-8910  
Fax: (303) 573-9107  
Web address: <http://www.westgov.org/wieb/wieb.html>

## 1.4 FEDERAL ORGANIZATIONS

### 1.4.1 U.S. DEPARTMENT OF ENERGY (DOE)

#### DOE Environmental Management Advisory Board (EMAB)

The EMAB was established in accordance with the Federal Advisory Committee Act (FACA) and is charged with providing advice and recommendations to the Department of Energy's Assistant Secretary for Environmental Management on a broad range of issues. The Board is comprised of representatives from Tribal nations, State and local governments, environmental and citizen activist groups, labor organizations, industry, other federal agencies, and scientific and academic communities.

The EMAB provides the Assistant Secretary for Environmental Management with information, advice and recommendations on issues confronting the Environmental Management program. The Board advises the Assistant Secretary from the perspective of affected groups and State and local governments. The Board is advised of the progress on Environmental Management projects at regular intervals determined by the Assistant Secretary.

The Board performs the following duties:

- advises the Department of Energy on Environmental Management projects;
- issues reports and recommendations;
- recommends options to resolve difficult issues faced in the Environmental Management program, including:
  - a) clean-up criteria and risk assessment, land use, priority setting, management effectiveness, cost-versus-benefit;
  - b) analyses, the future national configuration of waste management and disposal facilities, privatization, science; and
  - c) technology, strategic planning, and solutions to barriers to deploying market-driven technologies.

#### CONTACT:

Special Assistant to the Assistant Secretary  
Environmental Management Advisory Board USDOE, EM-1  
Rm. 5B-171  
1000 Independence Ave., SW  
Washington, DC 20585  
Phone: (202) 586-4400  
Web address: <http://www.em.doe.gov/emab/index2.html>

#### DOE Low-Level/Mixed Low-Level Waste (LL/MLLW) Center of Excellence

The Center is committed to helping the public to understand low-level and mixed low-level waste management issues and providing DOE and industry with solutions to their challenges. The primary role of the Center is to assist the field in implementing LLW and MLLW policies and requirements. The Center conducts strategic analyses of critical issues, recommends effective waste management practices, and serves as an instrument of effective communications.

The Center supports the Headquarters Office of Environmental Management. The Headquarters Office develops policy, requirements, and guidance for Environmental Management waste management activities. The Headquarters function also includes development of the strategic and long-range plans for the management of LLW and MLLW.

The Center complements activities of the field by acting as an advocate in the development of policy and guidance for programmatic LLW and MLLW activities. The Center fosters program integration through shared insights and lessons learned. The Center:

- serves DOE as a valued, independent technical resource to the complex;
- responds to Field and Program needs regarding issues analysis and data management;
- facilitates communication within DOE LLW/MLLW programs by sharing insight and lessons learned;
- integrates commercial experience with DOE's LLW and MLLW programs;
- coordinates activities with other DOE Centers of Excellence, Waste Management, and Environmental Restoration Programs;
- eliminates duplication of efforts and to share resources.

CONTACTS:

Idaho Operations Office  
850 Energy Drive  
Idaho Falls, ID 83401  
Phone: (208) 526-3181

or

Nevada Operations Office  
P.O. Box 98518  
Las Vegas, NV 89193  
Phone: (702) 295-0209

or

Albuquerque Operations Office  
P.O. Box 5400  
Albuquerque, NM 87185  
Phone: (505) 845-5463  
Web address: <http://www.em.doe.gov/llw/>

### **DOE Low-Level Waste Disposal Facility Federal Review Group (LFRG)**

On June 27, 1997, the Deputy Assistant Secretaries for Waste Management (WM) and Environmental Restoration (ER) in the Office of Environmental Management (EM) established the Low-Level Waste (LLW) Disposal Facility Federal Review Group (LFRG) to develop and implement a Performance Assessment (PA) and Composite Analysis (CA) review process for LLW disposal sites and facilities. The LFRG was chartered with providing EM management with information necessary to determine that low-level waste disposal facilities are designed, constructed, operated, maintained, and closed in a manner that protects the public and environment.

The establishment of the LFRG is an important element of DOE's response to the Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 94-2 and meeting the requirements of DOE Order 5820.2A, Radioactive Waste Management, and its revision (i.e., DOE O 435.1, Radioactive Waste Management). The creation of the LFRG centralizes the LLW disposal facility PA and CA review process, assigns responsibility for the review and recommendation for approval of PAs and CAs to Federal employees, and focuses senior DOE management officials on the review process and results.

The LFRG is made up of federal employees from Headquarters and Field organizations. LFRG members have been selected to ensure the overall membership of the LFRG reflects the necessary policy, technical, regulatory, and programmatic perspectives to conduct an effective review of the PAs and CAs. The LFRG is co-chaired by representatives from the Offices of Waste Management and Environmental Restoration, and reports to the Deputy Assistant Secretaries for Waste Management and Environmental Restoration.

**CONTACT:**

Co-Chair

U.S. Department of Energy, EM-35

19901 Germantown Road

Germantown, MD 20874-1290

Phone: (301) 903-7211

Fax: (301) 903-9770

### **DOE National Low-Level Waste Management Program (NLLWMP)**

NLLWMP at the Idaho National Engineering and Environmental Laboratory (INEEL) assists the US DOE in fulfilling its responsibilities under the Low-Level Radioactive Waste Policy Amendments Act of 1985 (the Act). The NLLWMP assists the DOE by providing technical assistance to States and compact regions as they develop new commercial LLW management systems.

The objective of the NLLWMP is to provide technical expertise, information, and other resources to States and compact regions in support of the development of their LLW management facilities. The NLLWMP maintains contact with State and compact region officials to identify and provide general and specific assistance. Principal areas of activity include providing workshops, fulfilling State-specific requests, developing technical documents, distributing general information on LLW and providing information management, providing technical coordination of organizations, LLW management projects, and supplying other assistance.

**CONTACT:**

Office of Scientific and Technical Information

U.S. Department of Energy

P.O. Box 62

Oak Ridge, TN 37831

ATTN: Information Services

Phone: (423) 576-8401

Fax: (423) 576-2865

E-mail: [usertalk@adonis.osti.gov](mailto:usertalk@adonis.osti.gov)

Web address: <http://www.inel.gov/national/national.html>

### **DOE State and Tribal Government Working Group (STGWG)**

STGWG was formed in 1989 by the Department of Energy (DOE). STGWG's purpose is to ensure that DOE facilities are operated and cleaned up in compliance with environmental laws and tribal treaty rights, and that the cleanup is performed efficiently, while protecting human health and the environment. To perform this mission, STGWG provides a forum for communication at all levels among States and tribes affected by DOE facilities and activities, and provides policy-level advice to DOE and other interested stakeholders.

The scope of issues that STGWG addresses includes environmental compliance and waste management at, and environmental restoration and reconfiguration of, the DOE weapons complex. STGWG also is dedicated to developing and maintaining the government-to-government relationship between the DOE and Indian tribes in accordance with the 1991 DOE Indian Policy.

STGWG is composed of policy-level and regulator representatives of member States and tribes--those States and tribes that host DOE facilities or are otherwise affected by contamination from or activities at a DOE facility. STGWG State representatives are appointed by and represent the governors or attorneys general of the member States. The governing bodies of their respective tribes appoint the STGWG tribal representatives. STGWG also includes representatives from various national associations of government officials, who are appointed in accordance with the procedures of their respective associations.

The National Conference of State Legislatures (NCSL) and DOE are parties to a cooperative agreement to have NCSL act as staff for and organize the activities of STGWG. Listed below are appropriate contacts from each organization.

#### CONTACTS:

Office of Intergovernmental and Public Accountability (EM-22)  
U.S. Department of Energy  
1000 Independence Ave., SW  
Washington, DC 20585  
Phone: (202) 586-0199  
Fax: (202) 586-0199

or

National Conference of State Legislatures  
1560 Broadway, Suite 700  
Denver, CO 80202  
Phone: (303) 830-2200  
Fax: (303) 863-8003  
Web address: <http://www.ncsl.org/programs/esnr/tribsove.htm#overview>

### **DOE Office of Civilian Radioactive Waste Management (OCRWM)**

The Nuclear Waste Policy Act of 1982 established the OCRWM within the U.S. DOE to develop and manage a Federal system for disposing of all spent nuclear fuel from commercial nuclear reactors and high-level radioactive waste resulting from atomic energy defense activities. The statute provides detailed direction for the scientific, technical, and institutional development of

the system, and it requires that the U.S. Nuclear Regulatory Commission (NRC) license waste management facilities.

CONTACT:

OCRWM

U.S. Department of Energy  
1000 Independence Ave., SW  
Washington, DC 20585

Web address: <http://www.rw.doe.gov/homejava/homejava.htm>

### **1.4.2 U.S. DEPARTMENT OF DEFENSE (DoD)**

#### **Low-Level Radioactive Waste Disposition Advisory Community (LLRWDAC)**

In 1992, the DoD designated the Army as the DoD LLRW Executive Agent for managing disposal of LLRW as a means of correcting past compliance problems. The DoD Executive Agent established a Low-Level Radioactive Waste Disposition Advisory Community (LLRWDAC). The LLRWDAC reports to the DoD Environment Safety and Occupational Health Board. Each DoD component and the Army Corps of Engineers has a representative on the LLRWDAC. The LLRWDAC reviews program issues related to performance and policy issues associated with the DoD Executive Agency responsibilities. The LLRWDAC will approve waiver procedures and monitor their implementation.

CONTACT:

Headquarters, Industrial Operation Command  
AMSI0-SF, Building 390  
Rock Island Arsenal, IL 61299-6000

Phone: (309) 782-2933

Fax: 782-2988

Web Address: <http://www-ioc.army.mil/dm/dmwweb/indexdmw.htm>

#### **Air Force Radioactive And Mixed Waste Office (AFRMWO)**

The AFRMWO, is located at Brooks Air Force Base, Texas. This office was established to provide instruction and oversight of proper management of Excess Radioactive Material (ERM) generated by the Air Force, Air National Guard, Air National Reserve, and civilian organizations that handle Air Force and related organizations material. In this role, the AFRMWO provides guidance with identification, recycling, sampling, storage, shipment and transfer of ERM.

This office works in cooperation with Wright-Patterson Air Force Base and the Radioisotope Committee, in the recycling of certain radioactive materials. This project was established to reduce the amount of radioactive material buried in designated landfills.

The AFRMWO is also presently responsible for the disposal of nuclear weapons maintenance mixed waste. Mixed waste contains a RCRA constituent, and falls under the jurisdiction of the EPA and NRC, the EPA being the lead regulatory agency. In accordance with Air Force Instruction (AFI) 40-201, this office also reviews all radiological remediation projects.

**CONTACT:**

AFRMWO Chief

IERA/SDRH

Chief, Radioactive and Mixed Waste Office

Chief, Radiation Safety Office

Phone: (210) 536-3489

Fax: (210) 536-3726

Web address: <http://sg-www.satx.disa.mil/iera/sdr/sdrh/afrmw/AFRMWO.html>**U.S. Army Corps Of Engineers (USACE)****Formerly Utilized Sites Remedial Action Program (FUSRAP)**

The U.S. Army Corps of Engineers serves the nation through management, design and execution of the full range of cleanup and protection activities. The FY 1998 Energy and Water Appropriations Bill, transferred management of the Formerly Utilized Sites Remedial Action Program (FUSRAP) from the U.S. Department of Energy to the U.S. Army Corps of Engineers. The bill was signed into law on October 13, 1997. FUSRAP was managed by the U.S. Department of Energy for the past 17 years.

The objectives of FUSRAP are to:

- find and evaluate sites that supported MED/AEC nuclear work and determine whether they need cleanup and/or control.
- dispose of or stabilize contamination in a way that is safe for the public and the environment
- perform all work in compliance with appropriate federal laws and regulations, comply with State and local environmental laws and land-use requirements; and
- certify the sites for appropriate future use.

**CONTACT:**

Formerly Utilized Sites Remedial Action Program

U.S. Army Corps of Engineers

20 Massachusetts NW,

Washington, D.C. 20314-1000

Web address: <http://www.hq.usace.army.mil/cecw/fusrap>**1.4.3 U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)****EPA Mixed Waste Team**

The EPA Mixed Waste Team is a coordinated effort among EPA headquarters and regional offices dedicated to resolving the administrative, regulatory, and technological hurdles that are facing government and private sector generators of mixed waste. EPA Offices participating in this coordinated effort include the:

- Office of Solid Waste
- Office of Radiation and Indoor Air
- Federal Facilities Enforcement Office
- Office of Compliance
- Office of Regulatory Enforcement

- Office of Administration

The team has been operating for several years, and has recently been strengthened as part of EPA's emphasis on the team management model. Some of the duties performed by the Team include:

- serving as a communication tool among regional and headquarter staff on mixed waste issues,
- providing assistance to Stakeholders and the Regulated community,
- encouraging mixed waste technologies and pollution prevention,
- analyzing the effect of current rule-making efforts on mixed waste, and
- examining the interface of mixed waste statutes and regulations.

In general, the Team serves as a focal point for coordination of mixed waste issues for the Agency. The Team meets on a monthly basis in Washington, D.C. with conference call lines available to the EPA regions. Periodic speakers and outside participants can also attend meetings at the invitation of the Mixed Waste Team Leader.

**CONTACT:**

Mixed Waste Team  
U.S. Environmental Protection Agency  
401 M Street, SW (5303W)  
Washington, DC 20460  
Phone: (202) 526-1866  
Web address: <http://www.epa.gov/radiation/mixed-waste/>

### **Office of Air and Radiation (OAR)**

The EPA OAR deals with issues that affect the quality of our air and protection from exposure to harmful radiation. OAR develops national programs, technical policies, and regulations for controlling air pollution and radiation exposure. Areas of concern to OAR include: indoor and outdoor air quality, stationary and mobile sources of air pollution, radon, acid rain, stratospheric ozone depletion, radiation protection, and pollution prevention.

**CONTACT:**

Office of Air and Radiation  
Mail Drop 6101  
401 M Street SW  
Washington, DC 20460  
Phone: (202) 564-7404  
Fax: (202) 501-0986  
Web address: <http://www.epa.gov/oar/oarhome.html>

### ***Office of Radiation and Indoor Air (ORIA)***

The goal of the ORIA is to protect the public and the environment from exposures to radiation and indoor air pollutants. The ORIA develops protection criteria, standards, and policies; 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 to 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 ORIA is EPA's lead office for intra- and inter-agency 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, including radon.

**CONTACT:**

Director  
Office of Air and Radiation  
Mail Drop 6101  
401 M Street SW  
Washington, DC 20460  
Phone: (202) 564-9320  
Fax: (202) 564-9651

### ***Radiation Protection Division (RPD)***

The EPA RPD mission is to protect the nation's people and environment from harmful exposure to radiation and to develop standards, provide guidance, and establish criteria to:

- protect the public and the environment from radiation exposure;
- clean up radioactively contaminated sites;
- identify and evaluate new radiation sources to determine any public health significance; and
- participate in Federal radiological emergency preparedness and response activities.

The RPD homepage provides detailed information to the various programs associated with radiation protection activities.

**CONTACT:**

U.S. Environmental Protection Agency  
401 M. Street, SW  
Washington, DC 20460  
Web address: <http://www.epa.gov/radiation/>

### **Remediation Technologies Development Forum (RTDF)**

The RTDF is a consortium of partners from industry, government, and academia who share the common goal of developing more effective, less costly hazardous waste treatment technologies to address complex problems of mutual concern. EPA facilitates the identification of issues of joint interest and assists in convening the initial working meetings. The collaborative research projects of the RTDF are planned and managed by the interested parties.

The RTDF members identify priority remediation technology development needs by examining their own remediation problems and the technologies currently available to meet those needs. For each priority need, the RTDF organizes an Action Team, comprised of organizations that share that particular interest, to plan and then conduct collaborative research and development projects to meet that particular need. RTDF participated in reviewing and finalizing RPD's document on "Technology Screening Guide for Radioactively Contaminated Sites."

CONTACTS:

RTDF

U.S. Environmental Protection Agency  
26 West Martin Luther King Drive  
Cincinnati, OH 45268  
(513) 569-7861

or

U.S. Environmental Protection Agency  
401 M Street, SW (5102G)  
Washington, D.C. 20460  
(703) 603-9910  
Web Address: <http://www.rtdf.org/>

#### **1.4.4 U.S. NUCLEAR REGULATORY COMMISSION (NRC)**

The U.S. NRC is an independent agency established by the U.S. Congress under the Energy Reorganization Act of 1974 to ensure adequate protection of the public health and safety, the common defense and security, and the environment in the use of nuclear materials in the United States. The mission of the U.S. Nuclear Regulatory Commission (NRC) is to ensure adequate protection of the public health and safety, the common defense and security, and the environment in the use of nuclear materials in the United States. The NRC's scope of responsibility includes regulation of commercial nuclear power reactors; non-power research, test, and training reactors; fuel cycle facilities; medical, academic, and industrial uses of nuclear materials; and the transport, storage, and disposal of nuclear materials and waste.

The NRC's scope of responsibility includes regulation of:

- commercial nuclear power reactors; non-power research, test, and training reactors;
- fuel cycle facilities; medical, academic, and industrial uses of nuclear materials; and
- the transport, storage, and disposal of nuclear materials and waste.

NRC's low-level radioactive waste activities associated with the disposal of waste in accordance with the Low-Level Radioactive Waste Policy Act of 1980, was amended in 1985. Either NRC or Agreement States must license commercial low-level waste disposal facilities in accordance with health and safety requirements. The facilities are to be designed, constructed, and operated to meet safety standards.

**CONTACT:**

US Nuclear Regulatory Commission  
One White Flint North  
11555 Rockville Pike  
Rockville, Maryland 20852-2738  
Phone: (301) 415-7000  
Web address: <http://www.nrc.gov/>

**Advisory Committee on Nuclear Waste (ACNW)**

ACNW was established by the US NRC in June, 1988 to provide the NRC with independent reviews of, and advice on, nuclear waste facilities, including application to such facilities of 10 CFR Parts 60 and 61 (disposal of high-level radioactive wastes in geologic repositories and land disposal of radioactive waste) and other applicable regulations and legislative mandates such as the Nuclear Waste Policy Act, the Low-Level Radioactive Waste Policy Act, and the Uranium Mill Tailings Radiation Control Act, as amended. The ACNW has recently, at the request of the NRC, been advising on site decommissioning issues. Before the ACNW was established, reviews of this type were performed by the ACRS, and the first members on the ACNW had been on the ACRS. The ACNW is, like the ACRS, subject to the NRC regulations set forth in 10 CFR Part 7.

The primary focus of ACNW's work is currently on waste disposal facilities. In performing its work, ACNW reviews and reports on those areas of concern referred to it by NRC and will undertake other studies and activities on its own initiative related to areas of regulatory activity identified by NRC.

**CONTACT:**

ANCW  
US Nuclear Regulatory Commission  
One White Flint North  
11555 Rockville Pike  
Rockville, Maryland 20852-2738  
Phone: (301) 415-7000  
Web Address: <http://www.nrc.gov/ACRSACNW/>

**1.4.5 DEFENSE NUCLEAR FACILITIES SAFETY BOARD (DNFSB)**

Under its enabling statute, (Public Law 100-456) the DNFSB is responsible for independent, external oversight of all activities in DOE's nuclear weapons complex affecting nuclear health and safety. This DNFSB was authorized under the National Defense Authorization Act of 1998. The DNFSB reviews operations, practices, and occurrences at DOE's defense nuclear facilities and makes recommendations to the Secretary of Energy that are necessary to protect public health and safety. In the event the DNFSB reviews disclose an imminent or severe threat to public health and safety, the DNFSB is required to transmit its recommendations directly to the President, as well as to the Secretaries of Energy and Defense.

**CONTACT:**

Defense Nuclear Facilities Safety Board  
P.O. Box 7887  
Washington, D.C. 20044-7887  
Phone: 1(800) 788-4016  
Web address: <http://www.dnfsb.gov/>

**1.4.6 U.S. NUCLEAR WASTE TECHNICAL REVIEW BOARD (NWTRB)**

The NWTRB is an independent agency of the U.S. Government. Its sole purpose is to provide independent scientific and technical oversight of the U.S. program for management and disposal of high-level radioactive waste and spent nuclear fuel from civilian nuclear power plants. Congress created the NWTRB in 1987 to review the Department of Energy's (DOE) scientific and technical activities pertaining to the management and disposal of the nation's commercial spent nuclear fuel. These activities include characterizing Yucca Mountain, Nevada, as a potential repository site, as well as packaging and transporting commercial spent nuclear fuel and defense high-level wastes.

The NWTRB provides ongoing independent and expert technical review of the DOE program. It is mandated to evaluate the science and technical work being conducted by the DOE in its commercial nuclear waste disposal program.

**The NWTRB:**

- makes scientific and technical recommendations to the DOE to ensure a technically defensible site-suitability decision and license application;
- advises the DOE on the organization and integration of scientific and technical work pertinent to the Yucca Mountain Site;
- provides an ongoing forum that fosters discussion and understanding among the DOE and its contractors of the complex scientific and technical issues facing the program;
- reports twice a year to Congress and the Secretary of Energy on scientific issues facing the nation's spent nuclear fuel disposal program;
- testifies before Congress on various legislative initiatives;
- conducts Board meetings each year, which are open to the public and two of which are in Nevada; and
- keeps up to date technical and scientific developments in the nuclear waste disposal programs of other developed countries.

**CONTACT:**

U.S. Nuclear Waste Technical Review Board,  
2300 Clarendon Blvd., Suite 1300  
Arlington, VA 22201  
Phone: (703) 235-4473  
Fax: (703) 235-4495  
E-mail: [info@nwtrb.gov](mailto:info@nwtrb.gov)  
Web address: <http://www.nwtrb.gov/>

## 1.5 NATIONAL ORGANIZATIONS

### **AMERICAN NUCLEAR SOCIETY (ANS)**

The American Nuclear Society is a not-for-profit, international, scientific and educational organization. It was established by a group of individuals who recognized the need to unify the professional activities within the diverse fields of nuclear science and technology.

Approximately 13,000 individuals representing 1,600 plus corporations, educational institutions, and government agencies belong to ANS. Approximately 1000 members live overseas in 40 countries. ANS currently has 52 U.S. and nine overseas local sections, 32 plant branches, 51 student branches, and more than 115 organization members.

The Society's main objective is to promote the advancement of engineering and science relating to the atomic nucleus, and of allied sciences and arts. Other purposes are to integrate the many nuclear science and technology disciplines, encourage research, establish scholarships, disseminate information, hold meetings for the presentation and discussion of scientific and technical papers, and cooperate with government agencies, educational institutions, and other organizations having similar purposes.

#### CONTACT:

American Nuclear Society  
555 N. Kensington Avenue  
LaGrange Park, IL 60526  
Phone: (708) 352-6611  
Fax : (708)352-0499  
Web address: <http://www.ans.org>

### **AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) COMMITTEE E-10 ON NUCLEAR TECHNOLOGY AND APPLICATIONS**

ASTM Committee E10 on Nuclear Technology and its Applications was formed in 1951. E10 meets twice a year, usually in January and June, with approximately 100 members attending three days of technical meetings. The Committee has a current membership of approximately 250, including representatives from over 20 countries. E10 has jurisdiction of over 90 standards, published in the Annual Book of ASTM Standards, Vol. 12.02. These standards have and continue to play a preeminent role in all aspects important to the nuclear industry, including radiation dosimetry, nuclear structural materials, and decontamination & decommissioning.

The main scope of the ASTM Committee E10 is to promote the advancement of nuclear science and technology and the safe application of energy by:

- standardizing measurement techniques and specifications for radiation effects and dosimetry including materials response, instrument response, and fuel burnup.
- standardizing the nomenclature and definitions used in or relating to testing methods or instruments in support of nuclear industry.

- maintaining a broad expertise in application of nuclear science and technology especially the measurement of radiation effects from environments of nuclear reactor, particle accelerators, indigenous space, spacecraft, and radionuclides.
- maintaining a broad expertise in the applications of radionuclides.
- sponsoring scientific and technical symposia and publications in the Committee's fields of specialization.
- performing liaison with related ASTM committees and other technical societies and organizations, both national and international.
- advising other technical committees of the Society in our field of expertise.

Subcommittees under Nuclear Technology and Applications include:

- E10.01 Dosimetry for Radiation Processing
- E10.02 Behavior and Use of Nuclear Structural Materials
- E10.03 Radiological Protection for Decontamination & Decommissioning of Nuclear Facilities & Components
- E10.04 Radiation Protection Methodology
- E10.05 Nuclear Radiation Metrology
- E10.07 Radiation Dosimetry for Radiation Effects on Materials and Devices
- E10.08 Procedures for Neutron Radiation Damage Simulation
- E10.92 Honors and Awards
- E10.93 Editorial
- E10.94 Membership
- E10.95 Long Range Planning
- E10.96 International Activities

CONTACT:

E10 Staff Manager

ASTM

100 Barr Harbor Drive,

West Conshohocken, PA 19428-2959

Phone: (610) 832-9738

Web address: <http://www.astm.org/COMMIT/e-10.htm>

### **BIOLOGICAL EFFECTS OF LOW LEVEL EXPOSURES (BELLE)**

In May 1990, a group of scientists representing several federal agencies, the International Society of Regulatory Toxicology and Pharmacology, the private sector, and academia met to develop a strategy to encourage the assessment of BELLE to chemical agents and radioactivity.

The focus of BELLE encompasses dose-response relationships to toxic agents, pharmaceuticals, and natural products over wide dosage ranges in in vitro, and in vivo systems, including human populations. While a principal emphasis of BELLE is to promote the scientific understanding of low-level effects (especially seemingly paradoxical effects), the initial goal of BELLE is the scientific evaluation of the existing literature and of ways to improve research and assessment methods.

**CONTACT:**

BELLE Office  
Northeast Regional Environmental Public Health Center  
School of Public Health University of Massachusetts  
Amherst, MA 01003  
Phone: (413)-545-3164  
Fax: (413)-545-4692  
E-mail: [edwardc@schoolph.umass.edu](mailto:edwardc@schoolph.umass.edu)  
Web address: <http://www.belleonline.com>

**CONCERNED CITIZENS FOR NUCLEAR SAFETY (CCNS)**

CCNS is an organization focused on increasing public awareness concerning the issues posed by radioactivity and the nuclear industry. Since its founding in 1988, CCNS has been a nonpartisan, non-profit organization based in Santa Fe, New Mexico. CCNS is composed of a broad base of citizens from a wide range of cultures who share a commitment to making public information about the environmental and economic impact of the production, handling, transportation and disposal of radioactive materials. Their purpose is:

- to compile and disseminate information to the public regarding the safety, environmental consequences, health effects and economic impact of the production, transportation, storage and disposal of hazardous and nuclear materials;
- to explore alternatives to geologic disposal of nuclear waste;
- to pursue legal and legislative options in upholding and enhancing local, State and federal regulations and health and safety standards.

CCNS also researches and maintains current, scientifically accurate information about Los Alamos National Laboratory (LANL) and the Waste Isolation Pilot Plant (WIPP) and other national and industrial projects that have to do with the production, transportation or disposal of radioactive materials. The CCNS News Update, a weekly radio news program highlighting important nuclear issues broadcast over 33 southwestern radio stations and records a Radioactive Hotline, available by phone.

**CONTACT:**

Concerned Citizens for Nuclear Safety  
107 Cienega  
Santa Fe, NM 87501  
Phone: (505) 986-1973; Hotline: (505) 982-5611 or (800) 456-8863  
Fax: (505) 986-0997  
E-mail: [ccns@nets.com](mailto:ccns@nets.com)  
Web address: <http://www.nuclearactive.org/>

**THE NATIONAL ACADEMIES**

The National Academies is a private, non-profit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Under The National Academies charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters.

## **Board of Radioactive Waste Management (BRWM)**

The BRWM was established in 1958 by the National Academy of Sciences (NAS) division of the National Academies, and is principally concerned with the safe and responsible management of radioactive wastes--including spent fuel, high-level waste from reprocessing, transuranic waste, low-level waste, mixed waste and naturally occurring radioactive materials.

The purpose of the BRWM is to help ensure that the public, workers, and the environment are protected through the appropriate management of all types of radioactive waste, including mixed waste. All steps in waste management, surveillance, and remediation must be considered, including, for example, waste minimization, generation, storage, treatment and conditioning, transport, and disposal. Overall systems performance also must be considered, as well as economic, environmental, and social values and costs. The prime concern of the BRWM is that waste management regulations, plans, and practices be based on sound scientific, technological, and procedural foundations. The BRWM will consider policy issues, as appropriate, including the public policy, sociological, and ethical aspects of radioactive waste management. These include, for example, long-term societal commitments, societal acceptability of waste management practices, and institutional capabilities in order to effectively and efficiently manage radioactive wastes. To accomplish this purpose, the BRWM reviews plans and programs; evaluates progress; conducts studies; recommends programs and actions; provides assessments; and furnishes advice and counsel.

The BRWM, primarily through the studies authorized under its guidance:

- provides assessments of existing and proposed standards, criteria, and approaches for the management of radioactive wastes;
- proposes priorities for research and funding by pertinent governmental organizations;
- conducts studies addressing risk, costs, and effectiveness of alternative strategies; and
- compares strategies for radioactive waste with those for other types of waste.

### CONTACT:

Board on Radioactive Waste Management  
National Research Council  
2101 Constitution Ave., NW  
Washington, DC 20418  
Phone: (202) 334-3066  
Fax: (202) 334-3077  
Web address: <http://www4.nas.edu/brwm/brwm-res.nsf>

## **NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS (NCRP)**

The National Council on Radiation Protection and Measurements (NCRP) seeks to formulate and widely disseminate information, guidance and recommendations on radiation protection and measurements that represent the consensus of leading scientific thinking. The Council is always on the alert for areas in which the development and publication of NCRP materials can make an important contribution to the public interest.

The Council's mission also encompasses the responsibility to facilitate and stimulate cooperation among organizations concerned with the scientific and related aspects of radiation protection and measurements.

**CONTACT:**

Publications Manager  
National Council on Radiation Protection and Measurements  
910 Woodmont Avenue, Suite 800  
Bethesda, MD 20814-3095  
Phone: (301) 657-2652  
Fax: (301) 907-8768  
Web address: <http://www.ncrp.com>

**NUCLEAR ENERGY INSTITUTE (NEI)**

The Nuclear Energy Institute focuses the collective strength of the nuclear energy industry to shape policy that ensures the beneficial uses of nuclear energy and related technologies in the United States and around the world. The Nuclear Energy Institute fosters and encourages the safe use of nuclear energy to meet the nation's energy, environmental and economic goals. NEI serves and supports the commercial energy industry by providing a unified voice to articulate the industry's position on the many complex social, political and market forces that shape energy policy.

Today, NEI is a highly focused organization that gives the industry a strong voice in national energy policy. The institute receives policy guidance from a board of directors representing all membership segments. Member advisory committees and working groups provide input in specific issue areas.

**CONTACT:**

Nuclear Energy Institute  
1776 I Street, NW, Suite 400  
Washington, D.C. 20006-3708  
Phone: (202) 739-8000  
Web address: <http://www.nei.org/index.html>

**NUCLEAR INFORMATION AND RESOURCE SERVICE (NIRS)**

NIRS is an information and networking center for citizens and environmental organizations concerned about nuclear power, radioactive waste, radiation, and sustainable energy issues. They rely on tax-deductible contributions to maintain this website and to help create a nuclear free future.

**CONTACT:**

1424 16th Street NW, #404,  
Washington, DC 20036  
Phone: (202) 328-0002  
Fax: (202) 462-2183  
E-mail: [nirsnet@nirs.org](mailto:nirsnet@nirs.org)  
Web address: <http://www.nirs.org/>

## **NUCLEAR WASTE CITIZENS COALITION (NWCC)**

The 18 organizations in this broad coalition include anti-nuclear power groups, nuclear reactor communities, peace activists, nuclear weapons opponents, groups from contaminated DOE facilities, residents of sites targeted for nuclear waste dumps, and national environmental groups. The Coalition strategy includes a combined campaign of grassroots activism and political action at the local, State, regional and national levels on the following issues:

- transfer of nuclear waste;
- health and safety risks of rail and highway shipments;
- disposition of commercial or military nuclear waste, particularly at the Yucca Mountain site; and
- reduction or elimination of sources of nuclear waste.

A Steering Committee of the NWCC acts as the overseeing body for the Waste Project and Anti-Reprocessing Campaign Coordinators, and serves as a conduit to the rest of the coalition.

### **CONTACT:**

Nuclear Waste Citizens Coalition  
c/o Citizen Alert  
P.O. Box 17173  
Las Vegas, NV 89114  
Phone: (702) 796-5662  
Fax: (202) 796-4886  
E-mail: [citizenalert@igc.org](mailto:citizenalert@igc.org)

## **SIERRA CLUB'S NUCLEAR WASTE TASK FORCE**

The Mission of the Nuclear Waste Task Force is to raise Sierra Club and public consciousness concerning the many sided, intermeshed, environmental problems associated with the production and management of nuclear waste.

The Sierra Club's Nuclear Waste Task Force has an official policy on all of the following issues.

- Decommissioning Nuclear Reactors
- Energy and Energy Economics
- Energy Facilities Siting
- Environmentally Hazardous Substances
- Hazardous Waste Management
- High-Level Nuclear Waste
- Low-Level Nuclear Waste
- Nuclear Exports and Plutonium Separation
- Nuclear Power
- Nuclear Weapons and Related Issues

**CONTACT:**

Chair, Nuclear Waste Task Force

Sierra Club

85 Second Street, Second Floor

San Francisco CA, 94105-3441

Phone: (415) 977-5500

Fax: (415) 977-5799

E-mail : [information@sierraclub.org](mailto:information@sierraclub.org)

Web address: <http://www.sierraclub.org/nuke/>

## 1.6 INTERNATIONAL ORGANIZATIONS

### INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA)

The IAEA serves as the world's central intergovernmental forum for scientific and technical co-operation in the nuclear field, and as the international inspector for the application of nuclear safeguards and verification measures covering civilian nuclear programs.

The IAEA's Radioactive Waste Safety Standards (RADWASS) program is focused on the establishment of a comprehensive set of internationally agreed safety standards with the active involvement of Member States and under the supervision of an international advisory committee. Other elements in the program are mainly aimed at providing guidance and assistance to Member States in the implementation of these standards. An important step towards reaching the goal of an international safety regime in the area of radioactive waste safety was the adoption of the 1997 Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the 'Joint Convention'), for which the Agency serves as the secretariat.

#### CONTACT:

IAEA

P.O. Box 100

Wagramerstrasse 5 A-1400

Vienna, Austria

Phone: (43-1) 2600-0

Fax: (43-1) 2600 7

E-mail: [Official.Mail@iaea.org](mailto:Official.Mail@iaea.org)

Web address: <http://www.iaea.org/worldatom/>

### INTERNATIONAL COMMISSION ON RADIATION UNITS AND MEASUREMENTS (ICRU)

The ICRU was established in 1925 by the International Congress of Radiology. Since its inception, it has had as its principal objective the development of internationally acceptable recommendations regarding:

- quantities and units of radiation and radioactivity;
- procedures suitable for the measurement and application of these quantities in diagnostic radiology, radiation therapy, radiation biology, and industrial situation; and
- physical data needed in the application of these procedures, the use of which tends to assure uniformity in reporting.

The ICRU endeavors to collect and evaluate the latest data and information pertinent to the problems of radiation measurement and dosimetry, and to recommend in its publications the most acceptable values and techniques for current use.

In recent times, the Commission has addressed the complex problems of assessing radiation exposure for protection purposes. A set of quantities and units has been developed which facilitates comparison of exposures with established limits.

**CONTACT:**

ICRU

7910 Woodmont Avenue

Suite 800

Bethesda, MD 20814-3095

Phone: (301) 657-2652

Fax: (301) 907-8768

E-mail: [icru@icru.org](mailto:icru@icru.org)Web address: <http://www.icru.org>**INTERNATIONAL ENERGY AGENCY (IEA)**

The IEA is the energy forum for 24 industrialized countries. IEA member governments are committed to taking joint measures to meet oil supply emergencies. They also have agreed to share energy information, to coordinate their energy policies and to cooperate in the development of rational energy programs. These provisions are embodied in the Agreement on an International Energy Program (IEP), which established the Agency in 1974.

**Energy Technology Data Exchange (ETDE)**

ETDE, through its member countries, provides an extensive bibliographic database announcing published energy research and technology information. As an IEA Implementing Agreement, ETDE has four objectives regarding topics in energy research and technology. These objectives are to:

- collect and exchange energy research and technology information through the creation and maintenance of a common database.
- disseminate and promote the energy research and technology information managed by the Exchange
- support IEA's strategic priorities and initiatives relevant to energy technology and R&D collaboration.
- collaborate with other providers of energy research and technology information in order to avoid duplication of efforts.

The ETDE program began in 1987 with 11 countries and now has 18 member countries. As with all IEA program, ETDE functions through Contracting Parties and an Operating Agent (OA). The Contracting Parties ensure that the energy information published within their national borders is announced in ETDE's Energy Database. Each Contracting Party assigns delegates to represent them on ETDE's Executive Committee and Technical Working Group. The Executive Committee sets policy for the Exchange and oversees budgetary matters. The Technical Working Group oversees the technical aspects of maintaining and improving the Energy Database.

ETDE's OA is the U.S. Department of Energy's Office of Scientific and Technical Information. The OA acts on behalf of the Contracting Parties that are designated by the government of every ETDE member country. Located in Oak Ridge, Tennessee, the OA handles the daily tasks that keep the Exchange functioning smoothly. Among those tasks are:

- receiving and processing data submitted by member countries

- providing quality assurance and semi-monthly database updates to members
- providing member support and training
- implementing Executive Committee decisions
- facilitating projects of the Technical Working Group
- publishing authorities and standards for the Energy Database
- maintaining financial records and projections
- serving as liaison with collaborating agencies
- preparing a quarterly newsletter, annual report, statistics, and other marketing materials

The Energy Database is gaining strong recognition as the leader for broad environmental coverage among a number of individual databases. The Energy Database includes records on the latest energy technologies that can help mitigate greenhouse gases and environmental aspects of energy production and use, such as oil spill cleanup devices and air pollution monitoring techniques. Environmental coverage also includes:

- analysis and assessment of environmental policy issues and legislation
- state-of-the-art hazardous and radioactive waste disposal practices
- environmental impact assessments for government-funded energy projects
- environmental restoration activities and lessons learned
- pollution mitigation activities, such as clean coal technology
- global climate change and greenhouse gas emissions
- substitution of less polluting energy sources
- advanced automotive engineering to reduce fuel consumption and pollution

**CONTACT:**

ETDE Operating Agent  
P.O. Box 1000  
Oak Ridge, TN 37831  
Phone: (423) 576 1272  
Fax: (423) 576 2865  
E-mail: [info@etde.org](mailto:info@etde.org)  
Web address: <http://www.etde.org/edb/environ.html>

**ETDE's Contact at the IEA:**

ETDE Desk Officer  
Office of Energy Efficiency, Technology and R&D  
International Energy Agency  
9, rue de la Fédération  
75739 Paris CEDEX 15 France  
Phone: 33 1 40 57 67 62  
Fax: 33 1 40 57 67 59  
Web address: <http://www.iea.org/>

## **INTERNATIONAL RADIATION PROTECTION ASSOCIATION (IRPA)**

The IRPA is the worldwide international association made up of individual members who are members of an affiliated national or regional Associate Society. IRPA now has more than 16,000 individual members in 38 Associate Societies that are active in 44 different countries.

The primary purpose of IRPA is to provide a medium whereby those engaged in radiation protection activities in all countries may communicate more readily with each other and through this process advance radiation protection in many parts of the world. This includes relevant aspects of such branches of knowledge as science, medicine, engineering, technology and law, to provide for the protection of man and his environment from the hazards caused by radiation, and thereby to facilitate the safe use of medical, scientific, and industrial radiological practices for the benefit of mankind.

It is a major task for IRPA to provide for and support international meetings for the discussion of radiation protection. The International Congresses of IRPA itself are the most important of these meetings. These have been held about every four years since 1966.

**CONTACTS:**

President

IRPA, Division of Radiation and Waste Safety

P.O. Box 100, A-1400 Vienna, Austria

Phone: 43-(1) 2060 22550

Fax: 43-(1) 2060 29550

10 Harbor Heights

P.O. Box 100

Gloucester, MA 01931-0100

Phone: (617) 253-9217

Fax: (617) 253-9624

Web address: <http://irpa.sfrp.asso.fr/index.html>

## **ORGANIZATIONS FOR ECONOMIC COOPERATION AND DEVELOPMENT (OECD)**

### **Nuclear Energy Agency Radioactive Waste Management (OECD/NEA)**

The NEA is an agency of the OECD. The objective of the agency is to contribute to the development of nuclear energy as a safe, environmentally acceptable and economical energy source through cooperation among its participating countries. The NEA has a few applicable committees of which their goals and tasks include:

- developing common approaches for radioactive waste management strategies;
- building confidence in long-term safety assessment of waste disposal systems and site evaluation methods;
- arranging international "peer reviews" of national programs; and
- promoting internationally accepted technical solutions for decommissioning of obsolete nuclear facilities through a co-operative program for the exchange of scientific and technical information.

### ***Radioactive Waste Management Committee (RWMC)***

RWMC is an international committee made up of senior representatives from regulatory authorities, radioactive waste management agencies, and research and development institutions. Its purpose is to foster international cooperation in the field of radioactive waste management amongst the OECD Member Countries. The main tasks of the RWMC are:

- to constitute a forum for the exchange of information and experience on waste management policies and practices in NEA Member countries;
- to develop a common understanding of the basic issues involved, and to promote the adoption of common philosophies of approach based on the discussion of the various possible waste management strategies and alternatives;
- to keep under review the state-of-the-art in the field of radioactive waste management at the technical and scientific level;
- to contribute to the dissemination of information in this field through the organization of specialist meetings and publication of technical reports and consensus statements summarizing the results of joint activities for the benefit of the international scientific community, competent authorities at national level and other audiences generally interested in the subject matter;
- to offer, upon request, a framework for the conduct of international peer review of national activities in the field of radioactive waste management, such as R&D programs, safety assessments, specific regulations, etc.

In the fulfillment of its responsibilities, the RWMC works in close cooperation with the *Committee on Radiation Protection and Public Health (CRPPH)*, the *Committee on Nuclear Regulatory Activities (CNRA)* and the *Committee on the Safety of Nuclear Installations (CSNI)* and with other NEA Committees as appropriate.

#### ***Performance Assessment Advisory Group (PAAG)***

PAAG was established by the RWMC early in 1986 with the mandate to advise it on technical aspects of the performance assessment (PA) of radioactive waste disposal systems and to help co-ordinate the NEA activities in this area. Since then the Group has served as an international forum for discussion and information exchange between the Member countries on performance assessment matters and has established working groups, held workshops and symposia, and performed studies of specific issues including the sponsoring of program reviews on behalf of Member organizations. These initiatives have helped build consensus and confidence among the Member countries on technical issues that affect all repository programs and have assisted in the development of advanced generic methods and tools for the assessment of the safety of radioactive waste repositories.

PAAG is composed of senior performance assessment experts and regulators from all NEA members with radioactive waste management programs.

#### ***Coordinating Group on Site Evaluation and Design of Experiments for Radioactive Waste Disposal (SEDE)***

SEDE is an international forum on methodologies and strategies for characterizing and evaluating disposal site. It consists of senior experts from the NEA Member countries representing national organizations with responsibility for either implementing or regulating the disposal of radioactive waste, or for performing R&D in this field. The interest is in both near-surface and deep geological disposal systems, even if emphasis has been placed on the latter up to now.

Within the general aim of promoting actions that enhance the confidence in safety assessment of radioactive waste repositories, the general objectives of the SEDE are:

- to exchange information between different site evaluation projects in particular concerning methodologies for data collection, design of experiments, modeling and interpretation of data for site characterization and evaluations for use in performance assessment and repository design;
- to discuss problems of mutual concern among the different site evaluation projects, to recommend and implement initiatives for international co-operation that will address these problems;
- to define a process of site characterization leading to site evaluation and determination of site suitability.

To achieve these objectives, the SEDE resorts to mechanisms well known within the NEA context: information exchange sessions, topical sessions, technical reports, working groups, workshops and joint projects.

The SEDE program of work is developed to serve a diverse set of needs. Indeed, different rock types, and geological and hydrogeological environments presenting potentially different capabilities are under investigation in the Member countries. Moreover, different organizations are at different stages of their national site evaluation programs: some countries have not yet conducted site-specific research at potential repository location(s) and are still undertaking generic feasibility studies; other countries are already involved in repository site selection; other countries have already specified potential repository site(s) that are now being characterized to assess their suitability.

CONTACT:  
OECD Washington Center  
2001 L Street, NW,  
Suite 650  
Washington, DC 20036-4922  
Phone: (202) 785-6323  
Fax: (202) 785-0350  
E-mail: [washington.contact@oecd.org](mailto:washington.contact@oecd.org)  
Web Address: [www.oecdwash.org](http://www.oecdwash.org)

## **GLOSSARY OF BASIC RADIATION REGULATORY TERMS**

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## GLOSSARY OF BASIC RADIATION REGULATORY TERMS

### 2.1 INTRODUCTION

The development and use of radioactive materials inevitably results in the production of radioactive waste. The management of this waste has led to the development of definitions and authorities to assign responsibility for their handling. The High-Level Waste (HLW) is regulated by the Nuclear Waste Policy Act (10 CFR 60), while the Low-Level Waste (LLW) is regulated by the Low-Level Radioactive Waste Policy Act (10 CFR 61), which also dictates categorization of Class A, B, C and Greater-Than-Class C Wastes. The Transuranic (TRU) Waste is regulated by 40 CFR 91, while waste or special nuclear material is regulated by the Atomic Energy Act. Naturally Accelerator Produced Radioactive Material and Naturally Occurring Radioactive Material (NARM/NORM) Waste produced as a result of nuclear transformation in an accelerator is under State authority, while the Mixed Waste found commonly at most Superfund, DOE and RCRA sites are regulated by Federal Facility Compliance Act of 1992.

The purpose of this glossary is to consolidate pertinent regulatory and technical terms and acronyms used in the radioactive waste management field to be used as a handy reference tool. Most of these terms have been extracted from various existing glossary sources, such as those used by USEPA's Mixed Waste Office and the Uranium Institute. For convenience, these terms have been grouped by their similarity of usage and source into the following subgroups:

- Basic radionuclide terms constitute the technical terms commonly used in the ionizing radiation field and also those used in the health physics and exposure/risk assessment;
- NRC/DOE regulatory terms are those related to Atomic Energy Act (AEA) and other regulations related to the Department of Energy;
- EPA regulatory terms include those relating to Environmental Protection Agency activities; and,
- DOT regulatory terms include those terms specific to regulations relating to transportation of radioactive materials.

To complement the basic terminology summarized here, this section also includes information related to new and old radiological units and their common conversions, Standard International (SI) prefixes used, and basic information on some common radionuclides.

Some of the regulatory terms are specific to certain regulations while others are more generic. Here, only the specific regulatory terms have been referenced with either the regulation or the Federal Register notice, while for generic regulatory and technical terms, a bibliography of pertinent regulatory and technical documents has been provided in Appendix B.

## **2.2 BASIC RADIONUCLIDE TERMS**

### **2.2.1 IONIZING RADIATION TERMS**

#### **Activity**

The rate of transformation (or "disintegration" or "decay") of radioactive material. The units of activity are the curie (*Ci*) and the becquerel (*Bq*).

#### **Alpha Particle**

A positively charged nuclear particle identical to the nucleus of a helium atom that consists of two protons and two neutrons and is ejected spontaneously at a high speed in certain radioactive transformations.

#### **Alpha Radiation**

Emission of an alpha particle from a radionuclide. Alpha radiation is more damaging than the same dose of beta or gamma radiation but can be stopped by a sheet of paper.

#### **Atom**

The basic building block of all matter. An atom has a relatively heavy nucleus made up of positively charged protons and neutral neutrons surrounded by orbiting electrons with a negative charge equaling that of the protons in the nucleus. The number and distribution of electrons (from 1 to 92) determines the chemical characteristics of the atom. The number of neutrons and protons in the nucleus (from 1 to 238) determines the weight and isotope of the atom.

#### **Atomic Mass**

The mass of a neutral atom of a nuclide; usually expressed in terms of the physical scale of atomic masses, i.e., in atomic mass units (amu). Originally defined as the number of protons and neutrons in the nucleus of an atom. Now measured in amu's which are exactly one twelfth the mass of a neutral atom of carbon-12 ( $\mu=1.660 \times 10^{-27}$  kg.)

#### **Atomic Number**

The number (*Z*) of protons within the atomic nucleus. The electrical charge of these protons determines the number and arrangement of the outer electrons of the atoms, and thereby the chemical and physical properties of the elements.

**Atomic Weight**

The relative weight of an atom on the basis of an oxygen atom having an atomic weight of 16. For a pure isotope, the atomic weight rounded off to the nearest integer gives the total number of nucleons (protons and neutrons) in the nucleus.

**Background Radiation**

The naturally occurring nuclear radiation coming from outer space as cosmic radiation, or from naturally occurring radioactive atoms such as uranium and radium in the materials of the earth. It is also called natural radiation.

**Becquerel**

A standard international (SI) unit used to measure radioactivity. One becquerel is the activity of a quantity of radioactive material in which one nucleus decays per second. Symbol Bq. The Bq is a very small unit, often radioactivity is expressed in larger units like: thousands kilobecquerel (KBq or  $10^3$ Bq), gigabecquerel (GBq or  $10^9$  Bq) or terabecquerel (TBq or  $10^{12}$  Bq). The unit is named after A. Henri Becquerel who first discovered radioactivity in 1896 in a uranium salt. Replaces the curie (Ci). One curie is equal to  $3.7 \times 10^{10}$  becquerels.

**Beta Particle**

A negatively charged particle that is emitted by the nucleus of certain radioactive atoms during radioactive decay. A beta particle is identical to an electron.

**Beta Radiation**

Emission of an electron (or a particle of equal weight to an electron but with a positive electrical charge, positron) from a radionuclide. Less damaging than the same doses of alpha radiation but rather more penetrating. Can be stopped by a thin sheet of metal or plastic.

**Chain Reaction**

A reaction that initiates its own repetition in nuclear fission.

**Charged Particle**

Parts of an atom possessing a small charge of static electricity. A proton has a single unit of positive charge. An electron has a single unit of negative charge. A very large number of electrons passing through a conductor produce an electrical current.

**Counter**

A general designation applied to radiation detection instruments or survey meters that detect and measure radiation. The signal that announces an ionization event is called a count.

**Cosmic Radiation**

Highly penetrating ionizing radiation, both particulate and electromagnetic, originating in outer space. Secondary cosmic rays, formed by interactions in the earth's atmosphere, account for about 45 to 50 mrem of the 125 mrem background radiation that an average individual receives annually.

**Cpm**

Counts per minute.

**Critical Group**

A group of individuals reasonably expected to receive the greatest exposure to releases over time, given the circumstances under which the analysis would be carried out.

**Critical Mass**

The minimum amount of fuel need in the core of a nuclear reactor in order to start a self-sustaining chain reaction. When a reactor starts up it is said to "go critical".

**Curie (Ci)**

The unit of measure of radioactivity that equals the quantity of radioactive material that will have to  $3.7 \times 10^{10}$  disintegrations per second or  $3.7 \times 10^{10}$  becquerel (Bq). A common unit used in environmental measurements are smaller units such as the picocurie (pCi) which is equal to one trillionth ( $1/10^{12}$ ) Ci.

**Depleted Uranium**

Uranium which has less of the fissionable U-235 isotope than the approximate 0.7% by weight found in natural uranium. It is rich in the U-238 isotope.

**Decay**

Radioactive emission takes place at the instant that an atom disintegrates. As the number of radioactive atoms is reduced by this disintegration, the rate of radioactive emission is said to decay or lessen with time.

**Decay Chain**

A series of radionuclides each of which disintegrates into the next until a stable nuclide is reached.

**Decay Constant**

The fraction of the amount of a radionuclide that undergoes transition per unit time.

**Decay Product**

Nuclide or radionuclide produced by decay.

**Deuterium**

A stable, naturally occurring hydrogen isotope. Its natural abundance is about one part in 7000 of hydrogen. Used in the form of deuterium oxide.

**Deuterium Oxide**

Known as "heavy water", it is the most effective moderator available for nuclear reactors. Heavy water occurs in natural water in approximately one part in 7000.

**Disintegration**

Used to describe any process in which the arrangement of particles in the nucleus of an atom is disrupted, producing a change in the nature of the atom. It may happen spontaneously, in the case of a radioactive atom, or as a result of bombardment by other particles.

**dpm**

Disintegrations per minute, the rate of emissions by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

**Electromagnetic Radiation**

Electromagnetic waves of a range of frequencies which includes radio, infrared, visible light, ultraviolet, x-rays, gamma rays and cosmic rays Each ray has a different characteristic wavelength. See also background radiation.

**Electron**

An elementary particle carrying one unit of negative electrical charge. Electrons determine the chemical behavior of elements.

**Element**

Atoms that have the same number of protons in the nucleus. Such atoms have the same chemical properties.

**Enrichment of Uranium**

The physical process of increasing the concentration of the uranium-235 isotope relative to the predominant uranium-238 isotope in natural uranium. For pressurized water reactor (PWR) fuel the proportion of uranium-235 is typically increased from 0.7% to between 3% and 5%. Current technologies for enriching uranium include the gas centrifuge process and the gas diffusion process, both of which use uranium hexafluoride as their feedstock.

**Exosphere**

The outermost layer of the Earth's atmosphere, starting about 400 km above the Earth's surface.

**Fissile**

Capable of fission.

**Fissile Material**

Although sometimes used as a synonym for fissionable material, this term has acquired a more restricted meaning; namely, any material fissionable by *thermal* (slow) neutrons. The three primarily fissile materials are uranium-233, uranium-235, and plutonium-239.

**Fission**

The splitting of a heavy nucleus into two parts. The release of energy and two or more neutrons accompany fission. It may occur spontaneously or be induced by capture of bombarding particles, generally neutrons.

**Fission Products**

The two smaller atoms produced as fragments when a large atom is fissioned. The size of these fragments varies, producing a mixture of many different atoms. See reprocessing.

**Fuel Cycle (Nuclear)**

All the stages involving the fuel - from uranium mining and making yellowcake, to the fuelling of a reactor, recycling of unused fuel, and radioactive waste management.

**Fusion**

The joining of two light nuclei such as helium or hydrogen to form a heavier nuclei. This is usually accompanied by the release of energy. The energy from the sun is produced by fusion.

**Giga (Ga)**

Giga is a unit of measure of radioactive elements. One Giga is equal to ( $10^9$ ) years.

**Gamma Radiation**

High energy, short wavelength radiation emitted from the nuclei of atoms. Less damaging than the same dose of alpha radiation but much more penetrating. Can be stopped by thick slabs of lead or concrete.

**Geiger-Mueller Counter**

A radiation detection and measuring instrument. It consists of a gas filled tube that contains electrodes, between which there is an electrical voltage but no current flowing. When ionizing radiation passes through the tube, a short, intense current passes from the negative electrode to the positive electrode and is measured or counted. The number of pulses per second measures the intensity of radiation. It was named for Hans Geiger and W. Mueller who invented it in the 1920s. It is sometimes called simply a Geiger counter or a G-M Counter.

**Graphite**

A dense black crystalline form of pure carbon which is an efficient moderator of neutrons; i.e. slows them down.

**Gray (Gy)**

SI unit of absorbed dose. Named after L. H. Gray, the British radiation biologist, and equal to the absorption of one joule of energy in one kilogram of tissue. The older unit rad is one hundred times smaller than the gray.

**Half-life**

The time for the activity of a radioactive isotope to decay to half its original value. Each radioactive isotope has a characteristic half-life, e.g. U-235 =  $0.7038 \times 10^9$  years; U-238 =  $4.468 \times 10^9$  years. (See decay).

Biological half-life is the time required for a biological system, such as a human, to eliminate, by natural processes, half the amount of a substance, such as radioactive material, that has entered the body.

**Heat Exchanger**

A unit in which the heat from one fluid (liquid or gas) is transferred to another. It usually takes the form of a bank of tubes carrying one fluid (the primary) which is heated by the reactor. Then a second fluid in a separate set of tubes is heated by the primary fluid. In the case of steam generators used in a PWR, both fluids are water, with the primary fluid circulating round the reactor and the secondary fluid circulating as steam through the turbine.

**Highly Enriched Uranium (HEU)**

Uranium in which the proportion of the fissile isotope, U-235, has been increased from the naturally occurring 0.71% to a high level, normally taken to be at least 90% for weapons purposes, but defined as anything over 20% for regulatory and safeguards purposes.

**Induced Radioactivity**

Radioactivity that is created when stable substances are bombarded by neutrons or other particles. For example, the stable isotope cobalt-59 becomes the radioactive isotope cobalt-60 under neutron bombardment.

**Ion**

An atomic particle, atom or chemical radical, either bearing an electrical charge, either negative or positive. Positive ions are formed when neutral atoms or molecules lose valence (outer) electrons; negative ions are those which have gained electrons.

**Ionization**

The process of splitting an atom or a molecule into a positive and a negative ion.

**Ionizing Radiation**

Any type of radiation which, directly or indirectly, can change the electric charges of atoms or molecules. In other words, ionizing radiation is radiation with enough energy so that during interaction with an atom, it can remove tightly bound electrons from their orbits, causing the atom to become charged or ionized. Ionizing radiation is produced when radionuclides decay. Examples are gamma rays and neutrons.

**Irradiation**

The bombarding of atoms with nuclear particles to change the structure of the nucleus and produce radioactive atoms. Fuel that has been in a reactor is often called "irradiated" because it has been bombarded with neutrons and has become radioactive.

**Isotope**

Different forms of atoms of the same element. Isotopes have the same number of protons in their nuclei (otherwise they would not be the same element); it is the number of neutrons that differs. They are described by the total number of particles in their nuclei. For example uranium-238 is uranium with 92 protons and 146 neutrons and uranium-235 is uranium with 92 protons and 143 neutrons: hydrogen-1 is hydrogen with 1 proton and no neutrons, and hydrogen-2 (commonly called deuterium) is hydrogen with 1 proton and 1 neutron. Isotopes may be stable (i.e. not spontaneously decaying) or unstable (i.e. spontaneously decaying, emitting ionizing radiation).

**Low Enriched Uranium (LEU)**

Any form of uranium having a U-235 isotope concentration greater than 0.71% but below 20%. Typical concentrations used in light water reactors range from 3% to 5%.

**Light Water**

Term used to distinguish ordinary water from heavy water. A light water reactor is cooled by ordinary water. Heavy water, on the other hand, is water that is rich in the heavy isotopes of hydrogen. It is an efficient moderator used in some other types of reactors.

**Natural Uranium**

Uranium with the isotopic concentrations found in nature, i.e. 99.3% uranium-238 and 0.71% uranium-235. (See enrichment, depleted uranium, and highly enriched uranium)

**Neutron**

One of the particles found in the nucleus of an atom, so-called because it has no electric charge. Free neutrons, released by fissioning or radioactive disintegration of atoms, are very penetrating. When they collide with the nuclei of other atoms they are likely to cause a wide variety of changes, or transmutations, in the physical characteristics of the atoms they strike.

**Non-ionizing Radiation**

It is radiation without enough energy to remove tightly bound electrons from their orbits around atoms. Examples are microwaves and visible light.

**Nucleus**

The small, central, part of an atom, consisting of protons and neutrons and having positive electrical charge.

**Nuclide**

A species of atom distinguished by the constitution of its nucleus. The nuclear constitution is specified by the number of protons, neutrons and energy content.

**Pitchblende**

A mineral composed of microcrystalline uranium dioxide (UO<sub>2</sub>).

**Plutonium**

An element with atomic number 94. A metallic by-product of nuclear fission of uranium. It is formed by the capture of a neutron by atoms of uranium-238. Plutonium also fissions and hence can be recycled as fuel either in the same type of reactor as it was produced or in future fast breeder reactors.

**Positron**

Particle equal in mass, but opposite in charge, to the electron; a positive electron.

**Proton**

Elementary particle with positive electrical charge which forms part of the nucleus of every atom. The number of protons in the nucleus of an atom determines the atomic number and distinguishes elements from one another.

**Radiation**

Energy given off by atoms when they are moving or changing state. Can take the form of electromagnetic waves, such as heat, light, X-rays, or gamma rays, or streams of particles such as alpha particles, beta particles, neutrons or protons.

**Radioactive Contamination**

Deposition of radioactive material in any place where it may harm persons or equipment, or environment.

**Radioactivity**

The spontaneous disintegration of unstable atomic nuclei with emission of energy in the form of ionizing radiation. This process is referred to as transformation, a decay or a disintegration of an atom.

**Radioisotope**

A radioactive isotope (see isotope)

**Radiometric**

Using radiation for detection.

**Radionuclide**

A nuclide that decays spontaneously, emitting ionizing radiation.

**Radium (Ra)**

A radioactive metallic element (Ra) with atomic number 88, used specially in luminous materials. It is a decay product of uranium.

**Radon (Rn)**

An element (Rn) with atomic number 86. An odorless, invisible, heavy gas which is the most significant source of natural radiation exposure. Its solid decay products - radon daughters - decay quickly, but can be inhaled and irradiate the lungs.

**Reactivity**

The departure of a reactor system from criticality; positive reactivity addition means a move towards power increase; negative a move towards power decrease.

**Reactivity Coefficient**

The ratio of change in reactivity to a change in a specified parameter such as temperature, pressure, void, power, and mass.

**Re-Conversion**

Process of converting enriched UF<sub>6</sub> back into a solid oxide form, typically UO<sub>2</sub>, prior to manufacture of fuel pellets.

**Redox**

Chemical reactions where an oxidizing agent is reduced and a reducing agent is oxidized.

**RepU**

Uranium extracted from spent fuel that may return to the fuel cycle to be fabricated as new fuel. RepU has a different isotopic composition than "fresh" uranium and generally contains higher proportions of U-232, U-234 and U-236.

**Reprocessing**

Chemical treatment of spent fuel from a nuclear reactor to separate unused uranium and plutonium from radioactive fission product wastes. This allows recycle of valuable fuel material and minimizes the volume of high-level waste materials.

**Short-Lived Daughters**

Radioactive isotope progeny of radioactive isotopes that have half-lives on the order of a few hours or less.

**Specific Activity**

The number of radioactive decays that take place per unit mass. In general this means that a low specific activity material releases a relatively small amount of radiation.

**Spent Fuel**

Fuel assemblies taken out of a nuclear reactor after a period of useful energy production. Also referred to as irradiated fuel or used fuel.

**Tails**

Common term for the residual waste from mining and milling also frequently applied to depleted uranium from enrichment.

**Tails Assay**

The concentration of the U-235 isotope remaining in tails material, most applicable to depleted uranium from enrichment.

**Transmutation**

The changing of atoms of one element into another by bombardment with nuclear particles; e.g. uranium-238 into plutonium or thorium into uranium-233 by neutron bombardment.

**Transuranic Elements**

Elements with atomic numbers higher than that of uranium (92).

**Tritium**

An abundant radioactive isotope of hydrogen (one proton, two neutrons). Because tritium is chemically identical to the most natural hydrogen isotope (one proton, one neutron), tritium can easily be taken into the body by any ingestion path. Decays by beta emission. Its radioactive half-life is about 12½ years.

**Uranium**

The heaviest naturally occurring element - atomic number 92.

**Vitrification**

Incorporation of radioactive waste materials into molten glass and formed into a solid ingot of glass, sealed in a steel container, for disposal in a repository.

## **2.2.2 HEALTH PHYSICS/EXPOSURE TERMS**

### **Absorbed Dose**

The energy imparted to a gram of tissue by radiation. It is measured in grays (Gy).

### **Activity Median Aerodynamic Diameter (AMAD)**

A method of characterizing average particle size.

### **Bioassay**

The determination of kinds, quantities or concentrations, and, in some cases, the locations of radioactive material in the human body, whether by direct measurement, in-vivo counting, or by analysis and evaluation of materials excreted or removed from the human body. "Radiobioassay" is an equivalent term.

### **Body Burden**

The amount of radioactive material that if deposited in the total body will produce the maximum permissible dose rate to the body organ considered the critical organ.

### **Chronic Exposure**

The absorption of radiation (or intake of radioactive materials over a long period of time, i.e., over a lifetime).

### **Class**

A classification scheme for inhaled material according to its rate of clearance from the pulmonary region of the lung. Materials are classified as D, W, or Y, which applies to a range of clearance half-times: for Class D, Days, of less than 10 days, for Class W, Weeks, from 10 to 100 days, and for Class Y, Years, of greater than 100 days ("lung class" and "inhalation class" are equivalent terms).

### **Collective Effective Dose Equivalent (for Collective Dose)**

Effective dose equivalent to a group of people exposed to a source of radiation. Equal to the average effective dose equivalent multiplied by the number of people exposed. It is measured in man sieverts (man Sv).

### **Committed Effective Dose**

The sum of the products of the weighting factors applicable to each of the body organs or the tissues that are irradiated and the committed equivalent dose to these organs or tissues ( $H_{E50} = \sum W_T H_{T-50}$ ). The unit of committed effective dose is the *sievert*.

### **Committed Dose Equivalent ( $H_{T-50}$ )**

The dose equivalent to organs of tissues of reference (T) that will be received from an intake of radioactive material by an individual during the 50-year period following the intake. The ICRP defines this as the committed equivalent dose. The units of committed equivalent dose are the *rem* or the *sievert*.

### **Critical Organ**

The body organ receiving a radionuclide of radiation dose that results in the greatest overall damage to the body.

### **Cumulative Dose**

The total dose resulting from repeated exposures of radiation to the same region, or to the whole body, over a period of time.

### **Dose or Radiation Dose**

The energy of radiation can damage human living tissue by causing chemical changes in cells that can have biological effects. The amount of damage depends on the energy of the radiation, how much of it is absorbed, which parts of the body absorb it and the timing and duration of the absorption over lifetimes and generations.

### **Dose equivalent**

Absorbed dose adjusted to allow for the biological harmfulness of different kinds of radiation. It is measured in sieverts (Sv).

### **Effective Dose ( $E$ )<sup>c</sup>**

The sum over specified tissues of the products of the equivalent dose in a tissue (T) and the weighting factor for that tissue ( $W_T$ ). i.e.,  $E^c = \sum W_T H_T$ .

### **Effective Dose equivalent**

Dose equivalent adjusted to allow for the different susceptibilities to harm of different tissues. It is measured in sieverts (Sv).

**Equivalent Dose ( $H_T$ )<sup>c</sup>**

A quantity used for radiation-protection purposes that takes into account the different probability of effects which occur with the same absorbed dose delivered by radiations with different  $W_R$  values. It is defined as the product of the averaged absorbed dose in a specified organ or tissue ( $D_T$ ) and the radiation-weighting factor ( $W_R$ ). The unit of equivalent dose is joules per kilogram ( $\text{JKg}^{-1}$ ) and its name is the sievert ( $Sv$ ).

**Dose Conversion Factor (DCF)**

Any factor that is used to change an environmental measurement to dose in the units of concern. Frequently used as the factor that expresses the committed effective dose equivalent to a person from the intake (inhalation or ingestion) of a unit of a given radionuclide.

**Dose Rate**

The radiation dose delivered per unit of time. Measured, for example, in *rem* or *Sv* per hour.

**Excess Lifetime Cancer Risk**

The incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen.

A cancer risk of  $1 \times 10^{-6}$  is one additional case of cancer (over background levels) per million people exposed (a one in a millions chance of having cancer in a lifetime).

**Exposure (as a radiological unit)**

The quotient of  $dQ$  by  $dm$  where " $dQ$ " is the absolute value of the total charge of the ions of one sign produced in air when all the electrons (negatrons and positrons) liberated by photons in a volume element of air having mass " $dm$ " are completely stopped in air. The SI unit of exposure is the coulomb per kilogram ( $C/kg$ ) and the older special unit is the roentgen ( $R$ ).

**External Dose**

The portion of dose equivalent received from external exposure to radioactive materials.

**Internal Dose**

That portion of dose equivalent received from radioactive material taken into the body.

**Internal Dosimetry**

Calculation of the *dose* to a person from radioactive materials deposited in, or in transit, through the body.

**Picocurie**

One trillionth ( $10^{-12}$ ) part of a *curie*.

**Radiation Absorbed Dose (Rad)**

The rad is a unit used to measure absorbed dose. One rad is defined as the absorption of 100 ergs per gram of material.

**Radiation Sickness**

The complex of symptoms characterizing the disease known as radiation injury, resulting from excessive exposure of the whole body ( or large part) to *ionizing radiation*. The earliest of these symptoms are nausea, fatigue, vomiting, and diarrhea, which may be followed by loss of hair (epilation), hemorrhage, inflammation of the mouth and throat, and general loss of energy. In sever cases, where the radiation exposure has been relatively large, death may occur within two to four weeks. Those who survive six weeks after the receipt of a single large dose of radiation may generally be expected to recover.

**Radiation Standards**

Exposure standards, permissible concentrations, rules for safe handling, regulations for transportation, regulations for industrial control of radiation and control of radioactive material by legislative means.

**Radiological Survey**

The evaluation of the radiation hazards accompanying the production, use, or existence of radioactive materials under a specific set of conditions. Such evaluation customarily includes a physical survey of the disposition of materials and equipment, measurements or estimates of the levels of radiation that may be involved, and a sufficient knowledge of processes affecting these materials to predict hazards resulting from unexpected or possible changes in materials or equipment.

**Roentgen Equivalent Man (Rem)**

The special unit of any of the quantities expressed as dose equivalent. This relates the absorbed dose in human tissue to the effective biological damage of the radiation. Not all radiation has the same biological effect, even for the same amount of absorbed dose. Here the quality factor ( $\theta$ ) is unique to the type of incident radiation. The dose equivalent is often expressed in terms of thousandths of rem or mrem. The equivalent dose (*rem*) is equal to the absorbed dose (*rad*) multiplied by the quality factor ( $1 \text{ rem} = 0.01 \text{ sievert}$ ).

**Roentgen**

A unit of exposure to ionizing radiation. It is the amount of gamma or x-rays required to produce ions carrying 1 electrostatic unit of electrical charge in 1 cubic centimeter of dry air under standard conditions. Roentgen is a measure of the ionizations of the molecules in a mass of air. The main advantage of this unit is that it is easy to measure directly, but is limited because it is only for deposition in air, and only for gamma and x-rays. Named after Wilhelm Roentgen, German Scientist who discovered *x-rays* in 1895.

**Sievert**

The SI unit of any of the quantities expressed as *dose equivalent*. The dose equivalent in *sieverts* is equal to the absorbed dose in gray multiplied by the quality factor (1 Sv = 100 rem).

**Smear or Smear Test**

A method of determining the removable contamination on a surface. The suspected area is wiped with a filter paper and the radioactivity in the paper is measured. Also called a wipe or swipe test.

**Whole Body Counter**

A device used to identify and measure the radioactivity in the body (body burden). It uses a sensitive radiation detector (or array of detectors) located outside the body to measure the radiation emitted by the radioactive materials inside the body. It is useful for detecting those radionuclides that have radiations sufficiently penetrating to be detected outside the body.

**Whole Body Exposure**

An exposure of the body to radiation, in which the entire body rather than an isolated part is irradiated. Where a radioisotope is uniformly distributed throughout the body tissues, rather than being concentrated in certain parts, the irradiation can be considered as a whole-body exposure.

**Working Level (WL)**

Working Level is the concentration of short-lived radon progeny in equilibrium with 100 pCi of radon per liter of air. This will release  $1.3 \times 10^5$  MeV of alpha energy during decay to Pb-210. The SI equivalent is 20.8 mJ/m<sup>3</sup>.

## **2.3 NRC/DOE REGULATORY TERMS**

### **Atomic Energy Act (AEA)**

The Atomic Energy Act of 1954 (68 Stat. 919), as amended. [42 U.S.C. § 2011, et seq]. This 1954 Act created the Atomic Energy Commission (AEC). The AEC later split into the Nuclear Regulatory Commission (NRC) and the Energy and Research and Development Administration (ERDA). ERDA then became part of the Department of Energy in 1977. This act encouraged the development and use of nuclear energy and research for the general welfare and of the common defense and security for the United States. It is the basis of authority for NRC, DOE, and Environmental Protection Agency (EPA) in regulating radioactive materials defined in the AEA.

### **AEC**

The U.S. Atomic Energy Commission, now the U.S. Nuclear Regulatory Commission.

### **Agreement State**

Any State with which the U.S. Nuclear Regulatory Commission or the US. Atomic Energy Commission has entered into an effective agreement under subsection 274b. of the Atomic Energy Act of 1954, as amended (73 Stat. 689).

### **Annual Limit of Intake (ALI)**

The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent of 0.05 Sv (5 rem) or a committed dose equivalent of 0.5 Sv (50 rem) to any individual organ or tissue. ALI values for intake by ingestion and by inhalation of selected radionuclides are specified by regulation.

### **Breakthrough**

The passage of a solution containing trace ions through a barrier.

### **Buffer Zone**

Any area outside the plan view footprint of the final reclamation cover but still within the outer perimeter of the Final Repository.

### **Commissioning**

All the detailed testing activities involved in putting a nuclear plant into service. De-commissioning is all the operations involved in reducing the plant to a safe state after its useful working life.

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## **Concentrate**

Frequently referred to as yellowcake, uranium concentrate is the refined chemical compound produced by uranium mines. Also commonly called  $U_3O_8$  or uranium oxide, it is the usual internationally traded form of uranium.

## **Containment**

1. The prevention of the release of unacceptable quantities of radioactive material into the environment by enclosing it tightly.
2. The containing system that provides the function of containment.

## **Contamination**

The presence of radioactive materials in or on a material or the human body or other places where they are undesirable or could be harmful.

## **Control Rods**

A rod incorporating neutron-absorbing materials, such as boron or cadmium. Control rods can be moved in and out of holes in the core of a reactor in order to control the reaction rate precisely.

## **Critical Group**

A group of individuals reasonably expected to receive the greatest exposure to releases over time, given the circumstances under which the analysis would be carried out. (NUREG 1573: A-1)

## **Decontaminate**

The process of removing radioactive substances causing contamination in order to reduce the residual amount in or on materials, persons or the environment.

## **Decommission**

To remove (as a facility) safely from service and reduce residual radioactivity to a level that permits release of the property for unrestricted use and termination of license. (10 CFR 40.4)

## **Decommissioning Funding Plan**

A plan which includes a cost estimate for decommissioning and a description of the method of assuring funds for decommissioning, including means of adjusting cost estimates and associated funding levels periodically over the life of the facility. (10 CFR 40.36(d))

**Depleted Uranium**

Uranium having a percentage of uranium-235 smaller than the 0.7% found in natural uranium. It is obtained from spent (used) fuel elements or as by-product tails, or residues, from uranium isotope separation.

**Disposal Site**

All land that is subject to transfer to a government agency after termination of the license.

**Enriched Uranium**

Uranium having a larger fraction of fissionable U-235 than the approximate 0.7% found in naturally occurring uranium. An atomic separation process based on differences in isotopic weights is used to increase the concentration. (May also be enriched in U-233).

**Exposure**

Either external exposure from sources of radiation outside the body or internal from sources inside the body. Exposure can be classified as either normal or potential exposure; either occupational, medical or public exposure; and, in intervention situations, either emergency or chronic exposure.

**Exposure Parameter**

Factor such as body weight, breathing rate, or time/activity that may be needed to quantify (calculate) human exposure to a contaminant. (EPA 1992)

**High Level Waste**

There are two levels of high level waste (HLW): the liquid waste from reprocessing which contains the fission products; and the entire unprocessed used fuel (if direct disposal is planned). HLW is highly radioactive and contains long-lived activity; it generates a considerable amount of heat and requires constant cooling for many years.

**High Radiation Area**

An area accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.1rem (1mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

**Licensed Material**

Radioactive material received, possessed, used, transferred or disposed of under a general or specific license.

**Licensed Site**

The area contained within the boundary of a location under the control of persons generating or storing radioactive materials under a license.

**Licensee**

Any person who is licensed in accordance with radiation regulations and statute.

**Naturally Occurring or Accelerator Produced Radioactive Material (NARM)**

Any naturally occurring or accelerator produced radioactive material. It does not include byproduct, source, or special nuclear material.

**Naturally Occurring Radioactive Material (NORM)**

Any nuclide that is radioactive in its natural physical state and is not manufactured; especially Uranium and Thorium in the mineral processing industry and Ra-226 associated with drilling sludges and pipe scale in the oil and gas industry.

**Performance Assessment (PA)**

A systematic analysis of the disposal facility and its surrounding environment, with the intent of demonstrating compliance with the radiological performance objectives (EGG-LLW 8843, 91) or a type of systematic (risk) analysis that addresses what can happen, how likely it is to happen, and what are the resulting impacts (NUREG-1573: 1-6).

**PPE**

Personal protective equipment.

**Protective Action Guide (PAG)**

The projected dose to reference man (or standard man), or other defined individual, from an accidental release of radioactive material at which a specific protective action to reduce or avoid that dose is warranted.

**Probabilistic Approach to PA**

To use a formal, systematic uncertainty analysis to quantify the uncertainty in performance estimates cause by uncertainty in models and parameters. (NUREG-573: xiv)

**Rad**

The special unit of absorbed dose. One rad is equal to an absorbed dose of  $0.01 \text{ Jkg}^{-1}$  (0.01 gray)

**Radiation Area**

Any area, accessible to individuals, in which there exists radiation at such levels that a major portion of the body could receive in any one hour a dose in excess of 0.05 mSv (0.005 rem) in 1 hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates.

**Radiation Safety Officer (RSO)**

An individual who has the knowledge, responsibility and authority to apply appropriate radiation protection regulations.

**Radioactive Material**

Any material, solid, liquid, or gas, which emits ionizing radiation spontaneously.

**Radioactivity**

The transformation of unstable atomic nuclei by the emission of radiation.

**Reference Man**

A hypothetical aggregation of human physical and physiological characteristics arrived at by international consensus. These characteristics may be used by researchers and public health workers to standardize results of experiments and to relate biological insult to a common base.

**Repository**

A permanent resting-place for radioactive wastes, which will finally decay to natural levels of radioactivity.

**RG**

Regulatory guide, issued by the NRC.

**Sensitivity Analysis**

To determine the relative contributions of input variables to the resulting dose.

**Site Area Emergency**

Events may occur, are in progress, or have occurred that could lead to a significant release of radioactive material and could require a response by offsite response organizations to protect people' offsite. (10 CFR 40.4)

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### **Site Boundary**

That line beyond which the land or property is not owned, leased, or otherwise controlled by the licensee.

### **Source Material**

Material, in any physical or chemical form, including ores, that contain by weight one-twentieth ( $\frac{1}{20}$ ) of 1 percent (0.05 percent) or more of uranium, thorium or any combination thereof.

### **Source Material Milling**

Any activity that results in the production of byproduct material, thus, any activity producing wastes from ore processed primarily to get Uranium or Thorium.

### **Special Form Radioactive Material**

Radioactive material that satisfies all the following conditions:

- a) It is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule;
- b) The piece or capsule has at least one dimension not less than 5 millimeters (0.197 inch); and
- c) It satisfies the test requirements specified by the U.S. Nuclear Regulatory Commission.

### **Special Nuclear Material**

Plutonium, uranium-233, uranium enriched in the isotope 233 or in the isotope 235, and any other material that the Nuclear Regulatory Commission determines to be special nuclear material, but does not include source material; or any material artificially enriched by any of the foregoing but does not include *source material*.

### **Specific License**

A license issued to a person to use, manufacture, produce, transfer, receive, acquire, own or possess quantities of or devices or equipment utilizing radioactive materials occurring naturally or produced artificially.

### **Uranium Fuel Cycle**

The operations of milling of uranium ore; chemical conversion of uranium; isotopic enrichment of uranium; fabrication of uranium fuel; generation of electricity by a light-water-cooled nuclear power plant using uranium fuel; and reprocessing of spent uranium fuel to the extent that these activities directly support the production of electrical power for public use. Uranium fuel cycle, as defined, does not include mining operations, operations at waste disposal sites, transportation

of radioactive material in support of these operations, and the reuse of recovered non-uranium special nuclear and by product materials from the cycle.

**Unrestricted Area**

Any area, access to which is neither limited nor controlled by the licensee or registrant. ["Uncontrolled area" is an equivalent term]

**Uppermost Aquifer**

The geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary. (10 CFR 40)

**Waste, Radioactive**

Solid, liquid and gaseous materials from nuclear operations that are radioactive or become radioactive and for which there are no further use. Wastes are generally classified as high level (having radioactivity concentrations of hundreds of thousands of curies per gallon or cubic foot), low level (in the range of 1 microcurie per gallon or cubic foot), or intermediate level (between these extremes).

## 2.4 EPA REGULATORY TERMS

### **Alert**

Events may occur, are in progress, or have occurred that could lead to a release of radioactive material, but the release is not expected to require a response by offsite response organizations to protect persons offsite. (10 CFR 40.4)

### **Alternate Concentration Limit (ACL)**

A concentration of a ground water constituent, which presents no significant hazard and has been approved for a specific site where protection to drinking water standards is not practically achievable.

### **As Low As Is Reasonably Achievable (ALARA)**

Making every reasonable effort to maintain exposures to radiation as far below the dose limits in regulation as is practical, consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed sources of radiation in the public interest.

### **Aquifer**

1. A geologic formation, group of formations, or part of a formation capable of yielding a significant amount of ground water to wells or springs. (40 CFR 260)
2. Any saturated zone created by uranium or thorium operations would not be considered an aquifer unless the zone is or potentially is:
  - a) Hydraulically interconnected to a natural aquifer;
  - b) Capable of discharge to surface water; or
  - c) Reasonably accessible because of migration beyond the vertical projection of the boundary of the land transferred for long-term government ownership and care. (10 CFR 40)

### **Applicable or relevant and appropriate requirements (ARAR)**

Those cleanup standards of control and other substantive requirements, criteria, or limitations promulgated under federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, or location or other circumstance found at a CERCLA site. Only those standards that are identified by a State in a timely manner and that are more stringent than federal requirements may be applicable. (40 CFR 300.5)

**Baseline Risk Assessment (RA)**

An evaluation of risk to human health and the environment of the No-Action Alternative in which no action is taken to (1) remediate or cleanup, (2) restrict use of the site or its resources, or (3) to prevent exposure to contamination.

The Baseline RA considers current use of the site and hypothetical future use.

**By-Product Material**

There are basically two types of by-product materials. The first are produced by a nuclear reactor and the second are produced by the uranium and thorium mining process. A more precise definition reads: "(1) Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure incident to the process of producing or utilizing special nuclear material, and (2) The tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute "by-product material" within this definition (10 CFR 20.1003).

**Certification**

A statement of professional opinion based upon knowledge and belief. (40 CFR 260)

**Disposal**

The discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters.

**Disposal Facility**

A facility or part of a facility at which hazardous waste is intentionally placed or on any land or water, and at which waste will remain after closure. (40 CFR 260)

**Disposal Site**

All contiguous land, including publicly owned land, used for hazardous waste disposal under common ownership. (40 CFR 260)

**Exposure [in Risk Assessment]**

Contact of a chemical with the outer boundary of a human (skin, nose, mouth, skin punctures and lesions). Guidelines for Exposure Assessment; (FR 57[104], 22888-22938, May 29, 1992)

**Exposure Parameter**

Factor such as body weight, breathing rate, or time/activity that may be needed to quantify (calculate) human exposure to a contaminant. (EPA, 1992)

**Exposure Pathway**

Route by which radioactive material can reach or irradiate humans. International Basic Safety Standards

**Exposure Pathway [in Risk Assessment]**

The course a chemical or physical agent takes from a source to a receptor.

An exposure pathway describes a unique mechanism by which an individual or population is exposed to chemicals or physical agents at or originating from a site. Exposure pathway includes a source or release from a source, an exposure point, and an exposure route. If the exposure point differs from the source, the transport/exposure medium (such as air) or media (in cases of intermedia transport, such as water to air) are also included. (EPA/540/1-89/002, Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Vol. I, EPA, 1989)

**Exposure Point**

A geographical location of potential contact between a receptor and a chemical or physical agent, i.e. a child ingesting soil. (EPA, 1989)

**Exposure Point Concentration**

Concentration at the point where receptors may be exposed. (EPA, 1989)

**Exposure Rate**

The exposure per unit of time, such as roentgen per minute and milliroentgen per hour.

**Exposure Route**

The way a chemical or physical agent comes in contact with a receptor, that is, inhalation or ingestion. (EPA, 1989)

**Exposure Setting**

A combination of potential land uses and exposure routes that describes the ways by which a specific type of receptor can contact contaminants, that is, residential setting, occupational setting, recreational setting.

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## **Groundwater**

Water below the land surface in a zone of saturation. (10 CFR 40 & 40 CFR 260)

## **Half-Life**

The half-life of a radioactive material is the time it takes for half of the material to radiate energetic particles and rays and transform to new materials. For example, the half-life of cesium (Cs-137) is 30 years after which time half of it decays to a non-radioactive stable nuclide, barium (Ba-137). If you start with 100 Kg of Cs-137 then after 30 years you will have 50 Kg of Cs-137 remaining. After 30 more years you will have 25 Kg of Cs-137 remaining and so on.

## **Intake**

The measure of exposure expressed as the mass of a chemical that crosses an outer boundary of a human or the chemical per unit body weight per unit time (milligrams of chemical per kilogram of body weight per day).

## **Mill Tailings**

Naturally radioactive residue from the processing of uranium or into yellowcake in a mill. Although the milling process recovers about 93 percent of the uranium, the residues, or tailings, contain several radioactive elements, including uranium, thorium, radium, polonium and radon.

## **Reasonable Maximum Exposure (RME)**

The highest exposure that is reasonably expected to occur at a Superfund site--the product of a few upper-bound exposure parameters with many average or typical exposure parameters, thus, exposure point concentrations and exposure frequencies and durations that are a mix of distributions (averages, 95th percentile, etc.) to reflect a 90th percentile, so that the result represents an exposure that is both protective and plausible.

## **Remediation Waste**

All solid and hazardous wastes, and all media (including groundwater, surface water, soils, and sediments) and debris that contain listed hazardous wastes or which themselves exhibit a hazardous waste characteristic, that are managed for the purpose of implementing corrective action requirements. For a given facility, remediation wastes may originate only from within the facility boundary, but may include waste managed in implementing regulatory requirement for releases beyond the facility boundary. (40 CFR 260)

## **Relevant and Appropriate Requirements**

Those cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under federal environmental or state environmental or facility siting laws that--while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action,

location or other circumstance at a CERCLA site--address problems or situations sufficiently similar to those encountered at the particular site that their use is well suited. (40 CFR 300.5)

**Restricted Area**

An area, access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to sources of radiation (restricted areas cannot include residential quarters, but separate rooms in a residential building may be set apart as restricted).

**Survey**

An evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of sources of radiation, including when appropriate, but not limited to, tests, physical examinations, and measurements of levels of radiation or concentrations of radioactive material present.

**UMTRCA**

The Uranium Mill Tailings Radiation Control Act of 1978 (42 USC 7901), which amended the Atomic Energy Act.

**Uranium Milling**

Any activity that results in the production of definition (2) byproduct material, thus, any activity producing wastes from ore processed primarily to obtain uranium. (10 CFR 40.4)

## **2.5 DOT REGULATORY TERMS\***

### **A1**

The maximum activity of special form Class 7 (radioactive) material permitted in a Type A package.

### **A2**

The maximum activity of Class 7 (radioactive) material, other than special form, LSA or SCO, permitted in a Type A package. These values are either listed in §173.435 or derived in accordance with the procedure prescribed in §173.433.

### **Class 7 (Radioactive) Material**

Any material having a specific activity greater than 70 Bq per gram (0.002 microcurie per gram).

### **Closed Transport Vehicle**

A transport vehicle or conveyance equipped with a securely attached exterior enclosure that during normal transportation restricts the access of unauthorized persons to the cargo space containing the Class 7 (radioactive) materials. The enclosure may be either temporary or permanent, and in the case of packaged materials may be of the "see-through" type, and must limit access from top, sides, and bottom.

### **Containment System**

The assembly of components of the packaging intended to retain the radioactive contents during transportation.

### **Conveyance**

- 1) For transport by public highway or rail: any transport vehicle or large freight container;
- 2) For transport by water: any vessel, or any hold, compartment, or defined deck area of a vessel including any transport vehicle on board the vessel; and
- 3) For transport by aircraft, any aircraft.

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\*Note: Most DOT definitions have originated from DOT Radiation Regulation 49 CFR 173.403

## **Design**

The description of a special form Class 7 (radioactive) material, a package, packaging, or LSA-III, that enables those items to be fully identified. The description may include specifications, engineering drawings, reports showing compliance with regulatory requirements, and other relevant documentation.

### **Exclusive use (also referred to in other regulations as "sole use" or "full load")**

Sole use by a single consignor of a conveyance for which all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the consignor or consignee. The consignor and the carrier must ensure that any loading or unloading is performed by personnel having radiological training and resources appropriate for safe handling of the consignment. The consignor must issue specific instructions in writing, for maintenance of exclusive use shipment controls, and include them with the shipping paper information provided to the carrier by the consignor.

## **Fissile Material**

Plutonium-238, plutonium-239, plutonium-241, uranium-233, uranium-235, or any combination of these radionuclides. The definition does not apply to unirradiated natural uranium and depleted uranium, and natural uranium or depleted uranium that has been irradiated in a thermal reactor. Certain additional exceptions are provided in §173.453.

### **Fissile Material, Controlled Shipment**

Any shipment that contains one or more packages that have been assigned, in accordance with §173.457, nuclear criticality control transport indices greater than 10.

## **Freight Container**

A reusable container having a volume of 1.81 cubic meters (64 cubic feet) or more, designed and constructed to permit its being lifted with its contents intact and intended primarily for containment of packages in unit form during transportation. A "small freight container" is one that has either one outer dimension less than 1.5 meters (4.9 feet) or an internal volume of not more than 3.0 cubic meters (106 cubic feet). All other freight containers are designated as "large freight containers."

## **Highway Route Controlled Quantity**

A quantity within a single package which exceeds:

- a) 3,000 times the A1 value of the radionuclides as specified in §173.435 for special form Class 7 (radioactive) material;
- b) 3,000 times the A2 value of the radionuclides as specified in §173.435 for normal form Class 7 (radioactive) material; or

- c) 1,000 TBq (27,000 Ci), whichever is least.

### **Limited Quantity Of Class 7 (Radioactive) Material**

A quantity of Class 7 (radioactive) material not exceeding the materials package limits specified in §173.425 and conforming to requirements specified in §173.421.

### **Low Specific Activity (LSA) Material**

Class 7 (radioactive) material with limited specific activity that satisfies the descriptions and limits set forth below. Shielding materials surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents. LSA material must be in one of three groups:

#### **1. LSA-I.**

- a) Ores containing only naturally occurring radionuclides (e.g., uranium, thorium) and uranium or thorium concentrates of such ores; or
- b) Solid unirradiated natural uranium or depleted uranium or natural thorium or their solid or liquid compounds or mixtures; or
- c) Class 7 (radioactive) material, other than fissile material, for which the A2 value is unlimited; or
- d) Mill tailings, contaminated earth, concrete, rubble, other debris, and activated material in which the Class 7 (radioactive) material is essentially uniformly distributed and the average specific activity does not exceed  $10^{-6}A_2/g$ .

#### **2. LSA-II.**

- a) Water with tritium concentration up to 0.8 TBq/liter (20.0 Ci/liter); or
- b) Material in which the Class 7 (radioactive) material is distributed throughout and the average specific activity does not exceed  $10^4A_2/g$  for solids and gases, and  $10^5A_2/g$  for liquids.

#### **3. LSA-III. Solids (e.g., consolidated wastes, activated materials) that meet the requirements of §173.468 and which:**

- a) The Class 7 (radioactive) material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen, ceramic, etc.); and
- b) The Class 7 (radioactive) material is relatively insoluble, or it is intrinsically contained in a relatively insoluble material, so that, even under loss of packaging, the loss of Class 7 (radioactive) material per package by leaching when placed in water for seven days would not exceed 0.1 A<sub>2</sub>; and
- c) The average specific activity of the solid does not exceed  $2 \times 10^3A_2/g$ .

### **Low Toxicity Alpha Emitters**

- 1) Natural uranium, depleted uranium, and natural thorium;
- 2) Ores, concentrates or tailings containing uranium-235, uranium-238, thorium-232, thorium-228 and thorium-230; or
- 3) Alpha emitters with a half-life of less than 10 days.

### **Maximum Normal Operating Pressure**

The maximum gauge pressure that would develop in a receptacle in a period of one year, in the absence of venting or cooling, under the heat conditions specified in 10 CFR 71.71(c)(1).

### **Multilateral Approval**

Approval of a package or shipment by the relevant competent authority of the country of origin and of each country through or into which the package or shipment is to be transported. This definition does not include approval from a country over which Class 7 (radioactive) materials are carried in aircraft, if there is no scheduled stop in that country.

### **Natural Thorium**

Thorium with the naturally occurring distribution of thorium isotopes (essentially 100 percent by weight of thorium-232).

### **Non-Fixed Radioactive Contamination**

Radioactive contamination that can be readily removed from a surface by wiping with an absorbent material. Non-fixed (removable) radioactive contamination is not significant if it does not exceed the limits specified in §173.443.

### **Normal Form Class 7 (Radioactive) Material**

Class 7 (radioactive) material that has not been demonstrated to qualify as "special form Class 7 (radioactive) material."

### **Package**

For Class 7 (radioactive) materials, the packaging together with its radioactive contents as presented for transport.

1. **Excepted Package** means a packaging together with its excepted Class 7 (radioactive) materials as specified in §§173.421-173.426 and 173.428.
2. **Type A Package** means a packaging that, together with its radioactive contents limited to A1 or A2 as appropriate, meets the requirements of §§173.410 and 173.412 and is designed to retain the integrity of containment and shielding required by this part under

normal conditions of transport as demonstrated by the tests set forth in §173.465 or §173.466, as appropriate. A Type A package does not require Competent Authority Approval.

3. **Type B Package** means a Type B packaging that, together with its radioactive contents, is designed to retain the integrity of containment and shielding required by this part when subjected to the normal conditions of transport and hypothetical accident test conditions set forth in 10 CFR Part 71.
  - a) **Type B(U) Package** means a Type B packaging that, together with its radioactive contents, for international shipments requires unilateral approval only of the package design and of any stowage provisions that may be necessary for heat dissipation.
  - b) **Type B(M) Package** means a Type B packaging, together with its radioactive contents, that for international shipments requires multilateral approval of the package design, and may require approval of the conditions of shipment. Type B(M) packages are those Type B package designs which have a maximum normal operating pressure of more than 700 kilopascals per square centimeter (100 pounds per square inch) gauge or a relief device which would allow the release of Class 7 (radioactive) material to the environment under the hypothetical accident conditions specified in 10 CFR Part 71.
4. **Industrial Package** means a packaging that, together with its low specific activity (LSA) material or surface contaminated object (SCO) contents, meets the requirements of §§173.410 and 173.411. Industrial packages are categorized in §173.411 as either:
  - a) Industrial package Type 1 (IP-1);
  - b) Industrial package Type 2 (IP-2); or
  - c) Industrial package Type 3 (IP-3)".

## Packaging

For Class 7 (radioactive) materials, the assembly of components necessary to ensure compliance with the packaging requirements of this subpart. It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, service equipment for filling, emptying, venting and pressure relief, and devices for cooling or absorbing mechanical shocks. The conveyance, tie-down system, and auxiliary equipment may sometimes be designated as part of the packaging.

## Radiation level

The radiation *dose-equivalent* rate expressed in millisievert(s) per hour or mSv/h (millirem(s) per hour or mrem/h). Neutron flux densities may be converted into radiation levels. (See table A-1 in Appendix A).

## **Radioactive Contents**

A Class 7 (radioactive) material, together with any contaminated liquids or gases within the package.

## **Radioactive Instrument and Article**

Any manufactured instrument and article such as an instrument, clock, electronic tube or apparatus, or similar instrument and article having Class 7 (radioactive) material in gaseous or non-dispersible solid form as a component part.

## **Radioactive Material**

Any material having a specific activity greater than 70 Bq per gram (0.002 microcurie per gram) (see definition of specific activity).

## **Special Form Class 7 (Radioactive) Material**

Class 7 (radioactive) material that satisfies the following conditions:

1. It is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule;
2. The piece or capsule has at least one dimension not less than 5 millimeters (0.2 inch); and
3. It satisfies the test requirements of §173.469. Special form encapsulations designed in accordance with the requirements of §173.389(g) in effect on June 30, 1983 (see 49 CFR Part 173, revised as of October 1, 1982), and constructed prior to July 1, 1985 and special form encapsulations designed in accordance with the requirements of §173.403 in effect on March 31, 1996 (see 49 CFR Part 173, revised as of October 1, 1995), and constructed prior to April 1, 1997, may continue to be used. Any other special form encapsulation must meet the requirements of this paragraph.

## **Specific Activity of a Radionuclide**

The activity of the radionuclide per unit mass of that nuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the activity per unit mass of the material.

## **Surface Contaminated Object (SCO)**

A solid object which itself is not radioactive, but which has Class 7 (radioactive) material distributed on any of its surfaces. SCO must be in one of two groups with surface activity not exceeding the following limits:

1. **SCO-I:** A solid object on which:
  - a) The non-fixed contamination on the accessible surface averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 4 Bq/cm<sup>2</sup> (10<sup>-4</sup>

- microcurie/cm<sup>2</sup>) for beta and gamma and low toxicity alpha emitters, or 0.4 Bq/cm<sup>2</sup> (10<sup>-5</sup> microcurie/cm<sup>2</sup>) for alpha emitters;
- b) The fixed contamination on the accessible surface averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 4 x 10<sup>4</sup> Bq/cm<sup>2</sup> (1.0 microcurie/cm<sup>2</sup>) for beta and gamma and low toxicity alpha emitters, or 4 x 10<sup>3</sup> Bq/cm<sup>2</sup> (0.1 microcurie/cm<sup>2</sup>) for all other alpha emitters; and
  - c) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 4 x 10<sup>4</sup> Bq/cm<sup>2</sup> (1 microcurie/cm<sup>2</sup>) for beta and gamma and low toxicity alpha emitters, or 4 x 10<sup>3</sup> Bq/cm<sup>2</sup> (0.1 microcurie/cm<sup>2</sup>) for all other alpha emitters.
2. **SCO-II:** A solid object on which the limits for SCO-I are exceeded and on which:
- a) The non-fixed contamination on the accessible surface averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 400 Bq/cm<sup>2</sup> (10<sup>-2</sup> microcurie/cm<sup>2</sup>) for beta and gamma and low toxicity alpha emitters or 40 Bq/cm<sup>2</sup> (10<sup>-3</sup> microcurie/cm<sup>2</sup>) for all other alpha emitters;
  - b) The fixed contamination on the accessible surface averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 8 x 10<sup>5</sup> Bq/cm<sup>2</sup> (20 microcurie/cm<sup>2</sup>) for beta and gamma and low toxicity alpha emitters, or 8 x 10<sup>4</sup> Bq/cm<sup>2</sup> (2 microcuries/cm<sup>2</sup>) for all other alpha emitters; and
  - c) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 8 x 10<sup>5</sup> Bq/cm<sup>2</sup> (20 microcuries/cm<sup>2</sup>) for beta and gamma and low toxicity alpha emitters, or 8 x 10<sup>4</sup> Bq/cm<sup>2</sup> (2 microcuries/cm<sup>2</sup>) for all other alpha emitters.

### Transport Index (TI)

The dimensionless number (rounded up to the next tenth) placed on the label of a package to designate the degree of control to be exercised by the carrier during transportation. The transport index is determined as follows:

- 1) For nonfissile material packages, the number determined by multiplying the maximum radiation level in milliSievert(s) per hour at one meter (3.3 feet) from the external surface of the package by 100 (equivalent to the maximum radiation level in millirem per hour at one meter (3.3 feet)); or
- 2) For fissile material packages, the number determined by multiplying the maximum radiation level in milliSievert per hour at one meter (3.3 feet) from any external surface of the package by 100 (equivalent to the maximum radiation level in millirem per hour at one meter (3.3 feet)) or, for criticality control purposes, the number obtained by dividing 50 by the allowable number of packages which may be transported together, whichever number is larger.

### **Type A Quantity**

A quantity of Class 7 (radioactive) material, the aggregate radioactivity which does not exceed A1 for special form Class 7 (radioactive) material or A2 for normal form Class 7 (radioactive) material, where A1 and A2 values are given in §173.435 or are determined in accordance with §173.433.

### **Type B Quantity**

A quantity of material greater than a Type A quantity.

### **Unilateral Approval**

Approval of a package solely by the competent authority of the country of origin.

### **Unirradiated Thorium**

Thorium containing not more than  $10^7$  grams uranium-233 per gram of thorium-232.

### **Unirradiated Uranium**

Uranium containing not more than  $10^6$  grams plutonium per gram of uranium-235 and a fission product activity of not more than 9 MBq (0.24 millicuries) of fission products per gram of uranium-235.

### **Uranium-Natural, Depleted or Enriched**

1. **Natural uranium** means uranium with the naturally occurring distribution of uranium isotopes (approximately 0.711 weight percent uranium-235, and the remainder essentially uranium-238).
2. **Depleted uranium** means uranium containing less uranium-235 than the naturally occurring distribution of uranium isotopes.
3. **Enriched uranium** means uranium containing more uranium-235 than the naturally occurring distribution of uranium isotopes.

## **APPENDIX A**

### **Useful Radiation Information Tables**

**Table A-1 Neutron Flux Density Conversions to Radiation Levels**

| <b>Flux Density Equivalent to<br/>0.01 Msv/h (1 mrem/h)</b> | <b>Radiation Levels<br/>neutrons per square<br/>centimeter per second<br/>(n/cm<sup>2</sup>/s)</b> |
|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Thermal ( $2.5 \times 10^8$ )MeV                            | 272.0                                                                                              |
| 1 keV                                                       | 272.0                                                                                              |
| 10 keV                                                      | 281.0                                                                                              |
| 100 keV                                                     | 47.0                                                                                               |
| 500 keV                                                     | 11.0                                                                                               |
| 1 MeV                                                       | 7.5                                                                                                |
| 5 MeV                                                       | 6.4                                                                                                |
| 10 MeV                                                      | 6.7                                                                                                |

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<sup>1</sup> Flux densities equivalent for energies between those listed in this table may be obtained by linear interpolation.

**Table A-2 Summary of New and Old Radiological Units**

| <b>Summary of New<br/>And<br/>Old Radiological Units</b> |                              |
|----------------------------------------------------------|------------------------------|
| <b>Quantity</b>                                          | <b>Name and Symbol</b>       |
| Activity                                                 | Becquerel (Bq)<br>Curie (Ci) |
| Absorbed Dose                                            | Gray (Gy)<br>Rad (rad)       |
| Dose Equivalent                                          | Sievert (Sv)<br>Rem (rem)    |
| Exposure                                                 | Coulombs/ kg<br>Roentgen (R) |

**Table A-3 List of Common Radionuclide Conversions**

| <b>Common Conversions</b> |                       |                                        |
|---------------------------|-----------------------|----------------------------------------|
| <b>Multiple</b>           | <b>By</b>             | <b>To Obtain</b>                       |
| Becquerels                | 27.03                 | Picocuries                             |
| Curies                    | $3.70 \times 10^{10}$ | Disintegrations per sec (dps)          |
| Curies                    | $3.70 \times 10^{10}$ | Becquerels                             |
| Curies                    | $2.22 \times 10^{12}$ | Disintegrations per minute (dpm)       |
| Gray                      | 100                   | Rad                                    |
| Rem                       | 0.01                  | Sievert                                |
| Rad                       | $2.39 \times 10^9$    | ion pairs/cm <sup>3</sup> of air (STP) |
| Sievert                   | 100                   | Rem                                    |

**Table A-4 List of Standard International Unit Prefixes**

| <b>SI Prefixes</b> |             |               |  |               |             |               |
|--------------------|-------------|---------------|--|---------------|-------------|---------------|
| <b>Factor</b>      | <b>Name</b> | <b>Symbol</b> |  | <b>Factor</b> | <b>Name</b> | <b>Symbol</b> |
| $10^{24}$          | Yotta       | Y             |  | $10^{-1}$     | deci        | d             |
| $10^{21}$          | Zetta       | Z             |  | $10^{-2}$     | centi       | c             |
| $10^{18}$          | Exa         | E             |  | $10^{-3}$     | milli       | m             |
| $10^{15}$          | Peta        | P             |  | $10^{-6}$     | micro       | $\mu$         |
| $10^{12}$          | Tera        | T             |  | $10^{-9}$     | nano        | n             |
| $10^9$             | Giga        | G             |  | $10^{-12}$    | pico        | p             |
| $10^6$             | Mega        | M             |  | $10^{-15}$    | femto       | f             |
| $10^3$             | Kilo        | K             |  | $10^{-18}$    | atto        | a             |
| $10^2$             | Hecto       | H             |  | $10^{-21}$    | zepto       | z             |
| $10^1$             | Deka        | Da            |  | $10^{-24}$    | yocto       | y             |

**Table A-5 Name, Emission, and Half-Life for list of Common Radionuclides.**

| <b>Information on Common Radionuclides</b> |               |                  |                              |
|--------------------------------------------|---------------|------------------|------------------------------|
| <b>Nuclide</b>                             | <b>Name</b>   | <b>Emissions</b> | <b>Half-life</b>             |
| H-3                                        | Tritium       | Beta             | 12.3 Years                   |
| C-14                                       | Carbon 14     | Beta             | 5730 Years                   |
| P-32                                       | Phosphorus 32 | Beta             | 14.3 Days                    |
| S-35                                       | Sulfur 35     | Beta             | 87 Days                      |
| K-40                                       | Potassium 40  | Beta/Gamma       | 1.27 x 10 <sup>9</sup> Years |
| Co-60                                      | Cobalt 60     | Gamma            | 5.26 Years                   |
| Sr-90                                      | Strontium 90  | Beta             | 28.1 Years                   |
| Mo-99                                      | Molybendum 99 | Beta/Gamma       | 66.7 Hours                   |
| Tc-99                                      | Technetium 99 | Beta             | 2.1 x 10 <sup>5</sup> Years  |
| I-129                                      | Iodine 129    | Beta/Gamma       | 1.57 x 10 <sup>7</sup> Years |
| Cs-137                                     | Cesium 137    | Beta/Gamma       | 30.0 Years                   |
| Ra-226                                     | Radium 226    | Alpha/Gamma + D  | 1602 Years                   |
| U-235                                      | Uranium 235   | Alpha/Gamma + D  | 7.04 x 10 <sup>8</sup> Years |
| U-238                                      | Uranium 238   | Alpha + D        | 4.5 x 10 <sup>9</sup> Years  |
| Pu-238                                     | Plutonium 238 | Alpha            | 87.75 Years                  |
| Pu-239                                     | Plutonium 239 | Alpha            | 2.4 x 10 <sup>4</sup> Years  |
| Am-241                                     | Americium 241 | Alpha/Gamma      | 433 Years                    |

## **APPENDIX B**

### **Selected References**

## Selected References

The following are a few selected regulatory and technical documents that are relevant for ITRC Radionuclide work group activities. Some of these documents were used in the definitions and regulatory terms stated in Section 2.0 of this Reference Guide.

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## **APPENDIX C**

**ITRC Work Team Contacts, ITRC Fact Sheet,  
ITRC Product List, and Document Evaluation Survey**

## **Radionuclide Work Team Contacts**

### **Team Co-Leaders**

#### **Tom Schneider**

Ohio Environmental Protection Agency  
Ohio Office of Federal Facilities Oversight  
401 East 5<sup>th</sup> Street  
Dayton, OH 45402  
P (937) 285-6466  
F (937) 285-6404  
Tom.schneider@epa.state.oh.us

#### **W. Carl Spreng**

Colorado Depart. of Public Health Environment  
Hazardous Materials and Waste Management  
Division  
4300 Cherry Creek Drive S., HMWMD-B-2  
Denver, CO 80246-1530  
P (303) 692-3358  
F (303) 759-5355  
Carl.spreng@state.co.us

### **Contractor Support**

#### **Dr. Smita Siddhanti**

Booz·Allen & Hamilton Inc.  
8283 Greensboro Drive  
McLean, VA 22102  
P (703) 917-2447  
F (703) 902-3613  
Siddhanti\_Smita@bah.com

#### **Michelle Brown**

Booz·Allen & Hamilton Inc.  
8283 Greensboro Drive  
McLean, VA 22102  
P (703) 902-5838  
F (703) 902-3613  
Brown\_michelle@bah.com

#### **Patricia Reyes**

Booz·Allen & Hamilton Inc.  
8283 Greensboro Drive  
McLean, VA 22102  
P (703) 917-2447  
F (703) 902-3613  
Reyes\_Patricia@bah.com