Publication No. E-14-2

CRITERIA FOR AN ADEQUATE RADIATION CONTROL PROGRAM

May 2014

Published by
Conference of Radiation Control Program Directors, Inc.
www.crcpd.org

This page is intentionally blank.

CRITERIA FOR AN ADEQUATE RADIATION CONTROL PROGRAM

Developed by
CRCPD's G-58 Task Force for the Criteria for an Adequate Radiation Control Program
Roland Fletcher, Chairperson (Maryland)
Paul Schmidt, Member (Wisconsin)
Richard Ratliff, Member (Texas)
Terry Frazee, Member (Washington)
Doug Draper, Advisor (Ohio)
Aubrey Godwin, Advisor (Arizona)
Adela Salame-Alfie, Advisor (New York)

May 2014

Published by
Conference of Radiation Control Program Directors, Inc.
1030 Burlington Lane, Suite 4B
Frankfort, Kentucky 40601
www.crcpd.org

This publication was supported in part by grant number FD-004840 from the Food and Drug Administration.

The information contained in this document is for guidance. The implementation and use of the information and recommendations contained in this document are at the discretion of the user. The implications from the use of this document are solely the responsibility of the user.

The mention of commercial products, their sources, or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such products by the Conference or any federal agency supporting the work contained in this document.

This document has been developed by a working group of the Conference of Radiation Control Program Directors, Inc. (CRCPD) and approved by the Board of Directors for publication. The contents contained herein, however, may not necessarily represent the views of the entire membership of the CRCPD or any federal agency supporting the work contained in this document. The mention of commercial products, their sources, or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such products by CRCPD or any federal agency.

FOREWORD

The Conference of Radiation Control Program Directors, Inc., (CRCPD) is an organization made up of the radiation control programs in the United States including the District of Columbia and Puerto Rico, and of individuals, regardless of employer affiliation, with an interest in radiation protection. The primary purpose and goal of CRCPD is to assist its members in their efforts to protect the public, radiation workers, and patients from unnecessary radiation exposure. CRCPD also provides a forum for centralized communication on radiation protection matters between the states and the federal government, and between the individual states.

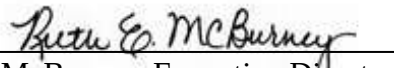
One method of providing assistance to the states, as well as to other interested parties, is through technical and administrative publications. Most technical publications of CRCPD are written by various committees, task forces, or special working groups. Most administrative publications are written by staff of the Office of the Executive Director (OED).

This updated publication, *Criteria for an Adequate Radiation Control Program*, reflects notable events since the 1999 publication of the same name, specifically, the Energy Policy Act of 2005 and lessons learned from the Fukushima Dai-ichi Facility accident. This publication is intended to provide program managers with a tool for evaluating program activities using consensus criteria that are well defined and represent the hallmarks of an adequately functioning radiation control operation. The document also serves as an authoritative reference when questions arise regarding the importance of specific program components or standards of practice.

Joseph G. Klinger, Chairperson
Conference of Radiation Control
Program Directors, Inc.

PREFACE

This update of Publication 99-2 was undertaken by CRCPD's G-58 Task Force for the Criteria of an Adequate Radiation Control Program chaired by Roland G. Fletcher, Program Director of the Maryland Radiological Health Program. This criteria document covers all program elements that should be considered part of an adequate radiation control program. This document updates the previously published criteria particularly with respect to changes brought about by the Energy Policy Act of 2005 (changing the scope of the federal Atomic Energy Act of 1954 as amended) and lessons learned from the devastating Japanese tsunami of 2011 that caused the release of radioactivity world-wide from the nuclear power reactors at the Fukushima Dai-ichi Facility.



Ruth E. McBurney, Executive Director
Conference of Radiation Control
Program Directors, Inc.

ACKNOWLEDGMENTS

The members of G-58 would like to thank all the Director Members and staff of the States that responded to the surveys, and provided feedback to the poster presentation at the 2013 annual meeting.

CONTENTS

FOREWORD iv

PREFACE v

ACKNOWLEDGMENTS vi

ABSTRACT 1

INTRODUCTION 2

ADMINISTRATION 3
ORGANIZATION 3
Jurisdiction 3
Interagency Cooperation 3
Organization Chart 4
MANAGEMENT 4
Management Structure and Philosophy 4
Radiation Control Program Director 4
Supervision 4
Coverage 4
Management Plan 4
Periodic Assessment 5
Policies 5
Technical and Administrative Procedures 5
Enforcement Options 5
Enforcement Philosophy 5
Enforcement Procedures 6
Enforcement Communications 6
Complaint/Allegation Procedures 6
Public Information 6
Record Formats and Maintenance 6
Electronic Recordkeeping and Client Submissions 7
Field Procedures Quality Assurance 7

AUTHORITIES 7
LEGISLATION 7
Suggested State Legislation 7
Additional Wording 7
Specific Content 8
REGULATIONS 9
Consistency and Compatibility 9
Comprehensiveness 9
Revisions 9
Reviews 9
Adoption Procedures 9

RESOURCES 9
PERSONNEL 9
Staffing Pattern 9
Compensation 10
Career Development 10
Job Descriptions 10
Staff Training Plan 10
Performance Reviews 10
Training Materials 10
Problem Intervention 10

Employees Conduct Manual 11
Disciplinary Action 11
Non-RCP Inspectors 11
Personnel Radiation Safety 11
Discrimination Policy 11
FINANCIAL 11
Funding Sources 11
Budgeting 12
Accounting 12
EQUIPMENT 12
Adequacy and Suitability 12
Inventory 12
Calibration 12
Repair and Maintenance 12
SUPPORT SERVICES 13
Legal 13
Analytical 13
Computer Technology Services 13

ELECTRONIC PRODUCT RADIATION 13
IONIZING (X-ray) 13
Staffing 13
Facility registration 14
Registration of services 14
Inspection scheduling 14
Inspection assignment and tracking 15
Inspection procedures 15
Inspection measurements 15
Inspection reports 15
Inspection review and correspondence 16
Non-RCP inspectors 16
Nationwide Evaluation of X-Ray Trends (NEXT) surveys 16
Quality assurance 16
Mammography 16
Operator certification 16
User education and assistance 16
NONIONIZING 17
Subprogram scope 17
Staffing 17
Nonionizing radiation source registration 18
Registration of services 18
Inspection scheduling 18
Inspection assignment and tracking 19
Inspection procedures 19
Inspection measurements 19
Inspection reports 19
Inspection review and correspondence 19
Non-RCP inspectors 19
Quality assurance 20
Operator certification 20
User education and assistance 20

RADIOACTIVE MATERIALS 20
NRC Agreement State 20
Subprogram scope 20
Staffing 21
Review of license applications 22

Content of license applications 22
Licensing guides 22
License document 22
License amendments 22
License renewal 23
Registration of devices under General License 23
Termination of licenses 23
Surety 23
Source and device evaluations 23
Inspection scheduling 23
Inspection assignment and tracking 24
Inspection procedures 24
Inspection measurements and samples 24
Inspection reports 24
Inspection review and correspondence 24
Quality assurance 24
User education and assistance 25
Low-Level Radioactive Waste (LLRW) 25
Subprogram scope 25
Staffing 25
LLRW verification program 25
Transport monitoring 26
Broker monitoring 26
Compact administration 26
Risk communication activities 26
Diffuse Naturally Occurring Radioactive Material (NORM) 26
Subprogram scope 26
Staffing 26
Review of license applications 26
Content of license applications 27
Licensing guides 27
License document 27
License amendments 27
License renewal 27
Termination of licenses 27
Surety 28
Inspection scheduling 28
Inspection assignment and tracking 28
Inspection procedures 28
Inspection measurements and samples 28
Inspection reports 28
Inspection review and correspondence 29
User education and assistance 29

RADIOACTIVITY IN THE ENVIRONMENT 29
Radon 29
Subprogram scope 29
Staffing 29
Measurement contractors 30
Mitigation contractors 30
Inspections 30
Radon concentration guidance 30
Mitigation practices 31
Surveys and research 31
Public information 31
Technology transfer 31
Schools and public buildings 31

External strategies 31

ENVIRONMENTAL RADIATION SURVEILLANCE 32
Subprogram scope 32
Staffing 32
Ambient monitoring 32
Source oriented monitoring 32
Emergency response monitoring 33
Laboratory procedures manual 33
Field procedures manual 33
Recording analytical results 33
Quality assurance 33
Annual reports 34
Surveillance guidance 34

RADIOLOGICAL EMERGENCIES 34
REACTOR PREPAREDNESS AND RESPONSE 34
Subprogram scope 34
Staffing 34
Response planning 35
Response personnel 35
Communications 35
Transportation 35
Field equipment 35
Interagency coordination 35
Exercises 35
Interstate assistance agreements 36
Federal agency support 36
Consultants 36
NON-REACTOR EMERGENCY PREPAREDNESS AND RESPONSE 36
Subprogram scope 36
Staffing 36
Response planning 36
Response personnel 37
Communications 37
Transportation 37
Field equipment 37
Interagency coordination 37
Exercises 37
Interstate assistance agreements 38
Federal agency support 38
Consultants 38

APPENDIX A: MANAGEMENT PLAN GUIDANCE 39
MISSION 39
ISSUES 39
OBJECTIVES 39
STRATEGIES AND MISSION 39
MANAGEMENT STRUCTURE AND PHILOSOPHY 39
ANNUAL WORK PLAN 39
EVALUATION 40

APPENDIX B: JOB DESCRIPTIONS 41
RADIATION CONTROL PROGRAM DIRECTOR 41
Duties and Responsibilities 41
Education and Experience 41
RADIATION CONTROL SUPERVISOR 42
Duties and Responsibilities 42

Education and Experience 42
PROFESSIONAL – SENIOR LEVEL 42
Duties and Responsibilities 42
Education and Experience 43
PROFESSIONAL – ENTRY LEVEL 43
Duties and Responsibilities 43
Education and Experience (General) 43
Education and Experience (Alternatives for X-ray and Nonionizing Subprograms) 43

APPENDIX C: PROFESSIONAL/TECHNICAL STAFFING GUIDANCE 44

APPENDIX D: SCHEDULING GUIDANCE 46
APPENDIX D – 1: X-RAY FACILITIES 47
APPENDIX D – 2: NONIONIZING DEVICES AND FACILITIES 48
APPENDIX D – 3: RADIOACTIVE MATERIALS LICENSEES 49

APPENDIX E: SURVEILLANCE GUIDANCE 50
APPENDIX E – 1: SURVEILLANCE GUIDANCE FOR THE AMBIENT ENVIRONMENT [1] 51
APPENDIX E – 2: SURVEILLANCE GUIDANCE FOR COMMERCIAL POWER REACTORS 52
APPENDIX E – 3: SURVEILLANCE GUIDANCE FOR URANIUM MINING 53
APPENDIX E – 4: SURVEILLANCE GUIDANCE FOR URANIUM MILLING 54
APPENDIX E – 5: SURVEILLANCE GUIDANCE FOR FUEL FABRICATION 56
APPENDIX E – 6: SURVEILLANCE GUIDANCE FOR WASTE REPOSITORIES 57
Notes for Appendix E 58

APPENDIX F: USE OF NON-RCP (NON-GOVERNMENTAL/PRIVATE) INSPECTORS 60
LEGISLATIVE AUTHORITY 60
REGULATORY AUTHORITY 60
SPECIFIC CONSIDERATIONS 61

ACRONYMS 61

ABSTRACT

Conference of Radiation Control Program Directors, Inc., Task Force G-58, *Criteria for an Adequate Radiation Control Program*. Publication 2014-2 (May 2014) 74 pages. This document supersedes CRCPD Publication E-99-2.

This document provides consensus criteria that are well defined and represent the hallmarks of an adequately functioning radiation control operation. The document also serves as an authoritative reference when questions arise regarding the importance of specific program components or standards of practice.

INTRODUCTION

For more than five decades, state and local radiation control programs have been evolving along similar lines, incorporating regulations, procedures, and activities that are quite uniform. During this period, the Conference of Radiation Control Program Directors, Inc., (CRCPD), the national organization of the managers and the staffs of these programs, has served as an agent to promote consistency and excellence in governmental radiation control programs. Among its many activities, CRCPD has previously published separate documents addressing criteria for adequate programs in specific areas of radiation control as well as a consolidated criteria document. This publication responds to a need to update the previously published consolidated criteria document to reflect changes brought about by the Energy Policy Act of 2005 and the lessons learned from the Fukushima Dai-ichi Facility accident.

This document is intended to provide program managers with a tool for evaluating program activities using consensus criteria that are well defined and represent the hallmarks of an adequately functioning radiation control operation. The document also serves as an authoritative reference when questions arise regarding the importance of specific program components or standards of practice. The criteria contained in this document will be used by CRCPD as the basis for program reviews conducted at the request of program management.

This document addresses:

- Administration: organization and management;
- Authorities: legislation and regulations;
- Resources: personnel, financial, equipment, and support services; and
- Radiation control program operations.

For purposes of this document, the overall radiation control activities are referred to as the Radiation Control Program (RCP). There are four overarching radiation control areas that must be addressed at least in part by every RCP. These overarching areas contain nine operational areas referred to as subprograms in this document:

Electronic Product Radiation:

- Ionizing (X-ray)
- Nonionizing

Radioactive Materials:

- U.S. Nuclear Regulatory Commission (NRC) Agreement State
- Low-Level Radioactive Waste (LLRW)
- Diffuse Naturally Occurring Radioactive Materials (NORM)

Radioactivity in the Environment:

- Radon
- Environmental Radiation Surveillance

Radiological Emergencies:

- Reactor Preparedness and Response
- Non-Reactor Emergency Preparedness and Response

The hallmark of an adequate RCP is the ability to protect the public, workers, and patients from unnecessary radiation exposure through consistent regulations and to effectively disseminate protective action recommendations to the public.

For simplicity, the RCP should be a single agency incorporating all appropriate subprograms within a jurisdiction, a concept that CRCPD supports. However, CRCPD recognizes that some jurisdictions apportion radiation control functions among two or more agencies. In such cases, each agency should meet those criteria applicable to those subprograms for which it has responsibility, and the state or local entity should meet all criteria.

ADMINISTRATION

ORGANIZATION

Jurisdiction

All major radiation protection subprograms that are applicable to a particular jurisdiction (state/region/local) ideally should be within the primary radiation control program (RCP). Major subprogram areas include the following:

- electronic product radiation, which is composed of two subprograms, ionizing (x-ray) and nonionizing;
- radioactive materials, which is composed of materials subject to the Atomic Energy Act (NRC Agreement States), disposal options for low-level radioactive waste, and naturally occurring radioactive materials in diffuse form (not subject to the Atomic Energy Act);
- radioactivity in the environment, which includes radon and environmental surveillance; and
- radiological emergencies, including both reactor and non-reactor radiological emergency preparedness and response.

Not all subprograms may fall under the jurisdiction of the RCP. For instance, reactor emergency preparedness and response applies only to those state within the 50-mile emergency planning zone of commercial power reactors. Likewise, not all states have entered into agreements with the NRC to relinquish its authority over certain radioactive materials to the state.

Interagency Cooperation

When radiation protection subprograms are divided among agencies within a jurisdiction, letters of agreement, memoranda of understanding, or other legally binding documents designed to maximize cooperation and minimize duplication of effort should be in place. The agencies should meet periodically (e.g., quarterly) to discuss interagency issues. Where the State Liaison Officer (SLO)

appointed by the Governor to interface with the NRC is not in the RCP, there should be an established and maintained communication link.

Organization Chart

The RCP should have an organization chart or other description that identities the RCP's position within the larger governmental hierarchy. It should also identify each major subprogram and position within the RCP, and delineate the chain of authority and responsibility by position within the RCP. The organization description should clearly identify and explain jurisdiction, authority, and management responsibility among state level, regional level, and local offices within the same jurisdiction. The description should also include support staff, contract services, and advisory bodies.

MANAGEMENT

Management Structure and Philosophy

The responsibilities for the achievement of objectives and the authority to approve assignments and work products within the RCP, whether for continuing programs or short-term projects, are traditional management roles that should be well defined and understood by all RCP staff. To this end the concept of management (e.g., line authority, shared governance, etc.) should be discussed in some detail in the RCP's Management Plan.

Radiation Control Program Director

Ideally, the RCP should be a separate and identifiable entity under the authority of a single individual. In jurisdictions where radiation control subprograms are apportioned among two or more agencies, each agency should clearly designate which individual has ultimate responsibility and authority for radiation control activities and decisions.

Supervision

Personnel performing radiation control activities should be under the supervision of the equivalent of a Radiation Control Supervisor as described in Appendix B – Job Descriptions. Those performing part-time or temporary duties and not directly under RCP supervision, including non-RCP inspectors as well as staff in other agencies or subdivisions of the agency in which the RCP exists, should be evaluated periodically and the results formally communicated to the appropriate supervisor.

Coverage

Essential functions within each subprogram area should be assigned to more than one person to assure continuous subprogram coverage in case of sickness, resignation, or other cause of a principal's unavailability.

Management Plan

The RCP should have a written management plan to guide its activities that includes each of the operating subprograms. The plan should follow the format and include the topics identified in Appendix A – Management Plan Guidance. The plan should be reviewed and revised on a periodic basis and whenever major changes in operating subprograms are made.

Periodic Assessment

The RCP should perform periodic internal self-assessments or arrange for periodic outside independent audits of its entire program. The CRCPD's Office of the Executive Director can provide resources for an independent program review. The RCP should review the results of its periodic assessments and consider changes to improve program effectiveness or expand into program areas that address emerging radiation issues.

Policies

The RCP should maintain for review by staff and other interested parties written statements of policy decisions addressing interpretations of administrative and technical procedures or official rulings made by the RCP.

Technical and Administrative Procedures

The RCP should develop and maintain written documents with step-by-step procedures to be followed by staff when conducting official activities of an administrative or technical nature. Such activities include:

- reviewing materials submitted in support of applications;
- conducting surveys, inspections, and other field activities; and
- performing compliance and enforcement activities.

Current versions of application formats, procedure manuals, and regulatory guides developed and/or endorsed by CRCPD and federal agencies should be adopted whenever available to promote consistency in data collection and evaluation.

Enforcement Options

The range of enforcement options available for response to regulatory noncompliance should include:

- administrative letters of agreement with licensees and registrants;
- management conferences;
- field notices of violation;
- orders of abatement;
- civil and administrative penalties;
- modification, suspension, and revocation of licenses and registrations;
- impoundment of sources of radiation; and
- referral for criminal prosecution.

Enforcement Philosophy

The philosophy behind enforcement options, actions and procedures should be documented. The following issues should be addressed:

- progressively escalated enforcement actions;
- preference for early and voluntary compliance;
- compliance assistance; and
- the basis for implementing various types and levels of enforcement action.

Enforcement Procedures

The RCP should have a document giving the step-by-step procedures for implementing each type of enforcement action. In addition, the following should be clearly stated:

- the enforcement actions to be taken at increasing levels of seriousness of noncompliance;
- the remedies available to persons cited (e.g., enforcement conferences, administrative hearings, etc.); and
- the on-site compliance procedures to be followed by inspectors in case of imminent hazard situations that cannot be handled through normal compliance channels.

Enforcement Communications

Inspection findings should be clearly communicated to the licensees and registrants. Standard wording and data formats that have been reviewed by legal counsel should be used in all enforcement communications with licensee, registrants, and others to promote uniformity and minimize legal error. Enforcement correspondence above the level of voluntary compliance should not be combined with reports of inspections results and other field activities and should always be signed by senior program management, preferably the program director. Outstanding enforcement actions and RCP responses thereto should be maintained in a time sensitive, secure, limited access filing system and closely followed by the responsible supervisory personnel until all enforcement matters are resolved.

Complaint/Allegation Procedures

Complaints or allegations from the public, patients, or employees of licensees and registrants should be recorded in standard format and promptly evaluated by supervisory personnel for response in accordance with a written protocol. Inspections resulting from complaints should be targeted to the areas cited in the complaint, but otherwise handled as routine compliance inspections. Investigations resulting from allegations should be handled by experienced staff. Identity of complainants or allegers should be kept confidential.

Public Information

The RCP should promote itself as a resource and authority on technical matters related to radiological health through contacts with the media, legislature, professional groups, educational institutions, use of the internet, and through participation in public forums. Regulations, procedures, educational materials (pamphlets, audio-visual presentations, etc.), and other useful information should be advertised and made available to the public. Ideally, substantial information of this type should be available in electronic format and posted to the internet. Use of social media should be considered as warranted. Materials in RCP files, as well as reports and communications based on these files, should be made available for public access in accordance with the jurisdiction's public records statutes. A written policy should clearly indicate what records are open to the public and the procedures to be followed in providing information.

Record Formats and Maintenance

The RCP should use uniform and standardized formats for collecting information and technical data during its official activities. This information should be maintained in a readily accessible system of files that facilitates use by staff preparing for inspections and surveys, preparing statistical and other reports, and following-up non-compliances. Due consideration should be given to the protection of sensitive personal information and proprietary information. Safeguards and Increased Controls information must be secured in accordance with criteria established by the NRC. A system for culling, discarding and/or archiving computer and written files and records at preset intervals should be in place.

Electronic Recordkeeping and Client Submissions

The RCP should make maximum use of computers and telecommunication modalities to facilitate storage of information and the development of statistical reports for review by management in planning and evaluating progress toward program objectives. A manual should be available that includes a list of databases, and for each database the:

- software format;
- collector and custodian;
- updating frequency;
- primary sources of the data;
- variables that can be used for sorting; and
- name of the person who may access for updating, editing, and extracting data.

Clients should have the option of submitting application, enforcement, and other information electronically.

Field Procedures Quality Assurance

The RCP should have a mechanism for early identification of faults in its field procedures and their implementation by staff. Accompanied visits by supervisory staff and targeted feedback (i.e., questionnaires) from clients should be included. Problems identified should be analyzed and addressed without delay.

AUTHORITIES

LEGISLATION

Suggested State Legislation

The RCP should have comprehensive basic enabling legislation modeled after the Council of State Governments' *Suggested State Legislation*, 1983 Edition, Volume 42, which has been extended to include activities introduced after the 1983 model legislation.

Additional Wording

In major subprogram areas not specifically addressed in the 1983 *Suggested State Legislation*, principally nonionizing radiation sources; radon; radiological emergency response; low-level radioactive waste; and environmental monitoring and surveillance; the RCP should either include specific wording in the basic enabling legislation, or identify authority contained in other statutes (e.g., general public health legislation) to provide a statutory basis for these subprograms.

Jurisdiction for nonionizing radiation control may come through a legal definition of "radiation" as including both ionizing and nonionizing in the existing authorization for the RCP. However, this approach may attract significant political resistance. A more specific authorization to regulate and enforce is a much better solution, especially since many professions combine several nonionizing modes with ionizing radiation uses. This includes medical, dental and veterinary facilities using lasers as a part of their practice, and cosmetic use of lasers along with radiofrequency devices. The RCP should also consider regulating the technician or operator for medical uses of nonionizing devices. At a minimum, states should regulate devices that are United States Food and Drug Administration (FDA) class 2 devices for human application.

Specific Content

The basic enabling legislation should authorize the RCP to:

- register or license owners and users of radiation producing machines;
- register radioactive materials sources, and license owners and users of radioactive materials sources;
- register owners and users of nonionizing radiation sources;
- issue regulations governing the possession, manufacture, distribution, use and disposal of radiation sources and standards for protection against exposure to radiation;
- inspect persons who own, possess, or use radiation sources as well as those who are licensed and/or registered with the RCP, and take enforcement action in cases of noncompliance with regulations;
- collect fees for any service, such as registering, licensing, issuing certificates, inspecting, conducting surveys, performing personnel and environmental monitoring, and emergency response activities;
- require surety arrangements of certain radiation source users;
- assess civil and administrative penalties for noncompliance with regulations and standards;
- appoint advisory committees and specify members' expertise, duties, and term;
- license or otherwise credential individual operators of radiation producing machines and individual users of other radiation sources;
- require the prompt correction of items of noncompliance with regulations;
- suspend, revoke, or otherwise curtail radiation related activities found to be inimical to public health or to be in willful non-compliance with regulations;
- impound radiation sources under circumstances found to be necessary for public health protection;
- enter into interstate and federal/state arrangements for mutual assistance in control of radiation hazards;
- enter into agreements with federal agencies to assume regulatory jurisdiction and/or provide specific services relating to control of ionizing and nonionizing radiation;
- accept funding, equipment, training, personnel assistance, and other forms of assistance from private entities and federal agencies in support of cooperative federal/state subprograms;
- grant reciprocity to persons authorized under similar provisions of other state and federal radiation control legislation and regulations;
- set qualifications, provide for enforcement, and require registration and/or licensure of private consultants, medical and health physicists, and radiation safety officers who provide inspections, surveys, repairs, and information upon which the RCP determines compliance with regulations (applicable only to states using non-RCP inspectors);
- require that radiation sources meet design and construction specifications;
- require that radiation measurement equipment meets design and performance specifications;
- set requirements for adequate radiation safety programs and procedures;
- set requirements for adequate training programs for radiation users and radiation safety personnel;
- set requirements for maintenance of records and submission of reports relating the safe use of radiation sources; and
- grant exemptions and variances from regulatory requirements providing that public health and safety is not adversely affected.

REGULATIONS

Consistency and Compatibility

To promote consistency among state radiation control regulations, the RCP should have regulations modeled after and closely tracking the *Suggested State Regulations for Control of Radiation (SSRCR),* published by the CRCPD for each major subprogram area where such regulations apply. Agreement states should have radioactive materials regulations that are compatible with NRC regulations in each area where compatibility is indicated by the NRC.

Comprehensiveness

Regulations should address each radiation source authorized to be regulated in the RCP's enabling legislation and should include activities addressing each area of radiation control specifically authorized in enabling legislation. RCP activities not specifically conducted under legally adopted regulations should be clearly explained as voluntary to participants.

Revisions

Regulations should receive a formal review on a regular schedule, not to exceed five years. Agreement State regulations must be revised to meet the implementation dates prescribed by the NRC, which is generally three years after implementation. Moreover, regulations should be reviewed as needed depending upon the area under review and the number of significant regulatory issues that have occurred as a result of *SSRCR* changes, new NRC compatibility requirements, new or revised state legislation, and technological developments since the last revision.

Reviews

Draft regulations, including proposed amendments and changes, should be reviewed by the RCP's Advisory Board during the drafting process. Affected groups and individuals should have an opportunity to review and comment on proposed rules or rule changes.

Adoption Procedures

Regulations should be formally adopted in accordance with the provisions of the state's Administrative Procedures Act, providing a period of time for public comment prior to adoption.

RESOURCES

PERSONNEL

Staffing Pattern

The RCP should have a staffing pattern that provides sufficient professional, technical, and administrative positions, as well as legal, accounting, computer, and other support personnel to carry out the activities in each major subprogram area. The number and types of staff required will depend upon the size and technical complexity of the activities involved. Specific guidance on staffing patterns is contained in Appendix C – Professional/Technical Staffing Guidance. The staffing pattern should provide for increasing levels of job categories that reflect the supervisory responsibilities, technical skills, educational level, and specific types of experience required for each position.

Compensation
The total annual compensation (salary plus benefits) for each position should be comparable to that provided for employment in similar positions, in the private and public sectors. The compensation scheme should provide for cost of living increases with length of employment based on a consumer index.

Career Development
A clear career ladder should exist within the RCP that allows employees to progress to positions of higher responsibility and technical skill when vacancies occur.

Job Descriptions
There should be an accurate and up-to-date description of each position in the RCP that describes the required responsibilities and tasks, the level of education and experience, and any special licenses or certifications. Appendix B – Job Descriptions contains recommended education and experience for various radiation control program positions.

Staff Training Plan
The RCP should have a written staff training plan that specifies the content and length of formal and on-the-job training programs to be completed by newly assigned personnel, and the in-service and continuing education programs expected for experienced staff. The written training plan should include:

- the general orientation and initial technical training required for all professional and technical personnel; specific subprogram training required to be completed by newly assigned staff before working in a subprogram area without close supervision, including training in personal safety equipment and procedures necessary for personal protection;
- the continuing education required for experienced staff and the acceptable options available for meeting the requirements;
- for each training entity cited, either reference to specific outside courses provided by universities, federal agencies, CRCPD, etc., or detailed training content descriptions and methods of evaluating successful completion.

Performance Reviews
The RCP should have a system for reviewing the performance of each employee on a periodic basis (at least annually). The system should include a conference with each employee to discuss progress toward established goals for quality and quantity of output as well as personal plans for further development of knowledge and skills.

Training Materials
The RCP should have available in a readily accessible system, for each subprogram area, copies of reference books, journals, federal publications, links to internet resources, audio visual presentations with necessary equipment for viewing, and educational computer programs for use by staff in continuing education efforts.

Problem Intervention
The RCP should have a system for early identification of stresses that are interfering with an employee's job performance and for referral for appropriate internal or external assistance, as necessary.

Employees Conduct Manual
The RCP should have a manual that provides a standard of conduct that must be followed by RCP employees involved in regulatory activities. Each employee should receive a copy of the manual and orientation in its content and use. The manual should cover any existing state legislation and regulations pertaining to employee conduct, as well as any prevailing written directives on employee conduct from higher authority within the organizational structure.

Disciplinary Action
The RCP should have a written disciplinary action program consistent with civil service procedures that includes warnings, counseling, right to hearing, specification of actions short of termination, and causes for termination.

Non-RCP Inspectors
If the legislature authorizes external personnel to conduct compliance or other activities in lieu of RCP personnel, the RCP should have in place a system for evaluating credentials prior to initial authorization, for periodic evaluation of performance as a condition of reauthorization, and for termination of authorization. See Appendix F – Use of Non-RCP (Non-governmental/Private) Inspectors for discussion of the potential benefits and drawbacks on the use of Non-RCP inspectors to perform compliance activities.

Personnel Radiation Safety
The RCP should provide appropriate personnel protective equipment and dosimeters for each staff member likely to be exposed to ionizing radiation at or above 10 percent of the occupational dose limit. Recording and reviewing exposure records and investigating unusually large doses should be in accordance with regulatory requirements. The annual occupational dose should be reported to each individual in a timely manner.

Discrimination Policy
The RCP should have in place safeguards to ensure that the applicable state and federal laws regarding discrimination are enforced. This must also be applied to Non-RCP inspection programs.

FINANCIAL

Funding Sources
RCP general expenses and expenses for each specific subprogram area should be fully supported by a secure funding source tied to:

- budgeted general funds;
- dedicated funds supported by legislative authority;
- dedicated user and/or other fees collected under legislative authority and regulatory schedules;
- federal funding pursuant to grants, cooperative agreements, or other arrangements provided by federal law and regulations; and/or
- other funding consistent with state and federal statutes.

Budgeting
RCP management should be a party to the budget preparation process of the higher-level organization with a fair opportunity to compete on the basis of merit and need for discretionary funds. Wherever appropriate, budget proposals should justify activities undertaken and their funding based on statistical and risk-based analyses.

Accounting
There should be an accounting system in place within the RCP or supporting agency that provides recording, tracking, disposition, responsibility, and accountability for all funds received, including fees, state funds, federal funds and any other funds. Likewise, all expenditures should be properly approved, charged against appropriate accounts, properly reconciled, and verified as to the value of services or products received. Periodic external financial audits should be conducted.

EQUIPMENT

Adequacy and Suitability
The RCP should have equipment in sufficient numbers, types, and technical capabilities to allow staff to properly conduct their activities in a timely manner.

Inventory
The RCP should maintain an updated list of equipment that includes a detailed description, specific identifier, and assigned storage location for each item. A physical inventory should be conducted at least annually.

Calibration
Each item of laboratory measurement equipment used in RCP activities should be checked for accuracy and precision against an appropriate standard traceable to a National Institute of Standards and Technology (NIST) or international standard. Each item of field measurement equipment used in RCP activities should be checked for accuracy and precision by a laboratory or test facility traceable to NIST or international standard measurements. The total uncertainly from NIST or international true value should be known and included in the measurement or calibration report. Calibrations should be performed at a frequency that is appropriate to the type of equipment and its use, and that is at least as often as is required of the regulated community. That calibration interval for each item of equipment should be stated in a written policy and the policy should include procedures to remove equipment from use when the interval is exceeded. Necessary repairs and/or adjustments resulting from calibration should be made promptly. The date of calibration and any correction factors should be affixed to the equipment.

Repair and Maintenance
The RCP should have a maintenance schedule that includes each item of equipment, especially emergency equipment, and, as a minimum:

- checks batteries;
- checks response against a radiation source; and
- completes any other periodic test and servicing required for proper functioning.

An established mechanism for obtaining timely diagnostic work and major repair services should be in place.

SUPPORT SERVICES

Legal
The RCP should have clearly identified legal counsel that is readily available and responsive to legal questions, review of legislative and regulatory issues, assistance with RCP compliance procedures, and any other legal matter.

Analytical
The RCP should have its own analytical laboratory or a contractual arrangement with an analytical laboratory that provides competent and timely analyses of samples collected in connection with its activities. Criteria for an adequate laboratory should include:

- a detailed written quality assurance program;
- participation in outside performance analytical testing programs;
- a safety and health program conforming to the federal Occupational Safety and Health Administration (OSHA) standards; and
- a radioactive materials and waste storage and handling program conforming to regulatory requirements.

Computer Technology Services
The RCP should have its own computer specialist or other established mechanism for obtaining computer services to ensure that essential data handling, technical analyses, and recordkeeping functions are continually available, and to upgrade and troubleshoot hardware and software as necessary.

RADIATION CONTROL PROGRAM OPERATIONS

ELECTRONIC PRODUCT RADIATION

IONIZING (X-RAY)

Activities should address all uses of x-ray producing equipment including the following areas:

- diagnostic and therapeutic medical;
- chiropractic, podiatric, dental, and veterinary x-ray, including computed tomography (CT), fluoroscopy and mammography;
- therapeutic medical use of particle accelerators;
- non-medical radiation generating devices such as industrial, academic and governmental x-ray devices; and
- fluoroscopy, including analytical x-ray equipment, security equipment and particle accelerators.

Staffing
Personnel requirements for registration, inspection, and enforcement should account for leave, holidays, staff meetings, necessary training (for new modalities and refresher technical training as well as other personnel training), administrative requirements, travel, and other factors unique to the state. In general, staffing should be as shown in Appendix C – Professional/Technical Staffing Guidance and approximately:

- for dental, a ratio of one full-time equivalent (FTE) per 500 unit (tube) inspections per year;
- for activities under the Mammography Quality Standards Act of 1992 (MQSA), a ratio of one FTE per 100 x-ray unit (tube) inspections per year unless modified by contract with FDA;
- for CT, fusion units (e.g., PET/CT), and therapeutic medical activities, a ratio of one FTE per 100 unit (tube) inspections per year;
- for other medical x-ray activities, a ratio of one FTE per 300 x-ray unit (tube) inspections per year; and
- for industrial, non-medical, or other x-ray activities, a ratio of one FTE per 500 unit (tube) inspections per year.

Small programs should assign responsibility between two persons to ensure continuous coverage and continuity in case of sickness, resignation, etc. For guidance in scheduling inspections, see Appendix D – Scheduling Guidance.

Facility registration

An efficiently functioning system should process registration of facilities with x-ray equipment prior to operation and after review of information submitted as required by regulations. This should include review and approval of shielding plans prior to construction of facilities where x-ray equipment is to be used. As a minimum, information should identify the facility location and owner, a facility supervisor with appropriate credentials, the requested x-ray equipment and procedures, and a facility radiation survey. More complex equipment, such as accelerators, should also require submittal of operating and emergency procedures, radiation safety program description, quality assurance process, and training plan. When other regulatory agencies are involved, the RCP should verify that the appropriate licenses or permits have been issued. Updating of changes to facility information and periodic renewal of registrations should be an integral part of the system.

Registration of services

An efficiently functioning system should process registration of commercial firms that offer services to x-ray facilities prior to operation and after review of information submitted as required by regulations. Services requiring registration should include consulting physicists, installation and repair, and personnel dosimetry. As a minimum, information should identify the service office location, owner, credentials of servicing staff, and types of services. Updating of changes to information and periodic renewal of registrations should be an integral part of the system. The RCP should make lists of persons providing various services available to the regulated community.

Inspection scheduling

There should be a written policy discussing the scheduling and frequency of initial, follow-up, and routine compliance inspections. The inspection scheduling policy should emphasize the following:

- setting frequencies based on potential patient and personnel exposure;
- using limited inspections and screening programs to identify problem facilities;
- combining inspections with special surveys whenever possible (e.g., National Evaluation of X-ray Trends (NEXT), mammography certification, etc.);
- considering workload and previous violation history of a facility or class of facilities in altering frequency;
- ensuring that new facilities are inspected within a reasonable time of becoming operational; and
- assigning more complex inspections to senior staff members.

For larger facilities that employ medical physicists, review of their reports and activities may be considered in lieu of RCP specific measurements on individual tubes. The policy should be reviewed annually and adjusted to reflect changes in program objectives and resources. Appendix D – Scheduling Guidance contains guidance on inspection frequencies.

Inspection assignment and tracking

An inspection assignment schedule should be developed at least quarterly, actual inspection frequencies should be tracked statistically, and any significant backlog should be addressed promptly. More complex and special category inspections (e.g., MQSA and CT) should only be performed or directly supervised by staff members who are fully qualified for the type of inspection involved.

Inspection procedures

Inspections should be conducted in accordance with written procedures that provide guidance for the following inspection components:

- an entrance interview with management;
- visits to x-ray use and image development areas where interviews with workers and measurement data can be obtained for compliance assessments and where programs, procedures, equipment and facilities can be examined;
- review of records on equipment quality control and maintenance, patient logs, employee exposure, employee training, area monitoring, and image quality; and
- an exit interview with management to summarize preliminary findings.

Opportunity should be taken to educate x-ray operators as appropriate. Standard forms and checklists should be used to record observations and measurement data. Use of nationally accepted guidance, such as CRCPD's Publication E-13-3, *Inspection Protocol for Medical Linear Accelerators,* should be used.

Inspection measurements

Tests and measurements to evaluate compliance with regulatory standards should be performed using appropriately sensitive instruments with current calibration, and procedures consistent with CRCPD and United States Food and Drug Administration/Center for Devices and Radiological Health (FDA/CDRH) guidance. Standard forms and formats should be used to record measurement data and perform on-site calculations and interpretations. Measurement equipment capable of electronic data capture, electronic calculators, and portable computers should be used whenever possible to promote standardization and minimize calculation errors.

Inspection reports

The inspector should prepare a report of each inspection that follows a uniform format and allows for timely (no later than 30 days after inspection) communication of results to the registrant. Reports should:

- summarize the inspection scope;
- include measurement data with appropriate interpretation;
- clearly list and categorize as to the severity each item of noncompliance;
- set a reasonable date for correction of each item; and
- require a plan for corrective action that includes submission of evidence that corrections have been performed and are effective.

Reports completed by inspectors on-site and left with the registrant should not be used as the sole official notification of violations intended as the basis for subsequent enforcement actions.

Inspection review and correspondence

Each inspection report should be reviewed by supervisory staff prior to preparation of enforcement and/or other inspection related correspondence with the registrant. See Enforcement Communications under Management in the section on RCP Administration.

Non-RCP inspectors

RCPs that accept reports of private consultants in lieu of inspections by RCP personnel should specify:

- minimum acceptable credentials for consultants:
- written report formats to be used;
- items to be assessed for compliance;
- measurements to be made;
- measurement protocols to be followed; and
- calibrated instruments to be used.

There should be a program for periodic field review of consultants' work and a mechanism for de-certifying consultants for good cause. See Appendix F - Use of Non-RCP (Non-governmental/Private) Inspectors.

Nationwide Evaluation of X-Ray Trends (NEXT) surveys

Staff should participate in the Nationwide Evaluation of X-Ray Trends (NEXT) surveys, administered through CRCPD, as an important outside quality assurance mechanism for survey activities, as well as a good source of state-of-the-art equipment, training, and survey procedures.

Quality assurance

The RCP should provide, either independently or as part of its inspection visits, assessment of and assistance with quality assurance procedures at healing arts facilities. The assessments and assistance should build on materials and procedures developed by CRCPD and federal agencies that emphasize use of normalized exposures and image quality evaluation tools by facilities.

Mammography

The RCP's participation in activities under the *Mammography Quality Standards Act of 1992* should be guided by regulations at least as stringent as those issued under that Act. Specific criteria are defined by the FDA/CDRH and must be met by RCPs performing mammography inspections.

Operator certification

All healing arts x-ray machine operators should be required to demonstrate a level of knowledge consistent with standards of national accrediting bodies. Either regulations should require operators to have appropriate national certification, or there should be a state certification program with equivalent requirements.

User education and assistance

Routinely during compliance and other survey activities, staff should provide information and assistance on regulatory requirements and procedures, radiological health risks, methods for reducing patient and worker doses, methods of improving image quality, and other topics of interest within their competence.

As new regulations and issues arise, the program should provide, through meetings and targeted literature, adequate opportunity for the regulated community to become better informed.

NONIONIZING

Subprogram scope

Activities should address all uses of nonionizing radiation producing equipment including those in the following areas:

- diagnostic and therapeutic medical;
- chiropractic;
- podiatric;
- dental;
- veterinary;
- industrial;
- academic; and
- governmental use.

Regulatory activities should address the following sources of nonionizing radiation:

- ultraviolet (UV) exposure in commercial tanning facilities;
- industrial, cosmetic, and medical radiofrequency (RF) devices;
- industrial microwave ovens;
- fixed laser light shows; and
- industrial, dental, veterinary, cosmetic, and medical laser devices.

Regulations should cover all FDA class 2 devices used for human application including certification of the technician or operator. User education and assistance programs should address the following:

- transient laser light shows;
- UV exposure from mercury vapor lamps;
- ultrasound devices;
- medical magnetic resonance imaging (MRI) systems;
- RF communications systems;
- radar systems and navigational aids;
- low voltage power line and 60 hertz electrical consumer products;
- high voltage transmission lines;
- medical microwave uses; and
- noncoherent optical sources.

Staffing

Personnel requirements for regulatory activities will depend upon the number and type of regulated sources. Generally, staffing for registration, inspection and enforcement should be approximately one full-time equivalent (FTE) per 300 device inspections per year. Guidance is provided in Appendix C – Professional/Technical Guidance. A minimum of 1.0 FTE should be allotted for public education and assistance programs. Small programs should assign responsibility between two persons to ensure continuous coverage and continuity in case of sickness, resignation, etc.

Nonionizing radiation source registration

An efficiently functioning system should process registration of facilities with nonionizing sources prior to operation and after review of information submitted as required by regulations. As a minimum, information should identify:

- the source, its maximum power and frequency range;
- the source location and owner;
- a facility supervisor with appropriate credentials;
- a facility radiation survey; and
- the specific process or procedure in which the source is used.

Updating of changes to source information and periodic renewal of registrations should be an integral part of the system.

In lieu of a survey of the nonionizing source, an acceptance of the manufacturer's output measurements can be acceptable if there is no indication of reworking the electronics and the output of the device. The RCP should be cautious in following this procedure. Updating of changes to facility information and periodic renewal of registrations should be an integral part of the system. As a minimum, the RCP should require appropriate training of the operating personnel. The registration should either list approved operators on the registration/license or require the registrant/licensee to maintain the records of their training. In addition, the RCP should require appropriate training for the safety officer for each registration/license. For human usage facilities, a medical director should be named and the degree of supervision addressed in the regulations. The RCP should require the reporting of medical events or injuries by the regulated facilities.

Registration of services

An efficiently functioning system should process registration of commercial firms that offer services to nonionizing facilities prior to operation and after review of information submitted as required by regulations. Services requiring registration should include installation and repair. As a minimum, information should identify the service office location and owner, credentials of servicing staff, and types of services. Updating of changes to information and periodic renewal of registrations should be an integral part of the system. The RCP should make lists of persons providing various services available to the regulated community.

Inspection scheduling

There should be a written policy discussing the scheduling and frequency of initial, follow-up, and routine compliance inspections. The inspection scheduling policy should emphasize the following:

- setting frequencies based on type of installation;
- variability of exposure and potential hazard to patients, workers and the general public;
- inspecting new facilities and installations within a reasonable time of becoming operational; and
- considering workload and previous inspection history in extending frequency.

The policy should be reviewed annually and adjusted to reflect changes in program objectives and resources. It is possible for one inspector to perform both an ionizing and a nonionizing radiation inspection at a facility. This would be appropriate in the case of primarily medical or dental facilities and for instances when the inspector is not making measurements of the nonionizing radiation devices.

Inspection assignment and tracking

An inspection assignment schedule should be developed at least semi-annually, actual inspection frequencies should be tracked statistically, and any significant backlog should be addressed promptly. More complex and special category inspections should only be performed or directly supervised by staff members who are fully qualified for the type of inspection involved.

Inspection procedures

Inspections should be conducted in accordance with written procedures that provide guidance for the following inspection components:

- an entrance interview with management;
- visits to use areas where interviews with workers and measurement data can be obtained for compliance assessments and where programs, procedures, equipment and facilities can be examined;
- review of records on equipment quality control and maintenance, employee exposure, employee training, and area monitoring; and
- an exit interview with management to summarize preliminary findings.

Standard forms and checklists should be used to record observations and measurement data.

Inspection measurements

Tests and measurements to evaluate compliance with regulatory standards should be performed using appropriately sensitive instruments with current calibration, and procedures consistent with guidance from CRCPD, relevant federal agencies, the National Council on Radiation Protection and Measurement (NCRP), and the American National Standards Institute (ANSI). Standard forms and formats should be used to record measurement data and perform on-site calculations and interpretations. Electronic calculators and portable computers should be used whenever possible to promote standardization and minimize calculation errors.

Inspection reports

The inspector should prepare a report of each inspection that follows a uniform format and allows for timely (no later than 30 days after inspection) communication of results to the registrant. Reports should:

- summarize the inspection scope;
- include measurement data with appropriate interpretation;
- clearly list and categorize as to the severity each item of noncompliance;
- set a reasonable date for correction of each item; and
- suggest what evidence of corrective action is acceptable.

Inspection review and correspondence

Each inspection report should be reviewed by supervisory staff prior to preparation of enforcement and/or other inspection related correspondence with the registrant. See Enforcement Communications under Management in the section on RCP Administration.

Non-RCP inspectors

RCPs that accept reports of private consultants in lieu of inspections by RCP personnel should specify:

- minimum acceptable credentials for consultants;
- written report formats to be used, items to be assessed for compliance;

- measurements to be made;
- measurement protocols to be followed; and
- calibrated instruments to be used.

There should be a program for periodic field review of consultants and a mechanism for decertifying consultants for good cause. See Appendix F – Use of Non-RCP (Non-governmental /Private) Inspectors for a discussion on the use of non-RPC inspectors.

Quality assurance

The RCP should provide, either independently or as part of its inspection visits assessment of and assistance with quality assurance procedures at healing arts facilities. The assessments and assistance should build on materials and procedures developed by CRCPD and federal agencies that emphasize use of quality evaluation tools by facilities.

Operator certification

All nonionizing radiation machine operators in the healing arts should be required to demonstrate a level of knowledge consistent with national standards. Either regulations should require operators to have appropriate national certification (e.g., American Society for Testing and Materials (ASTM)), or there should be a state certification program with equivalent requirements.

User education and assistance

Routinely during compliance and other survey activities, staff should provide information and assistance on regulatory requirements and procedures, radiological health risks, methods for reducing exposure, and other topics of interest within their competence. As new regulations and issues arise, the program should provide, through meetings and targeted literature, adequate opportunity for the regulated community to become better informed. For sources not regulated, the agency should develop and provide information to users for safe operation and respond to requests from users for on-site assessments and assistance.

RADIOACTIVE MATERIALS

NRC Agreement State

Subprogram scope

RCPs in states with 50 or more NRC licensees should enter into an Agreement with the NRC to become Agreement State programs. The RCP should address all radioactive material:

- source material;
- special nuclear material;
- by-product radioactive material; and
- naturally occurring and accelerator-produced radioactive material (NARM).

Regulated practices should include:

- diagnostic and therapeutic use of radioactive materials in the healing arts and veterinary medicine;
- use of radioactive materials in governmental, academic and industrial environments;
- manufacture and distribution of radioactive sources, and kits and devices containing radioactive materials, including consumer products;

- use of devices under general license; and
- any other activity involving radioactive material specified by regulations including sources subject to Increased Controls. See http://www.nrc.gov/about-nrc/state-tribal/agreement-states.html and http://www.nrc.gov/about-nrc/state-tribal/become-agreement.html#sa700 for details.

The Agreement State program also includes options for:

- regulating uranium mills and mill tailings;
- regulating disposal sites for low-level radioactive waste; and
- evaluating and registering sealed sources and devices.

RCPs that are NRC Agreement States shall maintain programs that meet NRC adequacy and compatibility requirements as set forth in its Integrated Materials Performance Evaluation Program (IMPEP).

Performance objectives for the Agreement State are specified in http://nrc-stp.ornl.gov/procedures/sa100.pdf; and specifically:

- for sealed source and device evaluation in http://nrc-stp.ornl.gov/procedures/sa108.pdf;
- for low-level waste disposal in http://nrc-stp.ornl.gov/procedures/sa109.pdf; and
- for uranium mills and tailings in http://nrc-stp.ornl.gov/procedures/sa110.pdf.

Criteria for operating programs addressing radon, environmental exposure to radioactive materials, diffuse sources of naturally occurring radioactive material (NORM) and low-level radioactive waste generation are presented separately. The following guidance for an Agreement State program is based on RCP experience.

Staffing

Professional/technical personnel requirements for licensing, inspection, and enforcement should be 1.0 to 1.5 FTE per 50 uncomplicated licenses. Additional professional/technical staff would be required for unusually large and time consuming licenses such as a major manufacturer, waste processor, uranium mining and milling, and sources subject to Increased Controls.

Technical personnel requirements for low-level radioactive waste are dependent on the stage of operations and numbers of sites:

- RCPs anticipating LLRW site characterization and pre-licensing activities should devote between 6.0 to 12.0 FTEs per site.
- RCPs with LLRW regulatory responsibility should devote from 4.0 to 6.0 FTEs per site.
- RCPs with closed LLRW sites should devote from 0.5 to 1.5 FTE, depending on site stability.
- For LLRW storage and processing only, the RCP should devote 0.5 to 1.0 FTE per license.

Programs should also consider adding 0.5 to 2 FTE for rule development, incident response and investigations to reflect the impact on normal licensing and inspection activities.
See Appendix C – Professional/Technical Staffing Guidance. Small programs should assign responsibility between at least two persons to ensure continuous coverage and continuity in case of sickness, resignation, etc.

Review of license applications

An efficiently functioning system should provide an adequately detailed technical review of license applications submitted for possession, use, manufacture, and distribution of radioactive materials, as well as any other associated activities requiring licensing by regulations (e.g., decontamination services) prior to approval for possession and/or operation. Contacts with applicants during the review process should be adequately documented through review letters and memoranda. For major operations, facilities subject to Increased Controls or applicants with no previous history with the RCP, pre-licensing visits to examine facilities and equipment may be in order.

Content of license applications

License applications should identity:

- the facility location and owner;
- a person who has appropriate credentials responsible for radiation safety;
- the types and quantities of proposed radioactive material; and
- proposed uses of the radioactive material.

Information should be obtained and reviewed for:

- technical adequacy on training of personnel;
- radiation safety procedures;
- equipment and facilities;
- operating and emergency procedures;
- environmental control equipment;
- personal protective equipment; and
- any other matters deemed necessary to evaluate whether a licensee can operate safely and in compliance with regulations and license conditions.

Licensing guides

Licensing guides, checklists, and policy guides should be used in the application review process to promote thoroughness, technical quality, and uniformity.

License document

The license document should be issued over the signature of a senior program manager and include:

- the type of radionuclides;
- the forms of radioactive materials and the quantities authorized;
- the specific uses authorized; any conditions attached to the license; and
- the time period (e.g., five years) for which the licensed activities are authorized.

License amendments

The licensing program should require licensees to obtain license amendments for any significant change in authorized radioactive materials, uses, and operations. The amendment review process should be equivalent to the license application review. An amendment document detailing all changes should be issued over the signature of a senior program manager.

License renewal

A complete technical review and reauthorization of active licenses comparable to the original licensing process should be required at a frequency based on the type of facility, materials authorized, and/or activities authorized.

Registration of devices under General License

The RCP should register certain devices containing large quantity or otherwise hazardous sealed sources of radioactive material that are generally licensed under its regulations. The registration program should:

- record the identity (serial number) of the device;
- information included in the NRC Registry of Radioactive Sources and Devices;
- the owner;
- the principal user; and
- the permanent use and/or storage locations.

Termination of licenses

Licensees should be required to notify the RCP in advance of intention to cease operations under a license. RCP procedures should require assurances on authorized disposition of radioactive materials and, if there is a significant potential for contamination, evidence of adequate decontamination of the site, facilities, and equipment.

Surety

For large quantity licensees with substantial potential for contamination of facilities, equipment, and the environment, or that possess large quantities of radioactive material requiring disposal, the RCP should require as part of the licensing process that an acceptable financial commitment in the form of a bond or other instrument be executed to be used for decontamination and/or waste disposal, if needed.

Source and device evaluations

RCPs under the appropriate agreement with NRC should initially evaluate new and periodically review sealed sources and devices containing radioactive material for radiation safety in accordance with procedures for entry into the NRC Registry of Radioactive Sealed Sources and Devices. This includes independent review by two qualified staff members.

Inspection scheduling

There should be a written policy discussing the scheduling and frequency of initial, follow-up, and routine compliance inspections. The inspection scheduling policy should emphasize the following:

- setting frequencies based on potential patient and personnel exposure;
- pre-licensing inspections;
- inspecting new facilities within six months of becoming operational;
- assigning inspections of more complex licenses to senior staff; and
- providing input on inspection needs from licensing staff.

The policy should be reviewed periodically and adjusted to reflect changes in program objectives and resources.

Inspection assignment and tracking
An inspection assignment schedule should be developed at least semi-annually, actual inspection frequencies should be tracked statistically, and any significant backlog should be addressed promptly.

Inspection procedures
Inspections should be conducted in accordance with written procedures that provide guidance for:

- an entrance interview with management;
- visits to use, storage, processing, and disposal areas where interviews with workers, compliance measurements and samples can be obtained and programs, procedures, equipment and facilities can be examined;
- observations of licensee employees using licensed material;
- review of inventory, patient, training, employee exposure, monitoring, disposal and other pertinent records; and
- an exit interview with management to summarize preliminary findings.

Standard forms and checklists should be used to record observations.

Inspection measurements and samples
Measurements to evaluate compliance with regulatory standards should be conducted using appropriately sensitive instruments with current calibrations, and procedures consistent with CRCPD and NRC guidance. Samples collected for subsequent laboratory analysis should be obtained, packaged, marked, and safeguarded according to a written protocol consistent with CRCPD and NRC guidance that is designed to ensure chain of custody, sample integrity, and analytical accuracy. Standard forms and formats should be used to record measurement data and perform on-site calculations and interpretations. Electronic calculators and portable computers should be used whenever possible to promote standardization and minimize calculation errors.

Inspection reports
The inspector should prepare a report of each inspection that follows a uniform format and allows for timely (no later than 30 days after inspection) communication of results to the licensee. Reports should:

- summarize the inspection scope;
- include measurement data with appropriate interpretation;
- clearly list and categorize as to the severity each item of noncompliance;
- set a reasonable date for correction of each item;
- and require a plan for corrective action that includes submission of evidence that corrections have been performed and are effective.

Inspection review and correspondence
Each inspection report should be reviewed by supervisory staff prior to preparation of enforcement and/or other inspection related correspondence with the licensee. See Enforcement Communications under Management in the section on RCP Administration.

Quality assurance
The program should provide, either independently or as part of its inspection visits, assessment of and assistance with quality assurance procedures at healing arts facilities. The assessments and assistance should build on materials and procedures developed by CRCPD and federal agencies that emphasize accurate patient dose administration and optimum image quality by facilities.

User education and assistance

Routinely during compliance and other survey activities, staff should provide information and assistance on regulatory requirements and procedures, radiological health risks, methods for reducing patient and worker doses, methods of improving image quality, and other appropriate topics within their competence. As new regulations and issues arise the program should provide, through meetings and targeted literature, adequate opportunity for the regulated community to become better informed.

Low-Level Radioactive Waste (LLRW)

Subprogram scope

Every state may have one or more radioactive materials licensees that have long-lived radioactive waste that requires disposal in a LLRW disposal site. Under the Low-Level Radioactive Waste Policy Act of 1980, every state has the responsibility to manage its own radioactive waste disposal needs by hosting a LLRW disposal site or through disposal within the Interstate Compact system. The RCP, whether an NRC Agreement State or not, should have a subprogram addressing how radioactive waste is handled in its jurisdiction. At a minimum, all state RCPs should:

- engage in activities designed to monitor the scope of LLRW;
- encourage generators to reduce LLRW and handle shipments properly;
- monitor brokers and transporters;
- participate in Low-Level Radioactive Waste Policy Act compact deliberations; and
- maintain a public information program.

RCPs in states preparing for a LLRW disposal site (proposed or anticipated) or in states that have an active or closed LLRW disposal site must adhere to NRC requirements. See preceding section and current NRC requirements for details on activities related to site characterization, comprehensive licensing and inspection, generator and shipper monitoring, emergency response, institutional controls, and environmental monitoring.

Staffing

Every state RCP, at a minimum, should devote a minimum of between 0.25 and 0.5 FTEs per year and 0.25 to 0.5 FTE per million population per year to monitor LLRW generated within the state.

LLRW verification program

Waste may require processing to satisfy the waste acceptance criteria of the LLRW disposal site. Typically, a commercial waste processor is used by the generator of the radioactive waste, which may be facilitated by a waste broker as part of the path to disposal. Waste processing is not part of the Low-Level Radioactive Waste Policy Act of 1980. The waste processor may be in a state different than the state where the waste is generated or the state where the waste will be disposed. Regardless, the RCP in the state where the LLRW is generated should be concerned that the final product satisfies the waste acceptance criteria and can be disposed in a LLRW disposal site and is not returned to the state. At least bi-annually the RCP should independently verify by type the amounts of LLRW generated, treated (e.g., compacted, incinerated, etc.), and shipped to brokers and/or disposal sites from within the jurisdiction. The results should be correlated with similar information produced by outside entities (e.g., LLRW compacts, Department of Energy Manifest Information Management System (MIMS), etc.). A report summarizing this information should be produced and made available to interested parties.

Transport monitoring
The RCP should periodically monitor shipments of LLRW in transport to ensure compliance with U.S. Department of Transportation (DOT) and RCP regulations on:

- external radiation exposures;
- surface contamination;
- packaging;
- loading;
- labeling;
- placarding;
- and integrity of the packages.

Broker monitoring
RCPs with LLRW brokers within their jurisdiction should license and inspect these operations in accordance with RCP regulations. See RCP Operations – Radioactive Materials – NRC Agreement State in this section. Host state RCPs should provide for the conduct and/or coordination of reviews/audits of all brokers with access to their state's LLRW disposal facilities.

Compact administration
Senior staff of state RCPs should participate (preferably as the Governor's designee) in the state's activities under the Low-Level Radioactive Waste Policy Act to provide technical information and assistance, and to represent the RCP's regulatory interests in providing for adequate LLRW disposal for licensees.

Risk communication activities
The RCP should employ various strategies to inform the public regarding the health risks as well as the other technical and regulatory issues involved in the disposal of LLRW.

Diffuse Naturally Occurring Radioactive Material (NORM)

Subprogram scope
RCPs, including NRC Agreement State programs, should address radioactive materials not otherwise regulated under the Atomic Energy Act. For all practical purposes, this is diffuse and technologically enhanced sources of naturally occurring radioactive materials (NORM or TENORM) that require a regulatory approach to protect the public. This is distinct from operating programs addressing radon and environmental exposure to radioactive materials.

Staffing
Professional/technical personnel requirements for licensing, inspection, and enforcement should be 1.0 to 1.5 FTE per 50 uncomplicated licenses. Small programs should assign responsibility between at least two persons to ensure continuous coverage and continuity in case of sickness, resignation, etc.

Review of license applications
An efficiently functioning system should provide an adequately detailed technical review of license applications submitted for processing operations that involve diffuse forms of naturally occurring radioactive material that are not covered by the Atomic Energy Act as amended. Contacts with applicants during the review process should be adequately documented through review letters and

memoranda. For major operations, pre-licensing visits to examine facilities and equipment may be in order.

Content of license applications

License applications should identity:

- the facility location and owner;
- a person with appropriate credentials who is responsible for radiation safety;
- the types and quantities of diffuse NORM; and
- proposed control of the radioactive material.

Information should be obtained and reviewed for:

- technical adequacy on training of personnel;
- radiation safety procedures;
- equipment and facilities;
- operating and emergency procedures;
- environmental control equipment;
- personal protective equipment; and
- any other matters deemed necessary to evaluate whether a licensee can operate safely and in compliance with regulations and license conditions.

Licensing guides

Licensing guides, checklists, and policy guides should be used in the application review process to promote thoroughness, technical quality, and uniformity.

License document

The license document should be issued over the signature of a senior program manager and include:

- the type of diffuse NORM;
- the process and procedures to be used to protect workers, the public and the environment from radioactive contamination;
- any conditions attached to the license; and
- the time period (e.g., five years) for which the licensed activities are authorized.

License amendments

The licensing program should require licensees to obtain license amendments for any significant change in authorized uses and operations. The amendment review process should be equivalent to the license application review. An amendment document detailing all changes should be issued over the signature of a senior program manager.

License renewal

A complete technical review and reauthorization of active licenses comparable to the original licensing process should be required at a frequency based on the type of facility and/or activities authorized.

Termination of licenses

Licensees should be required to notify the RCP in advance of intention to cease operations under a license. RCP procedures should require evidence of adequate decontamination of the site, facilities, and equipment.

Surety
For licensees with substantial potential for contamination of facilities, equipment, and the environment, or which possess large quantities of radioactive material requiring disposal, the RCP should require as part of the licensing process that an acceptable financial commitment in the form of a bond or other instrument be executed to be used for decontamination and/or waste disposal, if needed.

Inspection scheduling
There should be a written policy discussing the scheduling and frequency of initial, follow-up, and routine compliance inspections. The inspection scheduling policy should emphasize the following:

- setting frequencies based on potential public, environmental and personnel exposure;
- pre-licensing inspections;
- inspecting new facilities within six months of becoming operational;
- assigning inspections of more complex licenses to senior staff; and
- providing input on inspection needs from licensing staff.

The policy should be reviewed periodically and adjusted to reflect changes in program objectives and resources.

Inspection assignment and tracking
An inspection assignment schedule should be developed at least semi-annually, actual inspection frequencies should be tracked statistically, and any significant backlog should be addressed promptly.

Inspection procedures
Inspections should be conducted in accordance with written procedures that provide guidance for:

- an entrance interview with management;
- visits to processing and disposal areas where interviews with workers, compliance measurements and samples can be obtained and programs, procedures, equipment and facilities can be examined;
- review of training, employee exposure, monitoring, disposal and other pertinent records; and
- an exit interview with management to summarize preliminary findings.

Standard forms and checklists should be used to record observations.

Inspection measurements and samples
Measurements to evaluate compliance with regulatory standards should be conducted using appropriately sensitive instruments with current calibrations, and procedures consistent with CRCPD and NRC guidance. Samples collected for subsequent laboratory analysis should be obtained, packaged, marked, and safeguarded according to a written protocol consistent with CRCPD and NRC guidance that is designed to ensure chain of custody, sample integrity, and analytical accuracy. Standard forms and formats should be used to record measurement data and perform on-site calculations and interpretations. Electronic calculators and portable computers should be used whenever possible to promote standardization and minimize calculation errors.

Inspection reports
The inspector should prepare a report of each inspection that follows a uniform format and allows for timely (no later than 30 days after inspection) communication of results to the licensee. Reports should:

- summarize the inspection scope;
- include measurement data with appropriate interpretation;
- clearly list and categorize as to the severity each item of noncompliance;
- set a reasonable date for correction of each item; and
- require a plan for corrective action that includes submission of evidence that corrections have been performed and are effective.

Inspection review and correspondence

Each inspection report should be reviewed by supervisory staff prior to preparation of enforcement and/or other inspection related correspondence with the licensee. See Enforcement Communications under Management in the section on RCP Administration.

User education and assistance

Routinely during compliance and other survey activities, staff should provide information and assistance on:

- regulatory requirements and procedures;
- radiological health risks;
- methods for reducing worker doses;
- methods of reducing potential for environmental contamination; and
- other appropriate topics within their competence.

As new regulations and issues arise the program should provide, through meetings and targeted literature, adequate opportunity for the regulated community to become better informed.

RADIOACTIVITY IN THE ENVIRONMENT

Radon

Subprogram scope

There should be a registration/certification and/or licensing component for measurement and mitigation contractors. In other activities the RCP role should be:

- conducting surveys and research to locate and characterize areas of elevated radon;
- formulating and issuing guidance;
- providing public information;
- assisting with technology transfer to contractors; and
- overseeing and evaluating radon measurement and mitigation efforts in schools and other public buildings.

Staffing

Personnel requirements for regulatory activities should be at least 0.5 FTE and at a rate of 0.5 FTE per 100 contractors. Staffing for non-regulatory activities, since it will depend upon the extent and degree of the radon problem within the jurisdiction, should be at least 0.5 FTE with additional staff commensurate to that needed for the regulatory activities. Small programs should assign responsibility between two persons to ensure continuous coverage and continuity in case of sickness, resignation, etc.

Measurement contractors

An efficiently functioning system should process registrations/certifications or licenses for persons offering to collect samples and make laboratory or field measurements for the evaluation of radon and radon progeny in air and/or drinking water prior to their operation and after review of information submitted as required by regulations. As a minimum, information should identify:

- the facility location and owner;
- a facility supervisor who has appropriate credentials;
- individual testers' qualifications and training;
- the services to be offered (diagnostic, screening, etc.);
- sample collection, field measurement and/or laboratory procedures with appropriate quality control program; and
- specific field and laboratory equipment to be used.

Successful participation in a state approved measurement proficiency program should be required. Updating of changes to facility information and periodic renewal of registrations/certificates/licenses should be an integral part of the system. Periodic contractor reports or other means should be used to monitory the number, types, and results of testing activities.

Mitigation contractors

An efficiently functioning system should process registrations/certifications or licenses for persons offering to provide radon mitigation services prior to their operation and after review of information submitted as required by regulations. Services requiring registration should include design, supervision, and installation of systems in new and existing structures for the reduction of radon and radon progeny. As a minimum, information should identify:

- the office location and owner;
- credentials of design and supervisory staff;
- training of installation staff;
- the worker protection program for radon; and
- the types of mitigation services offered.

Updating of changes to information and periodic renewal of registrations should be an integral part of the system. Successful participation in a state approved contractor proficiency program should be required. Periodic contractor reports or other means should be used to monitor the number, types, and results of mitigation activities.

Inspections

Program staff should conduct random inspections of the work of both measurement and mitigation service providers, including, for mitigation contractors, verification of the degree of reduction in levels achieved. Inspections should be performed against the quality assurance programs of the service providers and state regulations. There should be minimum criteria for performance and regulatory authority to take action against service providers not meeting minimum criteria.

Radon concentration guidance

The RCP should adopt and promote consensus guidance for concentrations of radon and progeny in indoor air and for radon concentrations in drinking water. Guidance should include details on the method for evaluation of concentration (e.g., screening with charcoal canisters) the associated health risk, and the relationship of test results to the need for mitigation.

Mitigation practices
The RCP should adopt and promote consensus standards for mitigation methods for elevated levels of radon and progeny in indoor air and for elevated radon concentrations in drinking water. Guidance should be developed and issued describing the methods, their applicability to particular types of structures and concentrations, and their associated cost.

Surveys and research
The RCP should conduct and/or participate in EPA sponsored measurement surveys designed to characterize the location, extent, and degree of elevated indoor radon and progeny and/or elevated concentrations of radon in drinking water within its jurisdiction. The information from these surveys, together with research on geology and other factors, should be used in the planning of public information and other efforts.

Public information
The RCP should employ various strategies to inform and motivate the public regarding elevated radon concentrations in indoor air and drinking water. Strategies should include:

- making general and targeted mailings of information brochures;
- publicizing and staffing a telephone assistance service;
- issuing press releases and actively seeking other media opportunities;
- providing lists of approved contractors; and
- participating in public meetings and training forums.

Technology transfer
The RCP should facilitate transfer of information regarding pros and cons of current mitigation methods and techniques, improvements that can be made, and newly recommended mitigation approaches and methods. Potential RCP activities in technology transfer include:

- setting standards for qualifications and practice;
- requiring continuing education for contractor personnel and approving the training courses;
- revising regulations to account for technology changes; and
- using communications techniques (e.g., the internet) to transfer pertinent information.

Schools and public buildings
The RCP should actively participate in overseeing radon surveys, measurements, and mitigation efforts for public schools and other public buildings. This participation may include:

- design of surveys and evaluation of results;
- review of contracts and methods;
- information meetings and training sessions with building officials and staff; and
- inspection of mitigation work.

The RCP should develop and include in regulations protocols for school and public building measurement based on EPA School Measurement protocols.

External strategies
The RCP should develop strategies for exerting influence on external processes and entities engaged in radon related activities. For instance, the RCP should develop and include in regulations protocols for radon measurements in real estate transactions. Also, the RCP should actively participate in training

local governmental inspectors and updating building codes to include recommended radon prevent systems in new construction.

ENVIRONMENTAL RADIATION SURVEILLANCE

Subprogram scope

Activities should include a field sampling and measurement component, a laboratory analysis component, and a data analysis and report component. Activities should be directed toward three areas:

- ambient background characterization;
- surveillance of major facilities (e.g., reactor sites; uranium mills; processors of large quantities of loose materials; low-level radioactive waste processing and disposal facilities; naval nuclear propulsion bases and shipyards; and U.S. Department of Energy facilities); and
- emergency response for rapid evaluation of unplanned or unusual radiation exposures or releases of radioactive materials, both foreign and domestic.

Care should be taken to establish a radiological baseline and monitoring capability specific to potential widespread releases such as occurred with the Chernobyl Nuclear Power Plant and the Fukushima Dai-ichi Facility accidents, or that could result from a nuclear detonation regardless of cause.
Pre-established contaminant levels should be chosen for early identification of problems so that action can be taken before regulatory limits are approached. Where mixed radioactive and hazardous wastes are involved, the RCP's effort should be coordinated with environmental chemical surveillance conducted by other regulatory or governmental entities.

Staffing

The base staff time requirements, including management, health physics, laboratory, and field personnel time, should be from 1.0 to 3.0 FTEs, depending on the size of the jurisdiction. An additional 1.0 to 2.0 FTEs are required if the state is impacted by a major facility. For two to five major facilities, the program will need an additional 1.5 FTE per facility. For each major facility above five, the program will need an additional 1.0 FTE. Staffing recommendations are summarized in Appendix C – Professional/Technical Staffing Guidance

Ambient monitoring

There should be a network of strategically located stations at which ambient measurements are taken and samples collected for analyses to characterize variations in natural ambient background radiation and levels of radioactive materials within the RCP's jurisdiction. The schedule for measurements and samples, along with the types of media sampled (air, water, food, wildlife, vegetation, etc.) should be planned to include variations in environmental conditions and to reflect significant pathways for current or future human exposure and environmental contamination.

Source oriented monitoring

There should be a program of exposure measurements, sample collection, and analysis for surveillance of each major facility within the jurisdiction. The program should include independent sample analysis and measurements by the RCP, as well as close scrutiny of facilities' surveillance efforts. The agency should actively participate in the planning of the facilities' surveillance programs, including:

- location of sampling stations;
- technical equipment to be used; and
- procedures for field measurements, sample collection and laboratory analyses.

The RCP should regularly review and evaluate the data and reports from the facilities' surveillance programs.

Emergency response monitoring

A written plan should be in place for rapid response and evaluation for accidents and/or emergencies involving real or potential radiation exposure to non-radiation workers or unscheduled releases of radioactive materials to the environment beyond regulatory standards. The plan should draw upon the capabilities of the routine environmental surveillance program and should include:

- identification and responsibilities of key personnel;
- a notification system for key personnel;
- dedicated equipment for personal protection, transport, communications;
- anticipated measurement and sampling situations;
- contact telephone numbers for major facilities, outside consultants and support government agencies; and
- sampling and measurement procedures to be followed with emphasis on contamination prevention and radiation safely of field personnel.

Also see Non-reactor Emergency Preparedness and Response in this section.

Laboratory procedures manual

There should be a reference laboratory procedures manual containing, for each analytical procedure in use:

- detailed step-by-step procedures for preparing representative analytical specimens;
- the instrumental settings and adjustments to be employed during the analytical process; and
- the methods for acquisition, recording and interpreting the data produced.

Whenever possible, analytical procedures should reflect those developed by NIST or other recognized standards development bodies.

Field procedures manual

There should be a field procedures manual detailing the steps to be followed in:

- collecting field samples;
- operating and maintaining field monitoring equipment; and
- acquiring and interpreting data from field monitoring equipment.

Recording analytical results

There should be an efficient system, preferably computerized, for recording, tracking, and reporting the results of each specific laboratory and field measurement test. The system should enable staff to quickly identify specific samples, the test conducted, and the calculations and interpretations applied thereto.

Quality assurance

A written quality assurance program governing field and laboratory activities should be in place and regularly reviewed and revised as necessary. The program's goal should be to ensure that measurements and analytical results are sufficiently accurate and that they reflect actual conditions. A single person should be responsible for quality control. At least 10 percent of the environmental surveillance program effort should be allocated for quality control. The following areas should be addressed:

- sample collection and receipt, including proper identification and tracking of samples, and maintenance of chain of custody;
- sample preparation and analysis, including accuracy, precision, and lower limit of detection;
- health physics issues, including surveys of incoming samples and regular laboratory contamination surveys;
- calibration of instruments with standards traceable to NIST;
- quality control, including blind, spiked, and duplicate samples for each type of analysis at least quarterly, outside performance testing, and quality control charts and records;
- data analysis and analytical reports, including evaluating anomalous results and reporting measurement error with analytical results;
- preventive maintenance schedules for equipment;
- storage of samples and cross-contamination control; and
- disposal of hazardous and radioactive waste.

Annual reports

There should be a comprehensive report published at least annually that describes the scope and purpose of the environmental surveillance program and contains meaningful summaries of the analytical data. Discussion of summaries should clarify variations in background levels, secular trends of long-term sources, and changes due to the impact of temporary phenomena such as nuclear testing and/or accidental releases. Plans for any new activities should also be discussed.

Surveillance guidance

Appendix E – Surveillance Guidance for the Ambient Environment provides guidance for the number and types of specific samples, measurements, and laboratory analyses recommended for various surveillance situations.

RADIOLOGICAL EMERGENCIES

Reactor Preparedness and Response

Subprogram scope

The RCP should maintain a capability for responding to accidents and incidents involving sited nuclear reactors. The RCP should meet the criteria detailed in various NRC, Environmental Protection Agency (EPA) and Federal Emergency Management Agency (FEMA) documents for participation in nuclear reactor emergency response. The RCP's role in emergency response should be:

- assessing off-site radiation hazards;
- recommending protective actions;
- supervising decontamination efforts;
- supervising source stabilization and/or recovery;
- communicating; and
- coordinating with various other local, state, and federal agencies and task forces involved.

Staffing

Staff time devoted to reactor emergency response including planning, training, exercises, equipment maintenance, investigations, and response to incidents and accidents should meet NRC and FEMA requirements.

Response planning
The RCP should have written plans for response to reactor related accidents and incidents that meet FEMA requirements.

Response personnel
Specific staff, preferably senior staff with training in emergency response, should be designated for responding to reactor accidents and incidents. Information received should be reviewed by supervisory staff and assignments made according to expertise and availability. A response team should include field team, facility liaison, local jurisdiction liaisons, team leader, a RCP spokesperson, and a second shift staff available for extended accidents.

Communications
A communications network capable of providing notification, command, and control should be available to response personnel for both on-site communications and communication with an RCP emergency response center.

Transportation
Appropriate transport capable of providing rapid deployment and access to various terrains should be available to response personnel.

Field equipment
Equipment and supplies necessary for response should be available and maintained in operational condition. These include:

- mobile laboratory vehicles;
- radiation survey equipment;
- sample collection equipment;
- maps;
- personnel dosimetry;
- personal protective equipment;
- decontamination supplies;
- communication equipment; and
- reference manuals necessary for procedures and proper equipment functioning.

Interagency coordination
Procedures should be in place for coordinating a response with other responsible state and federal agencies (FEMA, state emergency management agency, NRC, EPA, etc.) when mixed hazards are involved or where implementation of protective actions requires the authority of other agencies.

Exercises
The RCP should participate in all exercises involving response to a reactor accident including plume and ingestion pathways. The exercise should be made as realistic as possible and the performance of response personnel should be constructively critiqued. The RCP should take every opportunity to participate in emergency response exercises conducted by other agencies as a means of improving coordination of effort during incidents and accidents. The emergency response plan should include emergency response contact names and telephone numbers for all coordinating state and federal agencies.

Interstate assistance agreements
In areas where interstate agreements between RCPs for assistance with emergency response are available, the RCP should seek out and enter into such agreements. The emergency response plan should include contact names and telephone numbers for accessing this assistance.

Federal agency support
The RCP should be familiar with the capabilities and resources of federal agencies that can provide support during an incident or accident. The emergency response plan should include contact names and telephone numbers for accessing support from these agencies.

Consultants
If the RCP uses private sector persons with appropriate expertise to provide assistance during radiological incidents, they should be properly briefed on their responsibilities and their roles, and their participation should be reflected in the emergency response plan.

NON-REACTOR EMERGENCY PREPAREDNESS AND RESPONSE

Subprogram scope
The RCP should maintain a capability for responding to accidents and incidents involving radioactive materials in transport, originating from outside the United States, or at sites other than nuclear reactors. The RCP's role in emergency response should be:

- assessing radiation hazards;
- recommending protective actions;
- supervising decontamination efforts;
- supervising source stabilization and/or recovery;
- communicating; and
- coordinating with various other local, state, and federal agencies and task forces involved.

The RCP should train for and be prepared to integrate into the National Incident Management System/Incident Command Systems (NIMS/ICS).

Staffing
Staff time devoted to non-reactor emergency response including planning, training, exercises, equipment maintenance, investigations, and response to incidents and accidents should be approximately 0.5 FTE per million state population. In no case, should less that 0.5 FTE be devoted to non-reactor emergency response.

Response planning
The RCP should have written plans for response to various types of radiation related accidents and incidents (e.g., transportation accidents, industrial radiography incidents, scrap metal incidents, contaminated consumer products, fallout from world-wide catastrophes, etc.). The plans should:

- contain policies and procedures regarding securing the site, assessing the radiation hazards, providing for source stabilization, providing for decontamination, coordinating with other response personnel and communicating protective action recommendations to responsible authorities;
- identify likely accident and incident situations and provide specific information on the nature and level of response to each;

- identify designated response personnel and their roles;
- contain notification procedures; and
- list communications, transport, and equipment resources.

Response personnel

Specific staff, preferably senior staff with training in emergency response, should be designated for responding to accidents and incidents. Information received should be reviewed by supervisory staff and assignments made according to expertise and availability. A response team composed of several staff under a team leader and including a RCP spokesperson should be designated for response to large scale or highly publicized events.

Communications

A communications network capable of providing notification, command, and control should be available to response personnel for both on-site communications and communication with a RCP emergency response center.

Transportation

Appropriate transport capable of providing rapid deployment and access to various terrain should be available to response personnel.

Field equipment

Equipment and supplies necessary for response should be available and maintained in operational condition. These include:

- mobile laboratory vehicles;
- radiation survey equipment;
- sample collection equipment;
- maps;
- personnel dosimeters;
- personal protective equipment;
- decontamination supplies; and
- reference manuals necessary for procedures and proper equipment functioning.

Interagency coordination

Procedures should be in place for coordinating a response with other responsible state and federal agencies (FEMA, state emergency preparedness agency, NRC, EPA, etc.) when mixed hazards are involved or where implementation of protective actions requires the authority of other agencies.

Exercises

Periodically the RCP should conduct exercises involving response to a typical radiological incident. The exercise should be made as realistic as possible and the performance of response personnel should be constructively critiqued. The RCP should take every opportunity to participate in emergency response exercises conducted by other agencies as a means of improving coordination of effort during incidents and accidents. The emergency response plan should include emergency response contact names and telephone numbers for all coordinating state and federal agencies.

Interstate assistance agreements

In areas where interstate agreements between RCPs for assistance with emergency response are available, the RCP should seek out and enter into such agreements. The emergency response plan should include contact names and telephone numbers for accessing this assistance.

Federal agency support

The RCP should be familiar with the capabilities and resources of federal agencies that can provide support during an incident or accident. The emergency response plan should include contact names and telephone numbers for accessing support from these agencies.

Consultants

If the RCP uses private sector persons with appropriate expertise to provide assistance during radiological incidents, they should be properly briefed on their responsibilities and their roles, and their participation should be reflected in the emergency response plan.

APPENDIX A

MANAGEMENT PLAN GUIDANCE

MISSION

A mission statement for the Radiation Control Program (RCP) should be crafted to identify, define, and clarify the positive outcomes of RCP operations on the community (e.g., improve community health status, enhance sense of community protection against radiation hazards, and discourage unsafe radiation practices). The statement should incorporate the overall purpose and role of the RCP in pursuing its activities.

ISSUES

At least one public health, environmental or other radiation control issue of significant importance should be identified to which each subprogram area responds. Each issue should be well described and justified with information on:

- the extent of radiation sources and exposures;
- individual and population dose estimates;
- economic consequences; and wherever possible
- health risk estimates.

OBJECTIVES

Measurable outcomes representing meaningful indicators of short and long-term success should be identified for each subprogram area.

STRATEGIES AND MISSION

The overall strategies (e.g., regulatory approach, educational approach) and the specific methods (e.g., licensing, public information campaign, etc.) for addressing each problem and accomplishing each objective should be identified and discussed. Resources, including funding and support services that are dedicated to each method, should be identified.

MANAGEMENT STRUCTURE AND PHILOSOPHY

The responsibility for successful implementation of each strategy and the achievement of each objective should be assigned and outlined. The philosophy and structure through which responsibilities for managing these strategies are to be exercised should be discussed. For instance, whether supervisors have absolute decision-making authority or whether there is a requirement for meaningful group input on major and routine program decisions and issues should be addressed. References to management texts and treatises should be used when applicable.

ANNUAL WORK PLAN

Specific quantitative objectives to be achieved at periodic intervals (e.g., monthly) throughout the year should be formulated addressing each stated objective.

EVALUATION

Specific evaluation methods and their application frequency should be identified. Wherever possible, actual public health impact of activities, (e.g., reduction in exposure, dose, and risk) should be highlighted for evaluation. Evaluation methods should include assessments of quality indicators, as well as audits of process and numerical indicators. Reference should be made to specific reports and tools used for evaluation and to action plans initiated by adverse evaluation findings.

APPENDIX B

JOB DESCRIPTIONS

The following guidance may be used to develop a description of radiation control positions.

RADIATION CONTROL PROGRAM DIRECTOR

Duties and Responsibilities

- has responsibility for the entire radiation control program in an agency or several subprograms;
- provides overall technical direction and performance oversight of the supervisors of subprograms, including assignment of work, scheduling, performance review, training, and problem resolution;
- leads program policy development, program planning, and program evaluation efforts for agency and/or subprograms;
- is the individual responsible for paperwork and performance on federal agreements and grants to agency and/or subprograms;
- if manager of all radiation control activities in an agency, has responsibility for coordinating efforts with higher level management and responding to the higher level agency's requirements;
- if manager of all radiation control activities in an agency, has responsibility for coordinating efforts under any interagency agreements and/or activities;
- has key responsibility in personnel appointments, evaluations, counseling, and promotions for agency and/or subprograms;
- prepares, defends, and implements budgets for agency and/or subprograms.
- has fiduciary responsibility for funds collected and disbursed by agency and/or subprograms;
- prepares, reviews, and/or approves compliance correspondence for agency and/or subprograms;
- implements and oversees compliance actions carried out by agency and/or subprograms.
- prepares, reviews, and approves official reports, news releases, and other publicly circulated documents issued by agency and/or subprograms; and
- represents the radiation control program to the media and at internal and external meetings and public and private forums, including making formal presentations and responding to questions on behalf of the RCP.

Education and Experience

- a four year degree with substantial coursework in mathematics and physical science or engineering and supplemental coursework (master's degree preferred) in subjects related to radiation protection (e.g., radiation physics, radiation biology, etc.) and public administration; and
- specific training in the technical aspects of the subprograms managed (i.e., licensing, inspection, and enforcement for radioactive materials); and
- at least four years of experience serving in a radiation protection position at the professional level, plus a record of progressive management responsibilities similar to those listed in the position description.

RADIATION CONTROL SUPERVISOR

Duties and Responsibilities

- supervises activities and staff for one of the subprograms of an agency's radiation control program, including task assignment; scheduling of activities; implementation of routine compliance actions; acquisition, calibration and repair of equipment; and training of staff;
- provides technical supervision and performance oversight for the staff of a subprogram;
- participates in policy development, program planning, and program evaluation for a subprogram;
- has responsibility for adequate performance of federal agreements and grants assigned to a subprogram;
- advises on personnel appointments, evaluations, and promotions for a subprogram.
- participates in budget development for a subprogram;
- supervises and/or coordinates fee collection related to subprogram activities;
- prepares and/or reviews compliance correspondence related to subprogram activities;
- participates in implementation of compliance actions related to subprogram activities;
- participates in preparing and reviewing official reports, news releases, and other publicly circulated documents related to a subprogram;
- conducts performance evaluations, including accompanied field visits, of the activities of subprogram staff;
- prepares performance evaluation reports, and provides remedial training, where indicated;
- as necessary may conduct technically oriented professional activities (license review, inspections, lab analyses, etc.) assigned to a subprogram during periods of staff shortage; and
- may be assigned to represent subprogram activities to the media and at internal and external meetings and public and private forums, including making formal presentations and responding to questions on activities of the subprogram.

Education and Experience

- a four year degree in a physical science or engineering that includes substantial coursework in physics, chemistry, and mathematics, and supplemental coursework (master's level preferred) in health physics and public administration; and
- specific training in the technical aspects of the subprograms supervised; and
- at least four years of experience serving in a radiation protection position at the professional level, including performance of technical duties specific to the subprogram supervised, and supervisory duties similar to those listed in this position description.

PROFESSIONAL – SENIOR LEVEL

Duties and Responsibilities

- with minimal supervision conducts the more complex technically-oriented professional assignments, as well as the routine technically-oriented professional activities, specific to a subprogram within a radiation control program;
- may be the lead individual for the implementation of new projects or procedures introduced by the subprogram;
- participates in the training and evaluation of more junior personnel assigned to the subprogram;
- as required, may assist the subprogram supervisor in the conduct of his/her duties;
- ensures complex technical equipment is properly functioning;

- uses complex technical equipment to obtain data for regulatory and/or advisory purposes;
- performs analyses of data collected for regulatory and/or advisory purposes and recommends alternative actions on the application of data analyses to regulatory and/or advisory decisions to be made by the subprogram and/or the RCP; and
- prepares inspection reports and correspondence, as well as other technical documents resulting from regulatory and/or advisory activities.

Education and Experience

- a four year degree with coursework in basic subjects relevant to the technical activities of the subprogram, including substantial mathematics and physical science; supplemental course work (master's degree preferred) in advanced subjects relevant to the activities of the subprogram (e.g., radiation physics, radiation biology, radiochemistry, etc.);
- specific training (e.g., short courses) in the technical aspects of the subprograms managed (i.e., licensing procedures, inspection procedures, analytical procedures, etc.); and
- at least two years of progressive experience at the entry professional level in radiation protection or regulation in governmental, military, or civilian employment.

PROFESSIONAL – ENTRY LEVEL

Duties and Responsibilities

- after a suitable orientation period, works independently to conduct technically-oriented professional activities specific to a subprogram within a radiation control program;
- with experience, may work under supervision to conduct more complex technically- oriented professional activities specific to a subprogram within a radiation control program;
- uses complex technical equipment to obtain data for regulatory and/or advisory purposes;
- performs analyses of data collected for regulatory and/or advisory purposes; and
- prepares inspection reports and correspondence, as well as other technical documents, based on regulatory and/or advisory activities pertinent to a subprogram's responsibilities.

Education and Experience (General)

- a four year degree with course work in basic subjects relevant to the technical activities of the subprogram including substantial mathematics and physical science; and
- at least one year of experience working at the professional level in radiation protection; or at least two semesters of additional coursework beyond the bachelor's level in advanced subjects relevant to the activities of the subprogram (e.g., radiation physics, radiation biology, radiochemistry, etc.).

Education and Experience (Alternatives for X-ray and Nonionizing Subprograms)

- for the x-ray subprogram, graduation from an American Medical Association (AMA) approved program in radiologic technology, plus two years job experience in radiologic technology; or
- for the nonionizing subprogram, graduation from a two year approved program in engineering or physical science, plus two years job experience in radiation protection activities.

APPENDIX C

PROFESSIONAL/TECHNICAL STAFFING GUIDANCE

A "full time equivalent" (FTE) should take into account the need to provide vacation, holidays, sick leave, mandatory proficiency and continuing education training, staff meetings, travel for training and meetings, and other administrative requirements such as personnel evaluations, time keeping, etc. In general, 1.0 FTE is approximately 200 working days a year for direct program activities including preparation, report writing and necessary follow-up activities. Recommendations below assume the FTE works only in the program area specified.

Program	Regulatory	Non-regulatory
Electronic Product X-Ray	FTEs are determined by the type and number of unit inspections per yr Dental: 1.0 FTE per 500 unit (tube) inspections per yr. MSQA: 1.0 FTE per 100 unit (tube) inspections per yr.unless modified by contract with FDA CT, fusion units (e.g.PET/CT) and therapy: 1.0 FTE per 100 unit inspections per yr. Other Medical: 1.0 FTE per 300 unit (tube) inspections per yr. Industrial, non-medical and Other: 1.0 FTE per 500 unit (tube) inspections per yr.	
Electronic Product Nonionizing	FTEs are determined by mix of sources on following basis: Fixed laser show – allow 5 days per show; RF heater, industrial laser, and medical laser – allow 3 days per registered device inspected per year. Regulatory: 1.0 FTE per 300 device inspections per yr.	Minimum of 1.0 FTE
Emergency Response	FTEs should meet NRC and FEMA requirements	Minimum of 0.5 FTEs per year and 0.5 FTEs per year per million population
Environmental Monitoring and Surveillance		Ambient monitoring – 1.5 to 3.0 FTEs 1 facility – 2.0 to 5.0 FTEs 2 to 5 facilities – additional 1.5 FTEs per facility >5 facilities – additional 1.0 FTE per facility

Program	Regulatory	Non-regulatory
Low-Level Waste	RCP with licensing responsibility for active site: 4.0 to 6.0 FTEs per site depending upon the stage of operation, the level of direct oversight of site operations, and the degree of administrative responsibility for the site. For LLRW storage and processing only, 0.5 to 1.0 FTE per license.	RCP without proposed or active site: Minimum of 0.25 to 0.5 FTE and 0.25 to 0.5 FTEs per million population. RCP with proposed site and assuming licensing responsibility: 6.0 to 12.0 FTEs per proposed site for characterization and pre-licensing activities. RCPs with closed site: 0.5 to 1.5 FTE per site depending upon the stability of site.
Radioactive Materials	1.0 to 1.5 FTE per 50 uncomplicated licenses For LLRW storage and processing only, RCP should devote 0.5 to 1.0 FTE per license. Additional FTEs may be needed for major manufacturer, waste processor, uranium mining and milling, other complicated licenses and sources subject to Increased Controls.	
Radon	0.5 plus 0.5 FTE per 100 contractors over 100	Minimum of 0.5 FTE with additional FTEs depending on extent and degree of radon problem within the jurisdiction.

APPENDIX D

SCHEDULING GUIDANCE

APPENDIX D – 1

X-RAY FACILITIES

The following guidance pertains to priorities for scheduling x-ray facility inspections.

Type of Facility	Frequency[1]
New Facility	Within reasonable time frame, but not to exceed one year from initial registration
Hospital or Similar Facility	Annually
Therapy Facility	Annually
Mammography Facility	Annually
Other Medical Facility[2]	Every two years
Chiropractic Facility	Every two years
Veterinary Facility	Every three years
Dental Facility	Every four years
Industrial or Other Non-medical Facility	Every five years

RCPs should routinely review inspection results to determine if the current frequency is adequate to achieve facility compliance and adjust inspection frequencies accordingly.

[1] In facilities where multiple types of diagnostic and therapeutic equipment is used, the RCP should apply an inspection frequency based on the type of use.

[2] Other medical facilities include medical clinics and private doctor's offices where diagnostic x-ray exams are taken.

APPENDIX D – 2

NONIONIZING DEVICES AND FACILITIES

The following guidance pertains to scheduling inspections of nonionizing devices and facilities.

Type of Facility	Frequency
Tanning Facility	Every two years
FDA Class 2 devices for human application	Every two years

APPENDIX D – 3

RADIOACTIVE MATERIALS LICENSEES

Scheduling inspections of radioactive materials licensees must meet current criteria provided by the NRC. See the enclosure to NRC's Inspection Manual Chapter 2800 for details: http://www.nrc.gov/reading-rm/doc-collections/insp-manual/manual-chapter/mc2800.pdf

APPENDIX E

SURVEILLANCE GUIDANCE

APPENDIX E - 1

SURVEILLANCE GUIDANCE FOR THE AMBIENT ENVIRONMENT [1]

EXPOSURE MEDIA	NUMBER OF SAMPLES AND SAMPLING LOCATION	SAMPLING FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS[2]	LOWER LIMIT OF DETECTION (LLD)[3]
Air	5 regional samples	168 hr/month	Fiber particulate Weekly-gross alpha, beta[4] Quarterly - composite gamma[5]	Alpha – 3.7 E-5 Bq/m3 (0.001 pCi/m3) Beta – 3.7 E-4 Bq/m3 (0.01 pCi/m3) Gamma[6] – 1.9 E-4 Bq/m3 (0.005 pCi/m3)
Ambient Gamma	5 regional samples	Quarterly	Gamma dose	1.3 E-3 mC/kg/mo (5 mR/mo)[7]
Surface Water	5 regional samples	Quarterly, Grab	Gross alpha, beta Tritium	Alpha – 1.9 E-1 Bq/l (5 pCi/l) Beta – 1.9 E-1 Bq/l (5 pCi/l) Tritium 1.5 E+1 Bq/l (400 pCi/l)
Ground Water	5 regional samples	Quarterly	Gross alpha, beta Tritium	Same as surface water
Soils	1 per year per station in conjunction with air sampling for radon	Annually	Gamma	Ra-226 – 7.4 E-3 Bq/g (0.2 pCi/g)
Radon	4-5 as identified by geological data. Sample lowest occupied level[8]	Quarterly for 1 year	Passive monitors Radon or working levels	Rn – 1.9 E-2 Bq/l (0.5 pCi/l)
COMMERCIAL POWER REACTORS:				
Ambient Gamma	10 per site; four or 10%, whichever is greater, located jointly with commercial power reactor; one control. Routinely monitor to 16 km., areas of high population and/or interest to 80 km.	Quarterly	Gamma dose	1.3 E-3 mC/kg/mo (5 mR/mo)
Air Particulate	3 located jointly with utility, including one at highest X/Q and one control	Continuous with weekly filter changes	Weekly-individual filters gross beta; Qrtly-composite gamma	Beta – 3.7 E-4 Bq/l (0.01 pCi/m^3) Gamma – 1.9 E-4 Bq/l (0.005 pCi/m^3)

APPENDIX E – 2

SURVEILLANCE GUIDANCE FOR COMMERCIAL POWER REACTORS

EXPOSURE MEDIA	NUMBER OF SAMPLES SAMPLING LOCATION	SAMPLING FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS[2]	LOWER LIMIT OF DETECTION (LLD)[3]
Air Iodine	3 located jointly with utility	Continuous with weekly filter changes	Weekly-gamma	I-131 – 2.6 E-3 Bq/m^3 (0.07 pCi/m^3)
Surface Water	2 split with utility one up and one down stream	Monthly	Gross alpha, beta, tritium, gamma (continuous sampling best for streams; grab samples are of questionable value)	Alpha – 1.9 E-1 Bq/l (5 pCi/l) Beta – 1.9 E-1 Bq/l (5 pCi/l) Tritium – 1.5 E+1 Bq/l (400 pCi/l) Gamma – 4.4 E-1 Bq/l (12 pCi/l)
Ground Water	If affected, minimum of one control and one affected well	Quarterly	Gross alpha, tritium, gamma if used for consumption	Same as surface water
Drinking Water	1 control; up to 3 of nearest water supplies which could be affected	Monthly composite; one split with utility	Monthly-gross alpha, beta; I-131 if dose projection >0.01 mSv/yr (1 mrem/yr). Quarterly composite tritium	Same as surface water and milk
Sediments	1 up and 1 down-stream in area of settling	Annually, in conjunction with utility	Gamma	3.7 E-3 Bq/g wet weight (0.1 pCi/g)
Fish	In vicinity of discharge one bottom and one top feeder	Semi-annually	Gamma	3.7 E-3 Bq/g wet weight (0.1 pCi/g)
Milk	1 near highest X/Q; 1 control	Monthly during grazing	Iodine and gamma	3.7 E-2 Bq/g (1 pCi/g)
Vegetation	1 sample broad leafy wet weight cover. One of each type of vegetable or ground cover produced for commercial distribution within 10 km.	Monthly And At harvest	Gamma isotopic of edible portion	3.0 E-3 Bq/g wet weight (0.08 pCi/g)
Shellfish	2 samples near facility, one control	6 months	Gamma	3.7 E-3 Bq/g wet weight (0.1 pCi/g)

APPENDIX E – 3

SURVEILLANCE GUIDANCE FOR URANIUM MINING

EXPOSURE MEDIA	NUMBER OF SAMPLES AND SAMPLING LOCATION	SAMPLING FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS[2]	LOWER LIMIT OF DETECTION (LLD)[3]
Uranium Mining				
Radon	1 at highest X/Q plus one at nearest resident[9]	Quarterly	Passive	7.4 E-3 Bq/l (0.2 pCi/l)
Ground Water	Site specific[9]	Quarterly	Unat, Ra-226 Gross alpha, beta	U – 7.4 E-3 Bq/l (0.2 pCi/l) Ra – 7.4 E-3 Bq/l (0.2 pCi/l) Alpha – 1.9 E-1 Bq/l (5.0 pCi/l) Beta – 1.9 E-1 Bq/l (5.0 pCi/l)
Surface Water	1 up and 1 down stream discharge exists[9]	Quarterly	Unat, Ra-226; verifies NPDES permit	Same as ground water

APPENDIX E – 4

SURVEILLANCE GUIDANCE FOR URANIUM MILLING

EXPOSURE MEDIA	NUMBER OF SAMPLES AND SAMPLING LOCATION	SAMPLING FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS[2]	LOWER LIMIT OF DETECTION (LLD)[3]
Uranium Milling				
Conventional Uranium Mill:				
Ambient Gamma	4 at fenceline, 1 bkg, 1 at highest X/Q, 1 at nearest resident if within 10 km., all co-located with facility. Additional at any place(s) of interest.	Quarterly	Gamma dose	1.3 E-3 mC/kg/mo (5 mR/mo)
Air Particulates	1 co-located at nearest resident if within 10 km; else at high X/Q[9]	Continuous (low volume) less for post operation	Qtrly composite-U, Ra, Th, Pb	U – 3.7 E-6 Bq/m^3 (0.0001 pCi/m^3) Ra – 3.7 E-6 Bq/m^3 (0.0001 pCi/m^3) Th – 3.7 E-6 Bq/m^3 (0.0001 pCi/m^3) Pb 7.4 E-5 Bq/m^3 (0.002 pCi/m^3)
Radon	4 stations; 2 co-located[8]	Quarterly	Passive	7.4 E-3 Bq/l (0.2 pCi/l)
Ground Water	3-4 samples annually to verify operator data	Annually unless elevated levels are observed	U, Ra, Pb, Po, Th, gamma, TDS, Sulfates, Se, Mo	U – 7.4 E-3 Bq/l (0.2 pCi/l) Ra – 7.4 E-3 Bq/l (0.2 pCi/l) Th – 7.4 E-3 Bq/l (0.2 pCi/l) Po – 3.7 E-2 Bq/l (1 pCi/l) Pb – 3.7 E-2 Bq/l (1 pCi/l) Gamma – 1.9 E-1 Bq/l (5 pCi/l) TDS – 500 ppm Sulfates – 250 ppm Se – 0.01 ppm Mo – 0.05 mg/l

EXPOSURE MEDIA	NUMBER OF SAMPLES AND SAMPLING LOCATION	SAMPLING FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS[2]	LOWER LIMIT OF DETECTION (LLD)[3]
Vegetation	Select predominant broad leafy and root type vegetables within 2 km. More samples may be necessary based on MILDOSE computer code	At harvest	U, Ra, Th, Pb, Gamma, Se, Mo	U – 7.4 E-6 Bq/g (2.0E-4 pCi/g) Ra (wet weight) – 1.5E-6 Bq/g (5.0 E-5 pCi/g) Th – 7.4 E-6 Bq/g (2.0 E-4 pCi/g) Pb – 3.7 E-5Bq/g (1.0 E-3pCi/g) Gamma – 3.0 E-3Bq/g (0.08pCi/g) Se – 5 ug/g Mo – 10 ug/g
Soil	4 co-located with facility	Annually	Th, U, Ra, Pb, gamma	Th – 7.4 E-3 Bq/g (0.2 pCi/g) U – 7.4 E-3 Bq/g (0.2 pCi/g) Ra – 7.4 E-3 Bq/g (0.2 pCi/g) Pb – 7.4 E-3 Bq/g (0.2 pCi/g) Gamma 3.0 E-3 Bq/g (0.08 pCi/g)
HEAP-LEACH AND ION EXCHANGE FACILITIES				
Water Ground typically May be surface also	site specific	Quarterly	Gamma, U, Ra, Th, Pb, Po, TDS, Sulfates, Se, Mo	Same LLD as listed above for Ground Water under Uranium Milling: conventional
IN-SITU RECOVERY Facility: Ground Water	only if above the water table. If associated with a plant/dryer, sample as a conventional mill.	Quarterly	Gamma, U, Ra, Th, Pb, Po, TDS, Sulfates, Se, Mo	Same LLD as listed above for Ground Water under Uranium Milling: conventional

APPENDIX E – 5

SURVEILLANCE GUIDANCE FOR FUEL FABRICATION

EXPOSURE MEDIA	NUMBER OF SAMPLES AND SAMPLING LOCATION	SAMPLING FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS[2]	LOWER LIMIT OF DETECTION (LLD)[3]
FUEL FABRICATION:				
Air Particulate	1 bkg, 1 high X/Q	Continuous, changed weekly	Individual samples-gross alpha, beta Quarterly-composite-isotopic uranium	Alpha – 3.7 E-5 Bq/m^3 (0.001 pCi/m^3) Beta – 3.7 E-4 Bq/m^3 (0.01 pCi/m^3) Gamma – 1.9 E-4 Bq/m^3 (0.005 pCi/m^3) U – 3.7 E-5 Bq/m^3 (0.001 pCi/m^3)
Soil	1 bkg, 1 high X/Q	Annually	Isotopic uranium	U – 3.7 E-4 Bq/g (0.01 pCi/g)
Surface Water	1 up and 1 down-stream or area of discharge	Monthly if associated with drinking water. Quarterly grab otherwise	Isotopic uranium	U – 3.7 E-4 Bq/g (0.01 pCi/g)
Vegetation	1 control; 1 at high X/Q	At harvest	Isotopic uranium	U – 3.7 E-1 Bq/kg (10 pCi/kg)
Sediments	1 up and 1 down-stream or area of discharge	Annually	Isotopic uranium	U – 3.7 E-3 Bq/kg (0.1 pCi/g)

APPENDIX E – 6

SURVEILLANCE GUIDANCE FOR WASTE REPOSITORIES

EXPOSURE MEDIA	NUMBER OF SAMPLES AND SAMPLING LOCATION	SAMPLING FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS[2]	LOWER LIMIT OF DETECTION (LLD)[3]
WASTE REPOSITORIES:				
Ambient Gamma	Co-located a minimum of 4 or 10% of licensees, whichever is greater	Quarterly	Gamma dose	1.3 mC/kg/mo (5 mR/mo)
Air Particulate	1 bkg, 1 co-located at high X/Q, closest resident, at population center if within 5 km.	Continuous with weekly filter changes	Weekly-individual filters-gross alpha, beta Qtrly-composite gamma	Alpha – 3.7 E-5 Bq/m^3 (0.001 pCi/m^3) Beta –3.7 E-4 Bq/m^3 (0.01 pCi/m^3) Gamma – 1.9 E-4 Bq/m^3 (0.005 pCi/m^3)
Air H-3	1 bkg, 1 high X/Q	Quarterly	Quarterly	Tritium – 1.5 E-6 Bq/ml (4 E-5 pCi/ml)
Surface Water	1 up and 1 down stream split with operator	Quarterly	Gross alpha; beta; tritium (chemical indicators to include pH, temperature, chloride, iron, color, turbidity, chemical oxygen demand and total or organic carbon)	Alpha – 1.9 E-1 Bq/l (5 pCi/l) Beta – 1.9 E-1 Bq/l (5 pCi/l) Gamma – 4.4 E-1 Bq/l (12 pCi/l) Tritium – 1.5 E+1 Bq/l (400 pCi/l)
Ground Water	4 or 10% of operators, whichever is greater; co-located	Annually	Same as surface water	Same as surface water
Soil	1 bkg plus 4 others to include major drainage, high X/Q, and 1 co-located and split with operator	Quarterly	Gamma, Sr if Cs is found	Sr-89 – 3.7 E-1 Bq/g (10 pCi/g) Sr-90 – 7.4 E-2 Bq/g (2 pCi/g) Gamma – 3.7 E-3 Bq/g (0.01 pCi/g)
Soil *(cont'd)*	Same as above.	Annually	Sr (if Cs-137 > 3.7 E-2 Bq/g)	
Vegetation	1 sample broad leafy vegetable or ground cover	Monthly	Gamma isotopic of edible portion	Gamma – 3.0 E-3 Bq/g (0.08 pCi/g)

EXPOSURE MEDIA	NUMBER OF SAMPLES AND SAMPLING LOCATION	SAMPLING FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS[2]	LOWER LIMIT OF DETECTION (LLD)[3]
Vegetation (cont'd)	1 of each type produced for commercial distribution within 10 km.	At harvest	Gamma	Gamma – 3.0 E-3 Bq/g (0.08 pCi/g)

Notes for Appendix E

1. The intent of the criteria for monitoring the ambient environment is to characterize the state's radiological environment, and not to monitor the same locations every year.
2. Unless otherwise stated, the frequency of analysis is the same as the sampling frequency.
3. As used in this document, LLD has the same definition as that used in U.S. Nuclear Regulatory Commission Regulatory Guide 4.14, "Radiological Effluent and Environmental Monitoring at Uranium Mills," Revision 1, April 1980, which is quoted below:

LOWER LIMIT OF DETECTION

For the purposes of this guide, the Lower Limit of Detection (LLD) is defined as the smallest concentration of radioactive material sampled that has a 95% probability of being detected with only a 5% probability that a blank sample will yield a response interpreted to mean that radioactive material is present. (Radioactive material is "detected" if it yields an instrument response that leads the analyst to conclude that activity above the system background is present.)

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ S_b}{3.7 \times 10^4\ E V Y \exp(-\lambda \Delta t)}$$

Where

LLD is the lower limit of detection (microcuries per milliliter);
S_b is the standard deviation of the instrument background counting rate (counts per second);
3.7×10^4 is the number of disintegrations per second per microcurie;
E is the counting efficiency (counts per disintegration);
V is the sample volume (milliliters);
Y is the fractional radiochemical yield (when applicable);
λ is the radioactive decay constant for the particular radionuclide; and
Δt is the elapsed time between sample collection and counting.
[exp indicates an exponent of the base of the natural logarithms-Ed. Note]

The value of S_b used in the calculation of the LLD for a particular measurement system should be based on the actual observed variance of the instrument background counting rate rather than an unverified theoretically predicted variance.

Since the LLD is a function of sample volume, counting efficiency, radiochemical yield, etc., it may vary for different sampling and analysis procedures. Whenever there is a significant change in the parameters of the measurement, the LLD should be recalculated.

4. Gross alpha and beta analyses are for screening purposes only. If elevated levels are observed, procedures should direct which additional analyses may be required.
5. "Gamma" means gamma isotopic.
6. The LLD for gamma isotopic analyses are to be determined for Cs-137 unless stated otherwise.
7. TLD systems should meet the criteria of ANSI Standard N545-1975 and U.S. Nuclear Regulatory Commission Regulatory Guide 4.13, "Performance, Testing, and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications," Revision 1, 1977.
8. The criteria for radon monitoring are interim guidance until the CRCPD E-25 Committee on Radon can make a final recommendation.
9. Sample collection and analysis is desirable, but not required.
10. X is the short-term average centerline value of the ground concentration in Bq/m, and Q is the rate of release of radioactivity in Bq/sec.

Source for Appendices E – 1 through E - 6: CRCPD Publication 99-2, *Criteria for an Adequate Radiation Control Program*

APPENDIX F

USE OF NON-RCP (NON-GOVERNMENTAL/PRIVATE) INSPECTORS

A number of RCPs have had experience using non-RCP personnel to perform regulatory inspections. Their experience has been mixed. Some have very successful non-RCP inspector programs while others have discontinued the practice. The following are the key considerations for any RCP considering use of non-RCP inspectors.

LEGISLATIVE AUTHORITY

A non-governmental or private inspector program should be limited to electronic radiation generating machines and must be established by legislative action. The definition of all devices that are subject to non-RCP inspector audits must be clearly defined. In almost every current program, the program covers all x-ray machines, accelerators, analytical instruments and other devices that generate both ionizing and nonionizing radiation. In some states, exemptions for categories of machines, primarily dental and veterinary, have been sought and achieved. The non-RCP inspector option is normally presented through legislative action when the forecast for increasing the state RCP's staffing and operation is not optimistic.

Non-RCP Inspectors must:

- meet specific licensing qualifications established by the RCP through regulation;
- adhere to the same procedural requirements as staff RCP inspectors;
- perform inspections according to the timetable established by the RCP;
- gather the data, submit it to the RCP, and verify that needed corrective actions are made; and
- preform radiation surveys and preparations for plan review submittal if required by the RCP.

Mammography facilities are not to be inspected by non-RCP inspectors to assure compliance with federal laws.

REGULATORY AUTHORITY

Specific regulations establishing the non-RCP inspection program must be promulgated to outline limits of authority, performance requirements, extent of use, renewal process, and a determination of whether fees are to be imposed. Licensed non-RCP inspectors must operate under the strict control of the RCP and must always be available for oversight audits. A conflict of interest policy with clear definitive requirements must be in place and understood by all. Regulations, required documents, written guidelines and procedures, etc., can be used to ensure understanding of:

- the minimum qualifications of a health physics inspector and a medical physics inspector;
- the term of the license authorizing the performance of state RCP inspections;
- prohibitions to the performance of state RCP inspections;
- specific limits to the time period for reporting;
- criteria for removal from non-RCP inspector roles;
- legal verification of availability for testimony in enforcement cases; and
- RCP point of contact for all matters not otherwise addressed.

In practice, the program consists of procedural and substantive regulations covering the licensing of inspectors, a timetable for machine inspection verification, regulations for the conduct of required inspections, and the standards that the radiation machines must meet.

SPECIFIC CONSIDERATIONS

Often, the use of non-RCP inspectors is justified as a budget consideration and may be rationalized as a way to accomplish at least some inspections when the state, for one reason or another, cannot or does not adequately fund the RCP program to perform the inspections in a timely manner.

Some of the issues that should be considered are:

- This should not be a program of self-inspection. While the non-RCP inspector may be paid by the inspected entity, the inspection protocol, inspection schedule, timetable for submission of reports, and periodic audits of the non-RCP inspector must be under the control of the RCP. Some entities may engage in having pre-inspections that are not reported so as to show a higher compliance rate than the true rate. Careful consideration must be given to whether this needs to be controlled to assure the protection of the public health and safety.

- Investigation of complaints and enforcement of inspection findings must be carried out by the RCP. The non-RCP inspector receives the necessary training to do an adequate inspection that assures that all of the public health and safety issues have been covered. The non-RCP inspector processes the findings of the inspection and notifies the facility. All findings and supporting details are provided to the RCP.

- Significant violations of law identified by the non-RCP inspector will be prosecuted by the RCP and the non-RCP inspector must agree to testify if needed during any hearing pursuant to enforcement.

- The level of RCP oversight of the non-RCP inspectors (audits and re-inspections to assure that inspections are performed correctly and reported in a timely manner) must be consistent with the health and safety significance of the inspected activity. It is important to note that neither the U.S. Nuclear Regulatory Commission nor the U.S. Food and Drug Administration will accept use of non-RCP Inspectors for radiation programs under their purview.

- The availability of non-RCP inspectors should be allowed to follow supply and demand considerations as long as inspections frequencies are maintained. Ultimately, the facility is responsible for meeting the inspection frequency requirement.

- Liability for injury caused by inadequate or poorly performed inspection should be the same whether performed by RCP or non-RCP inspectors.

- The true cost to the public is the combination of the cost per inspection by the non-RCP inspector plus the cost of the RCP quality assurance program to assure the quality of the non-RCP inspectors.

ACRONYMS

AMA ..... American Medical Association
ANSI ..... American National Standards Institute
ASTM ..... American Society for Testing and Materials
CDRH ..... Center for Devices and Radiological Health (FDA)
DOE ..... Department of Energy
DOT……... Department of Transportation
EPA..... Environmental Protection Agency
FDA..... Food and Drug Administration
FDA/CDRH .. Food and Drug Administration/Center for Devices and Radiological Health
FEMA ..... Federal Emergency Management Agency
IMPEP..... Integrated Materials Performance Evaluation Program (NRC)
LLRW ..... Low-Level Radioactive Waste
LLRWPA ..... Low-level Radioactive Waste Policy Act
MIMS..... Manifest Information Management System (DOE)
MQSA..... Mammography Quality Standards Act
MRI……Magnetic Resonance Imaging
NCRP ..... National Council on Radiation Protection and Measurements
NEXT..... National Evaluation of X-ray Trends
NIMS/ICS ..... National Incident Management System/Incident Command System
NIST..... National Institute of Standards and Technology
NORM..... Naturally Occurring Radioactive Materials
NRC ..... Nuclear Regulatory Commission
OSHA ..... Occupational Safety and Health Act
RCP…..... Radiation Control Program
RF……..….Radiofrequency
SLO …..…….State Liaison Officer
SSRCR…… Suggested State Regulations for Control of Radiation
TENORM..... Technologically Enhanced Naturally Occurring Radioactive Material
UV…..……Ultraviolet