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Cardelia Maupin
Office of State and Tribal Programs
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Dear Ms. Maupin:

The enclosed is the report on radiation control in Virginia by the CRCPD review team.

Copies have also been sent to Louis Rossiter, Robert Strube, Khizar Wasti and of course Les Foldesi. No further distribution of the report will be made by CRCPD unless at the request of Les Foldesi. In forwarding the report, I extended the invitation or the review team to discuss any questions that the readers may have for them.

On behalf of the CRCPD, I want to thank you for your participation in this review and for the timely report of your findings and suggestions.

Sincerely,


Patricia C. Gorman
Deputy Director

TLD/PCG/ss

Enclosure

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**Review of
Radiation Control in Virginia**

by the

Conference of Radiation Control

Program Directors, Inc.

Summer 2001

Prepared and published by the
Office of the Executive Director
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Executive Summary

The Conference of Radiation Control Program Directors, Inc., (CRCPD) is a professional association for governmental radiation control program personnel in the United States and Canada. The CRCPD promotes adequate, uniform control of radiation hazards. As one of its services, the CRCPD will review the radiation control program of a state and recommend improvements.

The Director of the Virginia Radiological Health Program (RHP) requested, in March 2001, a comprehensive review of radiation control in Virginia. A team of five volunteers from state and federal radiation control programs was enlisted to carry out this review. The team reviewed the statutory basis for the program, regulations, procedures, and information retained in the files. They interviewed staff and radiation users during the period August 22-24, 2001.

The Virginia RHP has a small but very dedicated staff that is committed to providing the best radiation protection services they can deliver within their limited resources. Their technical knowledge and desire to assist other agencies within the Commonwealth is widely recognized.

However, the review of radiation control in Virginia found deficiencies, by professional standards, in legislative authorization, administrative organization, regulations, interagency agreements, program staffing and staff support.

The empowering legislation is not comprehensive of all types of radiation; it lacks provisions for credentialing of x-ray and accelerator operators in all health care facilities, and for control of non-ionizing radiation. Several provisions of the legislation have not been fully implemented in the regulations and radiation control program, notably fees, bonding requirements, inspection, enforcement and civil penalties.

The regulations for radiation control require revision to incorporate the national standards for radiation protection and to comply with requirements of the federal programs with which Virginia is involved as well as to fully implement the existing legislative provisions.

The regulations should be further revised to meet the requirements for CRCPD recognition of the Virginia licensing of naturally occurring and accelerator produced radioactive materials. This national program enhances the uniform and adequate control of these materials, and it provides for reciprocal recognition of licenses at considerable cost savings to both the licensees and the regulatory agencies.

The management plan for the Radiological Health Program should be updated promptly, and periodically, to set goals and priorities, utilize resources and evaluate accomplishments.

Memoranda of understanding are needed among the departments that have radiation control responsibilities in order to create or formalize agreements concerning their respective roles in radiation control.

Among other programmatic needs are continuing education for radiation control staff, an information program for radiation machine and radioactive material users, improved tracking of enforcement actions and formal provision for legal assistance to the program.

Detailed discussion and recommendations for actions are provided in the body of this report. The recommendations are simply listed here as executive summary.

- The draft Radiological Health regulations should be promulgated as soon as possible and a regular process established for future regulation revision.
- The program for auditing the private inspectors should be strengthened. Requirements should be instituted for calibration and quality assurance for the instruments used by private inspectors.
- The processes for follow-up of serious violations and for analyzing patterns of violations should be strengthened.
- The Radiological Health Program should routinely compile and periodically analyze the data collected on patient exposure, and promote the use that information to help minimize the exposure of citizens to unnecessary radiation.
- The Radiological Health Program should review the effectiveness of the mechanisms it has to track the installation of new and resold x-ray machines within its jurisdiction and then take appropriate steps to assure that it has a complete inventory of x-ray tubes and machines.
- The Virginia Radiological Health Program should develop the requisites for, and pursue, CRCPD limited recognition as a NARM Licensing State, non-manufacturing.
- The Commonwealth of Virginia should implement statutory authority and a regulatory program for the control of non-ionizing radiation sources.
- The Department of Health should establish memoranda of understanding with the Department of Emergency Management and with the Consolidated Laboratories which document the respective roles and promote coordination and cooperation in conducting their program of monitoring environmental radioactivity.
- Control of access to the mobile radioassay van should be assigned to one of the Radiological Health Program staff along with the responsibilities for maintaining the equipment ready and supplied and for directing exercises of the analytical equipment by the other assigned staff. It may be appropriate to locate the vehicle in a secure location.
- The Radiological Health Program should begin formal discussions with the Department of Environmental Quality to explore limits and related exemptions for radioactivity in municipal waste landfills and incinerators, and in scrap for recycling.

- All personnel who may be involved in the response to a radiological emergency should complete the Unified Incident Command training offered by the Department of Emergency Management.
- The Radiological Health Program should extend to the Hazardous Materials (HazMat) section of the Department of Emergency Management an offer to assist in developing the radiological component of their training and an offer to cooperate in training the local HazMat responders in conjunction with an upcoming nuclear power plant exercise. This exercise is a unique opportunity to provide training in a 50-mile zone around the power plant.
- Memoranda of Understanding or other formal agreements should be implemented between the radiological health program and each of the other Departments with which services and resources are exchanged. Particular attention should be given to emergency operations.
- The Governor should establish, in his office, a Coordinator of Radiological Activities to assure and expedite the assignment of radiation control efforts in legislation, among the Departments involved, and between the Departments and federal or interstate agencies.
- The multi-year plan for the Radiological Health Program should be updated, promptly and at intervals of five years. An operational plan should be developed for the x-ray, the radioactive material, and each other section. The plans should include statements of the problems, the objectives with explicit regard for program resources, methods to accomplish the objectives and methods for the evaluation and reporting of accomplishments.
- Each aspect of radiation control policy, priority, procedure, and staff duties should, in general, be published to those who are to implement the action, those on whom the action may be taken, and to others who may have constructive suggestions or concerns.
- The Radiological Health Program should avail itself of the in-state training opportunities. The Department of Health should endorse the participation of radiological health professionals in the training activities and professional meetings that are essential to their work and uniquely offered by federal, regional or national organizations. Other needed training should be considered even if it is given out-of-state.
- Fees should be implemented on all radiation sources that are licensed, registered or inspected by the radiation control program. The fee schedules should be updated promptly, and every five years, with respect to program costs and the current requirement as to fraction of the program cost to be collected in fees.
- A periodic report, perhaps semiannual, of the program activities should be widely circulated to enhance communications within the Department, with registrants and with the public.

- The statutory authority for control of radiation should be updated, using the current Council of State Government model radiation control act. Provisions should be stated with sufficient generality that the empowered state agencies can be responsive to changes in federal programs, state government organization, and professional standards.
- The regulations for radiation control should be updated promptly, and subsequently at intervals of no more than five years, using current CRCPD *Suggested State Regulations for Control of Radiation* and criteria for recognition of NARM licensing states as well as pertinent federal regulations. In particular, regulations should be extended to the following:
 - Registration of radiation machine vendors and service providers
 - Credentialing of radiation machine operators in health care and in industrial radiography
 - Civil penalty provisions applicable to radiation machine registrants and radioactive material licensees
 - Non-ionizing radiation, at least for industrial and medical applications of those lasers, ultraviolet, radio frequency, and microwave sources that have high risk of inflicting severe injury.
 - Fees on radioactive material licenses and for credentialing radiation machine operators
 - Surety requirements on appropriate categories of state radioactive materials licensees.

Introduction

The Conference of Radiation Control Program Directors, Inc., (CRCPD) is a professional association for the staff of government radiation control programs throughout North America. The objective of the CRCPD is to promote adequate, uniform control of radiation hazards.

One of the services of the CRCPD is, upon request by a state radiation control official, to review the radiation hazards and the radiation control program in that state, and to recommend improvements in regulation and control. Following such a request, the CRCPD Executive Director assembles a review team that consists of technical staff of relevant federal agencies and their regional offices, a director of the radiation control program in another state, and staff of the CRCPD Office of Executive Director. This team interviews members of the radiation control program and other persons involved with the use or the control of radiation. The on-site review concludes with a presentation to state government officials of a summary of the significant findings and recommendations. The review team then prepares a detailed written report which is submitted to appropriate state officials selected with the concurrence of the requesting official.

The Director of the Virginia Radiological Health Program, in March 2001, requested a comprehensive review of the radiation control program in Virginia. On-site interviews were conducted August 22-24, 2001.

The aspects of radiation control that were reviewed were x-ray, radioactive materials, low-level radioactive waste, indoor radon, environmental surveillance, nuclear safety, emergency response, contaminated sites, non-ionizing radiation, and administration of the radiation control program.

The team's recommendations were based on information in the following documents:

Council of State Governments, 1983, *Suggested State Legislation, Radiation Control Act.*

Conference of Radiation Control Program Directors, *Suggested State Regulations for Control of Radiation* (in which separate parts are updated independently)

Conference of Radiation Control Program Directors, 1999, *Criteria for an Adequate Radiation Control Program*

CRCPD Recognition of Licensing States for the Regulation and Control of NARM, 1994

Attention was also given to federal radiation programs with which the Virginia radiation control program should be involved, and to the federal and federally licensed commercial facilities in Virginia which have radiation hazards as well as radiation control resources with which the Virginia program should be familiar.

Until this CRCPD review, there had been no outside, systematic, peer review of radiation control in Virginia.

An assessment of the population radiation exposure, made by the National Council on Radiation Protection and Measurements (NCRP 93) in 1987, found that uses of radiation in the healing arts represent approximately 83% of the total man-made exposure to the U.S. population. In contrast, occupational exposures were less than 2% and exposure to the entire nuclear fuel cycle was less than 0.5% of the total man-made exposure. Not only is diagnostic x-ray by far the single largest source of exposure to man-made radiation, it is also the source for which the largest dose reduction gains in man-made exposures can occur without having a negative impact on the benefits for the public.

Much of the responsibility for control of ionizing radiation sources resides with the states, notably the control of naturally occurring and accelerator produced radioactive materials and for radiation producing machines, except those materials or machines owned by federal government.

A substantial number of radiation sources have been identified in Virginia. Currently, 71 particle accelerators, approximately 17,000 x-ray machines and 215 persons licensed for naturally occurring or accelerator produced radioactive material (NARM) are regulated by the state. Another 375 persons are licensed by the U.S. Nuclear Regulatory Commission to utilize Atomic Energy Act radioactive materials; among these are two nuclear power plants and a nuclear fuel fabrication facility. Virginia has an unusually large number of military bases, notably nuclear navy facilities. The nuclear fuel fabrication and nuclear navy facilities contribute to a considerable traffic of nuclear fuel and related radioactive material, although the most frequent shipments are surely nuclear medicine to hospitals and clinics. The Department of Energy has a large particle accelerator facility in eastern Virginia.

As for environmental radioactivity, radon from soil and groundwater has been found at significant concentrations in many buildings, mainly in the mountainous areas of the state. "Pipe scale," consisting of mainly radium salts precipitated from groundwater, oil and natural gas, is much less prevalent in Virginia than in many other states.

Among the hazardous non-ionizing radiation sources that are within the purview of the state, but not regulated, are industrial lasers and microwave devices, tanning beds and high-intensity discharge lamps.

The Code of Virginia establishes control of some of the radiation sources within its purview through a Radiation Advisory Board that works through the Department of Health as well as the Department of Environmental Quality's Division of Waste Management and the Department of Emergency Management.

Statutory authority for the Radiation Control Program (RCP) is established in the *Code of Virginia* Sections 32.1-227 through 238. The RCP resides in the Department of Health.

Virginia's radiation control program is a unified radiation control agency, as recommended by the CRCPD. However, the Radiological Health Program interacts with other state agencies, notably:

Department of General Service's Consolidated Laboratories for radiological analyses,

Department of Environmental Quality for the management of waste, transportation, and hazardous material regulations, and

Department of Emergency Management for coordination of radiological emergency response training.

Virginia X-Ray Machine and Particle Accelerator Program Review

Under Virginia statutes and regulations x-ray machines and particle accelerators, in order to be lawfully operated, must be registered and periodically inspected and, on the basis of that inspection and the successful correction of any serious violations detected during that inspection, periodically certified. Certification may be denied for failure to meet the periodic inspection requirement as well as for failure to correct violations. Inspections can be conducted by a state inspector or by a private inspector, but currently the private inspectors conduct the vast majority of inspections.

The Radiological Health Program's X-ray inspection and compliance group is currently staffed at 7.5 full-time equivalent persons (FTE's) who are responsible for ~ 17,000 x-ray and accelerator machines. This is close to the number of staff recommended by CRCPD, taking into account that most inspections are performed by private inspectors, of which there are about 200.

The periods between inspections of radiation producing machines are essentially those recommended by the CRCPD.

The conduct of inspections is tracked in the state database of registered x-ray machines. Reports of inspections are forwarded to the main office of the Radiological Health Program. Inspections in which serious violations were detected are also tracked in the database and are subject to required follow-up by state inspectors. Follow-up of serious violations includes contact with the violative facility by a state inspector and a subsequent follow-up inspection to verify correction of the violation. Machine certification, which is dependent on the inspection, can be denied if effective correction of violations does not occur.

The x-ray component of the Radiological Health Program is generally effective in protecting the citizens of the Commonwealth from the hazards of x-ray exposure. The program's data system provides an effective means to maintain the registration system, to prompt facilities of the need for periodic inspection and certification, and to track the close-out of violative inspections. However, there are a number of shortcomings that the program should address.

The most significant shortcoming is that the state's regulations are seriously outdated. The regulations were last revised in 1988 and since that time there have been significant developments in the arena of radiation protection. There have also been significant changes in the related regulations promulgated by the federal agencies related to radiation protection. In these circumstances it is crucial that the new regulations, currently in draft, be promulgated as soon as possible. Given the continuing evolution of radiation protection and federal regulation, it is also imperative that state regulations be updated at intervals of no more than a few years. Therefore, a standard procedure for the amendment of regulations needs to be developed along with a clear expectation, shared by the Radiological Health Program, its management and the Radiation Advisory Board, concerning the frequency of routine amendments or the events that should trigger more immediate revision of the regulations.

Recommendation #1

The draft Radiological Health regulations should be promulgated as soon as possible and a regular process established for future regulation revision.

The promulgation of new regulations will also create the need and the opportunity to revise inspection procedures and forms. The Radiological Health Program should take full advantage of this opportunity to improve the procedures beyond the current standard. The new inspection procedures should include specific information on all the steps that need to be taken to perform an inspection. This is in contrast to the current procedures that are more of an outline of measurements to be made and issues addressed. The Radiological Health Program also will need to educate the inspectors, particularly the private inspectors, as well as the regulated community as a whole about the new regulations. It is particularly critical to invest in educating the regulated community since it is their responsibility to meet the requirements of the new regulations. They also represent the best opportunity to prevent unnecessary radiation exposure.

Private inspectors conduct most of the inspections of x-ray facilities in Virginia. While not the norm, this approach is used by a number of states. However, the private inspector program in Virginia has some shortcomings. First, guidance should be developed relative to conflicts of interest, and appearance of conflict, for private inspectors. Next, a standard operating procedure is needed for auditing the private inspectors. The current audit process is relatively unstructured. The audit SOP should address a number of issues including the minimum number of audits to be conducted each year, how often each private inspector should be audited and how that frequency should be related to the inspector's workload and past performance, how facilities will be selected for audit, and what details should be reviewed during audit. Without such a clear written procedure, the process for auditing the private inspectors appears unstructured and could be construed as providing inadequate oversight. The procedure should consider the appropriate role of joint inspections where a state inspector would accompany a private inspector. The procedure could also consider the role of follow-up inspections within the audit process. A second standard procedure needs to be developed for 'de-listing' a private inspector for inadequate performance of inspections relative to regulatory requirements. The Radiological Health Program should also consider establishing a process for periodically auditing the performance of its own inspectors.

The Radiological Health Program has adequate x-ray measurement equipment for use in its inspections, largely through its contract relationship with FDA. These instruments are calibrated annually by FDA. However, the same can not necessarily be said of the private inspectors. There is currently no regulatory requirement related to the capabilities of the measurement instruments used by private inspectors nor to how frequently they must be calibrated. The RCP should consider augmenting its regulations to impose reasonable requirements on the private inspectors related to radiation instruments and their calibration.

Recommendation #2

The program for auditing the private inspectors should be strengthened. Requirements should be instituted for calibration and quality assurance for the instruments used by private inspectors.

The process for follow-up of an inspection in which a serious violation was reported needs to be made more structured and more uniform. Currently when a serious violation is found during an inspection, the Radiological Health Program contacts the facility to assure that they are aware of the violation and of their responsibility to correct the violation in an effective and timely manner. However, while on occasion this contact is in writing, most often the contact is by phone. The latter approach does not create a record of the contact and does not constitute a "notice of violation," which may be critical if further enforcement action proves necessary. Standard forms are needed that give detailed procedures for inspection and recording of observations, both government and private inspections, i.e. non-government, and for initiating and tracking enforcement actions as they escalate or are resolved.

In addition, the program needs to note in its database not only that a violation was noticed during an inspection, as it currently does, but also the specific nature of the violation. Without such a step, the program is unable to track the frequency of specific violations. Such data would allow the program to identify important trends and patterns in the violations. For example, the private inspectors could be compared on the basis of the frequency with which they detect each specific violation as well as the total for all types. The regulated community could also be educated concerning the most significant and frequent violations via the program's web site, resulting in greater attention being paid to the particular concerns of the Radiological Health Program.

Recommendation #3

The processes for follow-up of serious violations and for analyzing patterns of violations should be strengthened.

Radiation exposure of health care patients is another topic on which the Radiological Health Program should do more to analyze and track data. The inspection procedures for x-ray facilities require that entrance skin exposure (ESE) values be measured, for a for a frequently performed examination, in the manual mode using typical techniques factors. This ESE data should be compiled in the Program's database. The ESE data should then be analyzed for trends. This data is crucial in the process of monitoring, and ultimately minimizing, the exposure of patients and operators to unnecessary radiation. Currently there are significant national and international efforts underway to promote the collection of such data routinely and to promote its use by health care facilities to minimize exposure. This effort is an outgrowth of the National Evaluation of X-Ray Trends (NEXT) program, in which Virginia has regularly participated. This data will become even more critical under the amended regulations, which impose limits on patient exposure.

Recommendation #4

The Radiological Health Program should routinely compile and periodically analyze the data collected on patient exposure, and promote the use that information to help minimize the exposure of citizens to unnecessary radiation.

While patient exposure is important, it is not the only issue of concern. Of equal concern is the quality of the image, and the associated interpretation. In recent years the trend among radiation control programs at all levels has been to broaden themselves beyond the traditional focus on exposure. A good example of this trend is the federal Mammography Quality Standards Act [MQSA]. Under MQSA all mammography facilities are required to maintain an internal quality control [QC] program designed to detect and correct problems with the imaging process before there is a significant negative impact on image quality. Virginia, along with most other states, performs inspections of MQSA certified facilities under contract to the Food and Drug Administration [FDA]. Virginia's performance in the MQSA program has been very good and the RCP has contributed significantly to assuring the quality of mammography in the Commonwealth.

Using MQSA as a model, the RCP should consider encouraging, and later requiring, QC programs in all x-ray facilities. As a first step, attention should be focussed on QC for the x-ray film processor, the most variable component in the imaging process. RCP inspectors already have experience in assessing processor performance from their participation in the MQSA contract inspections as well as from their role in NEXT since both of these programs include a measurement of processor "speed". Measurements of processor performance during each inspection conducted by RCP inspectors could be used to encourage x-ray facilities to give their film processing more attention. Once there is a regulatory requirement for processor QC, or for QC in general, the private inspectors could be trained to assess processing during their inspections. Better processor QC will result not only in lower patient exposures and improved image quality but also lower facility operating costs.

There is also some concern that the Radiological Health Program may not have an accurate accounting of all the x-ray tubes in Virginia. Historically, the program has depended on the copies it receives of the "reports of assembly" (the so called 2579) provide. This process is certainly subject to at least occasional errors of omission that would result in the program not knowing of the assembly of an x-ray machine. In addition, not all x-ray machines require "assembly" in the traditional sense; some can be simply uncrated and plugged in. Such units may not be reported via the "report of assembly." On the other hand, the state regulations require that the installer of an x-ray machine notify the commissioner within 90 days. It is unclear whether this regulatory requirement is being effectively enforced. If it is not, then there is some prospect that the registration database may not be comprehensive. Additionally, some types of x-ray systems, mammography units for example, can be used in a mobile configuration. If mobile x-ray units enter Virginia from another state it is not clear that the Radiological Health Program would be notified so that it could assure appropriate protection of the public that might be exposed.

Recommendation #5

The Radiological Health Program should review the effectiveness of the mechanisms it has to track the installation of new and resold x-ray machines within its jurisdiction and then take appropriate steps to assure that it has a complete inventory of x-ray tubes and machines.

Most states have a program of certification for a broader range of radiation machine operators than does Virginia, where the Board of Medicine licenses technicians in free-standing medical facilities and the Dental Board sets standards for dental assistants and dental hygienist taking x-rays. The expansion of credentialing to at least establish minimal requirements for training for all machine operators in health care and in industrial radiography should be considered during the next revisions of the radiation control authorization and regulations.

Virginia Radioactive Materials Program Review

Program Scope

Virginia has responsibility for naturally occurring and accelerator produced radioactive materials (NARM) within the state except that controlled by federal facilities.

The U.S. Department of Energy has one facility in Virginia, the Thomas Jefferson Accelerator Laboratory. It does not produce radioactive material for distribution, only some incidental to the research activity and beam operation. The Naval Reactor program is also a DOE project.

Approximately 375 licenses for atomic energy act radioactive materials, i.e. other than NARM, and three nuclear power facilities in Virginia are regulated by the Nuclear Regulatory Commission (NRC) regional office in Atlanta, Ga. The Code of Virginia provides for an agreement with the NRC to assume the regulation of the atomic energy act materials other than nuclear power related, but this agreement has not been pursued. Thirty-two states currently have this agreement in place, and find it constructive, self-supporting, and generally appreciated by licensees. In general, state assumption of this regulatory function results in significantly reduced fees for the licensees, as well as bringing the enforcement process "closer to home." There is generally no change to the regulations, only the agency which enforces them, so licensees are not subject to any additional regulatory burden. Virginia should continue to work toward such an agreement with the NRC, for which many of the specific recommendations of this report would be prerequisite.

There are currently 215 licenses issued by the Radiological Health Program; about one-third of these licenses are inspected each year by the Program staff. The Program currently has 2.5 full-time equivalent (FTE) staff, although one part-time position is currently vacant. This ratio of 1.0 FTE per 86 licenses is somewhat lower than the CRCPD staffing criteria for an adequate radiation control Program, but close to the average determined for all states when that was last evaluated. An increase in staff would be needed if the state were to assume the licensing and inspection responsibilities now handled by the NRC.

Staff and Training

The Radiological Health staff are adequately trained to address the types of licenses that they currently regulate. However, the Program should develop an in-service training plan to broaden the capabilities of the staff and to keep them informed of current developments in radiation control. This training should utilize local universities, federal agencies, and other sources. Such a training program is a criterion of both the CRCPD adequate radiation control program and CRCPD recognition as a NARM Licensing State. This training would be essential if the State were to assume NRC's regulatory authorities as an Agreement State.

Licensing

The Radiological Health Program provides an adequate and detailed review of license applications for the use of NARM. Licensing documents are clear, complete and accurate as to radionuclides, forms, quantities, authorized users, and uses. Commendably, the Program has developed its own licensing guide for x-ray fluorescence devices. For some of the major license applications, pre-licensing reviews are conducted; if the applicant also has an NRC license, copies of those licensing documents are obtained. License amendments are required for any significant changes to a licensee's program, including authorized materials, users, uses, or operations. The Program notifies licensees of the need to renew their licenses 2 to 3 months before expiration. The renewal and amendment applications are promptly and thoroughly reviewed before issuance. Each license is issued by the Program manager.

As discussed elsewhere, the radiation control regulations are severely outdated, having not been updated since 1988. As a result, the Program is currently issuing licenses in accordance with outdated regulations.

There is no federal or other uniform regulation for the use of naturally occurring or accelerator produced radioactive materials (NARM). States regulate NARM to differing standards if at all, which has created public health and occupational safety consequences. Specifically, states wishing to license NARM sealed sources/devices manufactured in another state for which there has been no validation of NARM licensing criteria or authority find it is difficult, if not impossible, to license such items other than to issue a single license for each individual source or device. The CRCPD has established a program of standards for NARM regulation including source and device evaluation, and formal recognition of a qualifying state for the licensing of NARM. There is no other mechanism for the reciprocal recognition of a license to manufacture, nor to accept under reciprocity a NARM licensee from another state. CRCPD recognition for the licensing of NARM enables the states' NARM licensees to work in other Licensing States under reciprocity, as well as in NRC Agreement States that extend this reciprocity. Virginia has not obtained this recognition.

The radioactive materials component of the Radiological Health Program meets most of the CRCPD criteria for an adequate radiation control program and for recognition as a NARM Licensing State, but notably lacks regulations that conform to national standards and also the capability for evaluation of sealed sources and devices.

Recommendation #6

The Radiological Health Program should develop the requisites for, and pursue, CRCPD limited recognition as a NARM Licensing State, non-manufacturing.

Inspection Program

The Radiological Health Program currently meets CRCPD's inspection criteria for recognition as a NARM Licensing State. The inspection program is adequate to assess license compliance. Inspection forms help to establish uniformity, consistency, and adequacy of inspections. The scope of the inspections are adequately covered. During their inspections, Program staff take into consideration any NRC license and NRC's regulatory actions regarding the licensee. For example, the Program's inspection forms indicate the NRC license number, the date of the last NRC inspection, whether any violations were noted, and if any corrective actions were taken.

The Program maintains information that is adequate to plan the number of inspections to be performed, make inspection assignments, prepare status reports and afford program managers to assess the status of the inspection program.

The inspection priority schedule is based upon license renewal cycles. Most licenses are granted for a 4-year period and inspected at least once during that period. Similarly, x-ray fluorescence licenses are for a 2-year period and inspected once during that period. Although these inspections are not prioritized by potential hazards, there are no overall negative impacts on health and safety because most major licensees also have an NRC license from which the inspection and enforcement actions are taken into account. However, if the state decides to pursue Agreement State status it would need to develop inspection procedures and revise its inspection priorities to reflect the potential hazard of licensee operations.

As a minor observation, surety arrangements on radioactive material licensees are authorized by the Code of Virginia but have not been implemented. This is of little consequence in the absence of a large radioactive waste processing facility or other state licensee having an existing or potential for substantial site contamination.

Virginia Non-Ionizing Program Review

Virginia has numerous laser, radio frequency and ultraviolet radiation sources, but no regulation of them. Medical and industrial lasers all too frequently cause permanent injury, sometimes with associated fatal injuries. Similar experiences are reported in regard to high intensity vapor discharge lamps. A few fatalities have been reported from tanning bed use by individuals who were taking certain medications. Both the *CSG Suggested State Legislation* and the *CRCPD Criteria for Adequate Radiation Control Program* recommend regulation of non-ionizing radiation.

Virginia does not regulate sources of non-ionizing radiation and so these have not been registered, inspected nor held to safety standards. It is currently left to the users to identify and utilize appropriate consultative expertise to assure that the hazards are reduced. The Department of Health radiation control program does, however, respond to inquiries about non-ionizing radiation. Implementation and enforcement of standards for non-ionizing radiation would help to assure Virginia residents of protection from unnecessary and hazardous exposures.

Recommendation #7

The Commonwealth of Virginia should implement statutory authority and a regulatory program for the control of non-ionizing radiation sources.

The regulatory program for non-ionizing radiation would require one staff person to publicize the program, deal with registrations, distribute guidance on radiation hazards and follow up on suspected injuries. Certain measuring instruments would be needed.

Virginia Environmental Monitoring Program Review

Environmental Monitoring

Environmental radiation monitoring in Virginia is conducted, for their own purposes, by the DOE accelerator facility, the two commercial nuclear power plants, the nuclear fuel fabrication facilities, the nuclear navy and likely by some others of the NRC licensed facilities. This is commendably more environmental monitoring than is conducted in many other states, but it does not satisfy the need for a program of monitoring by the government radiation control agency. Neither are the several facilities committed to provide monitoring during a radiological contamination incident outside their property.

The Radiological Health Program, under an agreement with the Department of Emergency Management, collects environmental samples in the vicinity of nuclear power facilities; these samples are analyzed by the state Consolidated Laboratories. The annual number of these samples has decreased over the years from approximately 4000 down to approximately 400 currently. This precipitous decrease does not appear to have significant implications to public health because the samples are largely background levels of radionuclides and serve to confirm that there has been no significant release to the environment. This provides confirmation to the extensive network of monitoring done by the nuclear utilities and federal facilities. However, in the event of an accident causing considerable contamination, it is not clear how the Commonwealth will gear up to analyze the wide variety of samples necessary to document that food and water supplies are clean.

The CRCPD *Criteria for Adequate Radiation Control Programs* recommends that the state radiation control program conduct environmental radiation monitoring, and that written formal agreement should be established with any other agency or commercial service that provides an aspect of the monitoring program.

Recommendation #8

The Department of Health should establish memoranda of understanding with the Department of Emergency Management and with the Consolidated Laboratories which document the respective roles and promote coordination and cooperation in conducting their program of monitoring environmental radioactivity.

The Consolidated Laboratory is geared to routine monitoring of samples from all media. If there were a significant release of radionuclides into the environment, it is doubtful that this lab could process very large volumes of samples in the short time that would be needed to make significant public health decisions, particularly for foods and medicines having low limits of contamination. Meanwhile, the more radioactive samples would necessarily be assayed by the Radiological Health Program's mobile radiological lab, supplemented by federal assets that would be dispatched to the area.

The mobile lab has an important role in the event of a substantial radiological contamination incident, but unauthorized removal of small equipment and supplies has been reported by the staff.

Particularly because of incident response obligations, CRCPD recommends that environmental monitoring functions should be assigned to two or more persons to assure continuous coverage. It is essential that the assigned staff exercise the mobile lab and other radioanalytical equipment regularly, and maintain radiation standards and other essential supplies.

Recommendation #9

Control of access to the mobile radioassay van should be assigned to one of the Radiological Health Program staff along with the responsibilities for maintaining the equipment ready and supplied and for directing exercises of the analytical equipment by the other assigned staff. The vehicle should be parked in a readily accessible but secure location.

Stray radioactive material

An increasingly common incident is the discovery of radioactive material in municipal waste or scrap metal. Although as yet few of these facilities in Virginia use radiation monitors, neighboring states that do have been returning several shipments each year to origins in Virginia. Thorough monitoring in Virginia would find radioactivity in several loads of scrap and trash each day. The Radiological Health Program is responsible for assessing this radioactivity and assuring its proper disposition. In each incident, resources on the order of a thousand dollars in disposal cost and tens of hours of staff work can be saved by prompt evaluation of the radionuclides involved, almost all of which are found to be discrete items of groundwater scale or medical patient waste that can be disposed of locally.

The efficient field evaluation of radionuclides is accomplished with a relatively new system called portable gamma-ray spectroscopy. Even at the cost of several thousand dollars each, the regulatory agencies and commercial firms will find it cost effective to equip the Radiological Health Program with one of these devices at each of its four offices.

Pennsylvania, which like Virginia is a large importer of waste, has a regulatory requirement for routine radiological monitoring of waste coming to disposal facilities, accompanied by exemptions for many items of negligible radiation hazard. And virtually every steel mill in the U.S. monitors feed material for radiation sources, the smelting of which results in costs on the order of \$10,000,000. Radiation monitoring of scrap metal and of municipal waste throughout Virginia, and the need for exemption from regulation of innocuous radioactive items should be anticipated.

Recommendation #10

The Radiological Health Program should begin formal discussions with the Department of Environmental Quality to explore limits and related exemptions for radioactivity in municipal waste landfills and incinerators, and in scrap for recycling.

Virginia Emergency Response Program Review

Radiological emergency response activities in Virginia are divided between nuclear power plant exercises under FEMA programs and the actual response to hazardous material (HAZMAT) incidents.

The FEMA drills involve a large-scale mobilization of resources in the 10-mile emergency planning zone (EPZ) around each of the two nuclear power plants every two years, and a more extensive mobilization in the 50-mile ingestion EPZ every 6 years. These exercises require both an extensive mobilization of resources during the exercise itself and also in preparation for the exercise. Most of the Radiological Health staff are routinely diverted from their normal tasks to participate in these exercises, which provide the cross-training that is essential for full utilization of staff should an emergency actually occur. However, there is significant loss of routine work such as X-ray inspection while the staff is occupied with the emergency response, including FEMA exercises.

The radiological HAZMAT activities are rarely if ever drills or exercises, in contrast to the FEMA exercises which rarely involve an actual incident. In HAZMAT activities, the Radiological Health staff have the role of Scientific Support to the Incident Commander. The knowledge and experience of the staff are essential in response to a complex situation where there is a potential for an immediate hazard to public health.

In regard to both activities, the Department of Emergency Management staff praised the Radiological Health staff for their competence and dedication. Both groups were of the opinion that there is adequate delegation of authority to handle emergencies. The Radiological Health duty officer has the authority to dispatch personnel to the scene of a spill or other incident in order to provide whatever assistance is needed. The only recommendation of this report with regard to emergency response is the need for training of Radiological Health personnel.

Emergency Response Training

There are two training problems in the Radiological Health Program: providing the staff with the training they need to be proficient at their jobs, and the training of the staff that delivers training to radiological emergency responders.

It appears that the Radiological Health staff are well schooled in the principles of radiation protection, but that there has been little or no training in the basic principles of emergency response. In particular the staff had no knowledge of the principles of Unified Incident Command and the authorities of Incident Commanders. Such knowledge is essential for the staff to provide the appropriate Scientific Support to the Incident Commander and for those division directors who potentially participate in important decisions during an emergency, and who also need to be aware of the incident command structure within which the staff are operating during an emergency.

During the CRCPD interview, the Department of Emergency Management Radiological Officer offered to conduct training on Incident Command principles, which requires one day.

Recommendation #11

All personnel who may be involved in the response to a radiological emergency should complete the Unified Incident Command training offered by the Department of Emergency Management.

Radiological Health staff provide emergency response training to appropriate persons in the ten-mile EPZ Counties surrounding the two nuclear power plants. These persons are trained in radiological monitoring and other duties involved in the response to an incident at a nuclear power plant. The Department of Emergency Management staff had high praise for the efforts of the Radiological Health instructors and recognized that providing this training is a burden.

The other training program is that provided by the Department of Emergency Management to HAZMAT responders throughout the Commonwealth. This is training for response to traffic accidents, derailments and such accidents where spills of radioactive materials are involved.

Of the individuals in the 10-mile EPZ Counties trained by Radiological Health staff, 30% to 40% also received training from Department of Emergency management staff. The two programs differ in the level of training, but Emergency Management is not concerned about this discrepancy as long as there is consistency in the training.

Two actions were suggested to the review team. First, Emergency Management would welcome Radiological Health assistance in developing the curriculum of radiological training for HAZMAT responders. It was felt that there is only an infrequent need for Radiological Health staff to provide their training in the non-EPZ counties. However, the 2003 exercise for the 50-mile ingestion EPZ around the nuclear power plants is an opportunity to augment the training of the local responders in a large portion of the state. By a cooperative effort with the Hazardous Materials portion of the Department of Emergency Management, the great majority of emergency responders throughout the state could be brought to a higher level of radiological competence with little or no additional effort by Radiological Health staff.

Recommendation #12

The Radiological Health Program should extend to the HazMat section of the Department of Emergency Management an offer to assist in developing the radiological component of their training and an offer to cooperate in training the local HazMat responders in the 50 mile ingestion EPZ exercises.

Virginia Administrative Program Review

As is recommended by the CRCPD, Virginia has essentially a single radiation control agency although the Department of Environmental Quality regulates transportation of radioactive and other hazardous waste, and it may be assigned a role in radioactive waste disposal site regulation.

The Radiological Health program is a customer to the Department of General Service's Consolidated Laboratories for radiological analyses, and it receives funds from the Department of Emergency Management for cooperating in environmental monitoring around nuclear facilities, radiological incident response, and coordination of radiological emergency training. There is little or no written agreement for these interdepartmental efforts and the associated resources, which is contrary to administrative policy in most states. Similarly the Radiological Health program needs legal and other services from other Divisions of the Department, in some cases conceivably urgent needs.

Recommendation #13

Memoranda of Understanding or other formal agreements should be implemented between the radiological health program and each of the other Departments with which services and resources are exchanged. Particular attention should be given to emergency operations.

The absence of interagency agreements is another evidence, along with deficiencies in statutory authority and regulations, of the need for a coordinator of radiological activities in the Governor's office, as recommended in the Council of State Government's Suggested State Legislation. Such a coordinator would be particularly helpful in the development of any new, multi-departmental program such as radiological monitoring of municipal waste and the establishment of related exemptions. This coordinator is by no means a full-time position. It is only a person whose duties include this role.

Recommendation #14

The Governor should establish, in his office, a Coordinator of Radiological Activities to assure and expedite the assignment of radiation control efforts in legislation, among the Departments involved, and between the Departments and federal or interstate agencies.

Operational Plan

A radiation control program should have well defined goals and clearly stated measurable objectives outlined in a written multi-year plan. The plans should include provisions for collection, analysis and publication of data that show the extent to which workers, patients and others of the public are exposed to sources of radiation as well as reports on progress made in meeting objectives and reaching goals. Both long term and short term objectives of staff training and performance should be established with specific targets for priority and accomplishment. Participation of the radiation control staff in the planning and reporting is recommended as providing long-term

motivation for them. The Radiological Health Program's six-year plan is from several years ago and quite out of date.

The day-to-day operations of the x-ray, the radioactive materials, and the environmental monitoring programs should each be guided by a written management plan. An inspection schedule should be developed semiannually. The inspection frequency should be based upon both the hazard and the inspection history. These plans should include periodic evaluation of program effectiveness. Successful plans from other states are readily available and could be used in developing Commonwealth-specific plans.

Recommendation #15

The multi-year plan for the Radiological Health Program should be updated, promptly and at intervals of five years. An operational plan should be developed for the x-ray, the radioactive material, and each other section. The plans should include statements of the problems, the objectives with explicit regard for program resources, methods to accomplish the objectives and methods for the evaluation and reporting of accomplishments.

Policies

The review team found a general lack of written documentation on the radiation control program, and consequent misunderstanding of important details in the delegation of authorities and the responsibilities of officials at the levels of the Section, Bureau, Division, Office, and Department. Such documentation affords the understanding of each role by others, allows each staff person to conduct their work with confidence as to their authority, and so promotes morale and efficiency.

It was not clear to the team which of the officials is authorized to commit resources to a radiological incident, initiate enforcement actions at each severity level, request Department legal assistance, convene the advisory board, or initiate discussions with a member of another Department.

The review team saw a routing diagram for draft regulation, but believe that a routing plans or diagrams for a press release, suggested legislation, or development of an MOU would strengthen the program.

Concise written statements of Radiological Health priorities for radon and for emergency response were well received by the review team, but similar statements are needed for environmental surveillance, radiation machine and radioactive materials sections.

Recommendation #16

Each aspect of radiation control policy, priority, procedure, and staff duties should, in general, be published to those who are to implement the action, those on whom the action may be taken, and to others who may have constructive suggestions or concerns.

Training of Radiological Health staff;

There appears to be a shortage of funds to provide in-service training to Radiological Health staff, and a great deal of difficulty in traveling out of state to receive training. Thus it is very difficult to provide the high level of training needed to develop new technical staff or to keep the existing staff proficient. This funding shortage is unlikely to be remedied in the near future because of the realities of the state budget, and such concerns are beyond the scope of this report.

However, there appears to be training available to Radiological Health staff at little or no cost from Dominion Electric, the Norfolk Naval Shipyard, Babcock and Wilcox and the major hospitals, which employ radiation control staff to conduct Health Physics training.

For the regulation of radiation sources, most high-level training and professional contacts are provided by the Nuclear Regulatory Commission at their Chattanooga and Oak Ridge facilities, by the Food and Drug Administration at varied regional courses, and by the CRCPD, Health Physics Society and other professional associations at their annual meetings. The Virginia administration has, as have many other states, sometimes restricted out-of-state travel, even when the travel expenses are provided by others.

Recommendation #17

The Radiological Health Program should avail itself of the in-state training opportunities. The Department of Health should endorse the participation of radiological health professionals in the training activities and professional meetings that are essential to their work and uniquely offered by federal, regional or national organizations. Needed training should be considered even if it is given out-of-state.

Fees for licensing of radioactive material, registration of radiation producing machines and related services are authorized by legislation. However, fees have not been implemented for radioactive materials, of which the current number of 215 is substantial. The schedule of fees has not been updated for the machine registration and inspection since 1988. Guidance on fee categories and amounts may be taken from those of the many other states that have implemented fees.

Recommendation #18

Fees should be implemented on all radiation sources that are licensed, registered or inspected by the radiation control program. The fee schedules should be updated promptly, and every five years, with respect to program costs and the current requirement as to fraction of the program cost to be collected in fees.

Computers are used to track licensing, inspections and enforcement actions and should be further used to generate summary data for periodic reports on the agency's activities, achievements and shortfalls. Standard forms are needed that give detailed procedures for inspection and recording of observations, both government and non-government inspections, and for initiating and tracking

enforcement actions as they escalate or are resolved. These could easily be computerized and would facilitate this process by making it easy to track trends, common problems, etc.

Recommendation #19

A periodic report, perhaps semiannual, of the program activities should be widely circulated to enhance communications within the Department, with registrants and with the public.

Virginia Statutory Authority and Regulations Review

The statutory authority for radiation control in Virginia differs in important details from the Council of State Government's (CSG) model radiation control act. The Virginia statute (32.1-227) defines 'ionizing radiation' but subsequent text addresses 'radiation' and 'x-ray machines,' where the CSG model quite comprehensively defines and addresses 'radiation,' 'ionizing radiation,' 'non-ionizing radiation' and 'radiation generating equipment.' The Virginia statute seems to leave the regulation of particle accelerators and non-ionizing radiation sources subject to interpretation.

One of the other differences, the CSG model act, but not the Virginia Code, provides for the radiation control program to exempt certain sources of radiation. Such exemptions preclude concern for such devices as radiation detector check sources, and they alleviate the problem of radioactivity such as groundwater scale and medical patient waste in municipal waste. The latter category will consume enormous resources when radiation monitors are installed at incinerators and landfills, as has been found to be the case in other states.

On several aspects of radiation control the Virginia Code presents finely detailed requirements, which the CSG model delegates to the regulatory agencies. Difficulties have been created by statutory requirements for involvement of state agencies that were subsequently abolished, and participation in specific federal programs that were subsequently discontinued by the federal agencies, e.g. the EPA radon testing proficiency program (though this particular difficulty appears to have been recently remedied).

Recommendation #20

The Virginia statutory authority for control of radiation should be updated, using the current Council of State Government model radiation control act. Provisions should be stated with sufficient generality that the empowered state agencies can be responsive to changes in federal programs, state government organization, and professional standards.

An effective radiation control program needs to keep its rules and regulations current and in conformance with federal standards and regulations. The agency should be able to promulgate new regulations or revisions to existing rules in a timely manner that will ensure protection of the public health. The Virginia Department of Health radiation control regulations have not been updated since 1988. In 1992 the federal regulatory limits on radiation exposure were decreased by a factor of five, and almost all other states have adopted these standards for all ionizing radiation sources. In other respects, too, the Virginia regulations do not meet the requirements of federal programs with which the Commonwealth is involved or may wish to be.

To facilitate state incorporation of federal standards and to reflect the experience of state and federal radiation control programs, the CRCPD maintains the *Suggested State Regulations for the Control of Radiation*, which have evolved for more than twenty years now. Further, it is the CRCPD position that states should obtain recognition as a NARM Licensing State.

Still another regulatory aspect, radiation control is more effective if a series of progressively more severe enforcement actions, have been implemented. Civil penalties are authorized by the Code of Virginia §32.1-229, but have not been implemented in regulations.

Recommendation #21

The regulations of the Radiological Health Program should be updated promptly, and subsequently at intervals of no more than five years, using current CRCPD *Suggested State Regulations for Control of Radiation* and criteria for recognition of NARM licensing states as well as pertinent federal regulations. In particular, regulations should be extended to the following:

Registration of radiation machine vendors and service providers

Credentialling of radiation machine operators in health care and in industrial radiography

Civil penalty provisions applicable to radiation machine registrants and radioactive material licensees

Non-ionizing radiation, at least for industrial and medical applications of those lasers, ultraviolet, radio frequency, and microwave sources that have high risk of inflicting severe injury.

Fees on radioactive material licenses and for credentialling radiation machine operators

Surety requirements on appropriate categories of state radioactive materials licensees.

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Appendix A

EPA Report on the Virginia Radon Program Executive Summary by Cristina Schulingkamp EPA Region III

The Virginia Department of Health, Radiological Health Program has been awarded eleven grants, one each year since 1988, to provide the citizens of Virginia with Radon outreach and education. At this time, the Department has submitted an application for the State Indoor Radon Grant (SIRG) for fiscal years 2001-2002. A separate grant was provided by EPA for fiscal year 2000-2001 to conduct outreach and education in the indoor air quality area, including radon, to school personnel throughout the Commonwealth. This grant introduced EPA's Tools for Schools Program which addresses several indoor air pollutants, their impact on occupants and the impact on school buildings. EPA commends the Program for all the years of its proactive radon work within the Commonwealth and for the proactive leveraging of resources, the insight to apply for and implement indoor air and radon training sessions throughout the Commonwealth.

The Program's management of the Radon Program has been timely and appropriate. The Program continues to be funded both with state and federal funds. Expanded activity continues through leveraging of outreach activities, educational forums and attendance at various public meetings with cooperative partners such as the American Lung Association. The staff continue to be trained to maintain their expertise in the program. The SIRG program prepares monthly reports which are submitted to EPA describing monthly activities. Midyear reports and reviews are conducted with the Radon program personnel to identify areas of concern, and areas where assistance is needed.

The Program provides radon presentations at various forums to inform the general public, school staff, building inspectors, real estate agents, and contractors information on the program. It also takes enforcement actions by following up on complaints regarding qualifications of radon contractors. Letters are sent to radon companies reminding them that their staff need to meet qualifications set forth by the Code of Virginia for performing radon testing and mitigations.

Virginia's small pop-up radon houses are provided to schools for inclusion as part of science curricula.

The Program continues to work with cooperative partners such as a VISTA volunteer group in partnership with the Mountain Empire Older Citizens, Inc. They have supplied 500 radon test kits to test homes of economically disadvantaged and elderly in the counties of Lee, Scott, and Wise. This project will begin January of 2002. Follow-up assistance and a final report will describe the project, it's findings and conclusions. EPA commends both organizations in this collaborative environmental justice

initiative. New releases have also been prepared for National Radon Action Week which will take place during October 14-20, 2001. This week is designated to providing an extensive outreach campaign to educate the public on the risks of radon. Also, the month of October is National Home Indoor Air Quality Month. During October 1-6, 2001 the focus will be on Secondhand Smoke and Children's Health issues, the week of October 7-13 will focus on Children and Asthma, the week of 21-27 will focus on Indoor Air Quality in general.

Many activities are planned nationwide and more information can be obtained at www.montana.edu/wwwcxair.

The Program also maintains a Radon Hotline, which responds to radon questions from citizens, radon professionals, real estate agents, home inspectors, teachers, homebuilders and local organizations such as health departments. Radon publications are also distributed on request and through targeted mass mailings to provide radon information to groups. The Program continues to maintain and distribute up-to-date information on listed radon testers and mitigators.

The Program's work with the Building Code Organizations to promote inclusion of radon resistant building codes and radon control has been very successful. The CABO Building Code includes provision for radon control.

Collaborative efforts with county extension agencies and the Northern Virginia Community College also continues. RHP has promoted the use of radio and television stations to air the public service announcements that EPA produces to enhance state activities.

Program staff along with VA Drinking Water staff have attend several EPA meetings to discuss the forthcoming Radon in Drinking Water Rule. Program staff have been very helpful in assisting the attendees in understanding some of the complexities of such a Rule. The expertise was very welcomed and needed since not all states that attended had such insight. Virginia has been very proactive in these issues.

In conclusion, the Program has continued to maintain, enhance and expand its radon program to include many audiences, many cooperative organizations and has provided the citizens of Virginia with excellent radon outreach and education. EPA commends RHP for its continued proactive commitment to provide this service to its citizens, for supporting our continued effort in this area and for assistance with the reduction of radon exposure to the general public in Virginia. We look forward to continued collaborative efforts in the future, continued support of the program from Program staff.